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Risk assessment of violent, suicidal and self-injurious behaviour in acute psychiatry – a bio-psycho-social approach

Thesis for the degree of Philosophiae Doctor

Trondheim, December 2010

Norwegian University of Science and Technology
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Science and Technology

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ISBN 978-82-471-2492-5 (printed ver.)
ISBN 978-82-471-2493-2 (electronic ver.)
ISSN 1503-8181

Doctoral theses at NTNU, 2010:248

Printed by NTNU-trykk

Vurdering av risiko for vold, suicidalitet og selvskading i akuttpsykiatrisk sammenheng – en bio-psyko-sosial tilnærming

”Risikoprosjektet” ved Psykiatrisk avdeling, Ålesund sjukehus, hadde to siktemål; (i) å undersøke ulike metoder til å vurdere risikoen for vold, suicudalitet og selvskade, og (ii) så tidlig som mulig etter akuttinnleggelser å kunne identifisere de som trenger videre utredning av risikoen for suicidaltet, selvskade eller vold.

Forskjellige metoder ble prøvet i et prospektivt, naturalistisk design. Denne avhandlingen tar for seg resultater fra deler av ”risikoprosjektet”; (i) serotonin målt i blodplater og lipider målt i blod, (ii) pasientenes egen risikovurdering (SRS), samt (iii) et strukturert screening instrument for volds-risiko (V-RISK-10, utviklet for bruk i akuttpsykiatrien).

Målgruppen var alle akutt innlagte pasienter gjennom ett år, fra 2006 -07. SRS og V-RISK-10 ble skåret ved innleggelse og utskriving. Blodprøver ble tatt ved innleggelse. Risikovurderingene og blodprøvesvarene ble sammenliknet med suicidalitet, selvskading og vold registrert under oppholdet og 3 og 12 måneder etter utskriving.

Vold og sucidalatferd under innleggelsen, og vold de tre første månedene etter utskriving, ble predikert av lave verdier av total kolesterol. Noen få pasienter med flere innleggelser og gjentatte voldshandlinger var kjennetegnet ved lave verdier av HDL. Høye triglyceridverdier predikerte selvskade i løpet av oppholdet, og også suicidalitet og selvskade etter utskriving. I vårt materiale ble det ikke funnet noen sammenheng mellom serotonin og aggresjon.

Pasientense egne risikovurderinger (SRS) predikerte vold, suicidalitet og selvskade. SRS var mest presis for suicidalitet og selvskade under innleggelsen og mest nøyaktig for vold etter utskriving. Vi har ikke funnet andre rapporter om pasienters egne risikovurderinger.

Valideringen av V-RISK-10, som også ble gjennomført ved Akuttpsykiatrisk avdeling, Aker Universitetssykehus, var like god eller bedre sammenliknet med andre etablerte risikoinstrumenter. Funnene var gyldige både for kvinner og menn og nøyaktigheten størst ved alvorlige voldsepisoder. V-RISK-10 predikerte vold også for pasienter uten kjent voldshistorie.

Resultatene for lipider og SRS var ikke gode nok til at disse metodene kan anbefales å bli brukt alene som screening instrumenter. De kan imidlertid vise seg nyttige som tillegg til etablerte prosedyrer. V-RISK-10 viste gode egenskaper som screeninginstrument. Resultatene bør bekreftes av annen forskning før metodene kan bli brukt med ønsket sikkerhet ved akuttpsykiatriske enheter.

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Finansieringskilde: *Samhandlingsorganet Helse Midt-Norge/NTNU og Helse Sunnmøre HF*

Ovennevnte avhandling er funnet verdig til å forsvares offentlig for graden PhD. Disputas finner sted i Auditoriet, Ålesund sjukehus, fredag 10.12.2010 kl 1215.

CONTENTS

Acknowledgements

I am most grateful to the staff members of the Psychiatric Departments at Ålesund Hospital and those at Aker University Hospital. Especially, I want to thank the staff members on the acute wards for their persistent work on the project; it has been carried out in addition to all of their other tasks. I also thank the staff in the laboratory at Ålesund Hospital for collecting and analysing blood samples throughout the study. Among the staff, special thanks go to Ragnar Thorsen for the data recording, to Marit Lindin for her help with the data collection and to Anette Molvær for the data entry.

I am most thankful to Professor K Gunnar Gøtestam, who was my main supervisor in the first part of the project. Without his inspiration and support, this project would never have been started. I am also most grateful to Professor Are Holen, who took over as my main supervisor in a smooth and steady transition towards the end of the project. He made considerable efforts in supervising the completion of the thesis.

Furthermore, I extend special thanks to my co-supervisor, Professor Stål Bjørkly, for his help, support and advice when planning the project, during the research process, and in handling the statistical and methodological issues. He has also contributed significantly as a co-author on the four papers, and he has offered advice and guidance in the preparation of the thesis. His availability and rapid feedback have exceeded all of my expectations.

I am also thankful to another co-supervisor, Professor Petter Laake, Faculty of Medicine, University of Oslo, for his help, advice and guidance in statistical matters.

Pål Hartvig deserves special thanks as the first and second author on two of the papers and a close discussant throughout the project. He was also the project leader at Aker University Hospital. Other colleagues at the Centre of Research and Education in Forensic Psychiatry, Oslo University Hospital, have been very generous with their help and support. The former director, Dr. Bjørn Østberg, assisted in planning the project and included Ålesund Hospital in the V-RISK-10

study. Mona Skjønberg was responsible for the SPSS database and the follow-up data registration, while former employee Svein Alfarnes assisted in planning the project. Anne Margrethe Bakken at the Blood Bank at Haukeland University Hospital, Bergen, deserves thanks for her cooperation in the biological part of the project and for the serotonin analyses. Moreover, she has also contributed as a co-author.

This research was funded by a PhD scholarship from both Helse Midt-Norge HF and the Faculty of Medicine at The Norwegian University of Science and Technology, by Helse Sunnmøre HF, and by the Centre for Research and Education in Forensic Psychiatry, Oslo University Hospital.

Last but not least, I have all along been inspired by my family. I am most grateful to my wife Ingvild for her patience, enthusiasm, encouragement and skilful advice, and also to my three grown-up children, Helle Marie, Live Karoline and John Martin, for supporting their old man in doing something new.

Ålesund 16. June 2010

John Olav Roaldset

List of papers

1. **Roaldset, J.O., Bakken A.M., Bjørkly, S.** (2010) A prospective study of lipids and serotonin as risk markers of violence and self- harm in acute psychiatric patients. *Psychiatry Research* doi:10.1016/j.psychres.2010.07.029

2. **Roaldset, J.O., Bjørkly, S.** (2010). Patients' own statements of their future risk for violent and self harm behaviour: A prospective inpatient and post-discharge follow up study in an acute psychiatric unit. *Psychiatry Research* **158,** 153-159

3. **Hartvig, P., Roaldset, J.O., Moger, T.A., Østberg, B., Bjørkly, S.** (2010). The first step in the validation of a new screen for violence risk in acute psychiatry: The inpatient context. *European Psychiatry* doi:10.1016/j.eurpsy2010.01.003

4. **Roaldset, J.O., Hartvig, P., Bjørkly, S**. (2010). V-RISK-10: Validation of a screen for risk of violence after discharge from acute psychiatry. *European Psychiatry*, doi:10.1016/j.eurpsy2010.04.002

Abbreviations and acronyms

AUC area under the curve

HDL high density lipoprotein

LDL low density lipoprotein

MMI major mental illness

NPV negative predictive value

NND number needed to detain

OR odds ratio

PPV positive predictive value

REFA report form of aggressive episodes

RESUS report of suicidal and self-injurious episodes

ROC receiver operator characteristics

RQ research question

SIB self-injurious behaviour

SRI serotonin reuptake inhibitors, including selective serotonin reuptake inhibitors (SSRI), tricyclic antidepressants (TCA) and serotonin noradrenalin reuptake inhibitors (SNRI)

SRS Self-report risk screening (by patients)

TCO threat-control-override: refers to beliefs that others will harm you or can control your thoughts or put thoughts into your mind

TG triglycerides

V-RISK-10 Violence risk screening-10

Central concepts and designations

Actuarial	based on algorithmic decision rules
Aggression	intentional behaviour or threat to inflict physical harm upon objects or human beings
Dynamic factors	factors that change over time due to interplay with other factors
Historical factors	items based on facts from patient's life history
Involuntary admission	admittance against one's will to a psychiatric ward in accordance with the Norwegian Mental Health Act
Major mental illness	a chronic or recurrent mental illness with obvious and undesirable signs and symptoms; includes major depressive disorders, bipolar disorders, schizophrenia and other psychotic disorders. A broader definition would include severe personality disorders and severe eating disorders.
Mandatory aftercare	treatment against a patient's will after discharge in accordance with the Norwegian Mental Health Act
Prediction	a statement forecasting what will happen under specific conditions
Predictive validity	the extent to which a score or a test predicts some measure or event
Risk	the probability of adverse events to happen
Risk assessment tool	instrument that provides comprehensive risk estimates; it often contains a list of risk items
Risk factor	a variable associated with increased risk (here: of violent, suicidal or self-injurious behaviours)
Risk management	coordinated application of resources to minimise, monitor, and control the probability and/or impact of unfortunate events

Risk screening	detection of individuals at risk (here: of violent, self-injurious or suicidal behaviours)
Screening	the process of detecting, checking or filtering
Self-injurious behaviour	inflicting harm upon oneself without the intention to kill oneself
Self-report	patient's response to a questionnaire about him- or herself
Severe mental illness	major mental illness (MMI)
Suicide	killing oneself
Suicide attempt	inflicting harm on oneself with the intention to kill oneself
Violence	the intentional infliction of injury upon another person that results in physical injury or death
Violent behaviour	threatening someone with violence, or acting violently towards another person

SYNOPSIS (Norwegian**)**

Risk assessment of violent, suicidal and self-injurious behaviour in acute psychiatry - a bio-psycho-social approach

av John Olav Roaldset

De psykiatriske avdelingene i Norge har vært utsatt for tildels sterk kritikk etter voldsdhandlinger og selvmord begått av pasienter under innleggelse, etter utskriving eller ved manglende innleggelse. Med innleggelsespress og kort liggetid er akuttavdelinger særlig utsatt. Ofte legges alene klinisk skjønn til grunn for en risikovurdering. Det foreligger imidlertid instrumenter til formålet, men de er tidkrevende og forutsetter spesiell ekspertise.

Et av siktemålene med dette "risikoprosjektet" ved Ålesund sjukehus var å identifisere tidlig hvilke pasienter som trenger videre utredning og oppfølging. Forskjellige metoder ble prøvet i et prospektivt, naturalistisk design. Denne avhandlingen tar for seg resultater fra deler av "risikoprosjektet" og omfatter ulike metoder brukt til vurdering av risiko for vold, selvmord og selvskading: (i) *Biologisk basert*: Serotonin og lipider målt i blod, (ii) *Pasientbasert:* Pasientenes egen risikovurdering (SRS), samt (iii) et *personalbasert,* strukturert screening instrument for volds-risiko (V-RISK-10, utviklet for bruk i akuttpsykiatrien) .

SRS og V-RISK-10 ble skåret ved innleggelse og utskriving. Blodprøver ble tatt ved innleggelse. Risikovurderingene og blodprøvesvarene ble sammenliknet med suicidalitet, selvskading og vold registrert under oppholdet

og i løpet av første året etter utskriving. Målgruppen var alle akutt innlagte pasienter gjennom ett år, fra 07.03.06 – 07.03.07. Studien av biologiske variabler og SRS ble utført på ett sykehus (n=489 pasienter). V-RISK-10 studien ble gjennomført på to sykehus (n=1017). Antallet pasienter var henholdsvis 254 innlagte og 196 utskrevne for den biologiske studien, 429 og 266 for SRS, og 980 og 381 for V-RISK-10.

Vold og sucidalatferd under innleggelse, dessuten vold de tre første månedene etter utskriving, ble predikert av lave verdier av total kolesterol. Noen få pasienter med flere innleggelser og gjentatte voldshandlinger var kjennetegnet ved lave verdier av HDL. Disse funn samsvarer med tidligere undersøkelser. Høye triglyceridverdier predikerte selvskade i løpet av oppholdet, og også suicidalitet og selvskade etter utskriving. Presisjonsnivået var størst for dem som ble registret med både suicidalatferd og selvskading. Resultatet støtter tre studier om virkningen av kortvarig og kronisk psykologisk stress, men er det motsatte av tidligere funn om lave triglyceridverdier ved sucidalitet. I vårt materiale ble det ikke funnet noen sammenheng mellom serotoninnivå og aggresjon.

SRS predikerte vold, suicidalitet og selvskade. I løpet av innleggelsen var SRS mest presis for suicidalitet og selvskade. Etter utskriving var den mest nøyaktig for vold. Vi har ikke funnet andre rapporter om pasienters egne risikovurderinger.

Valideringen av V-RISK-10 var like god eller bedre enn for andre etablerte risikoinstrumenter. Våre funn var gyldige både for kvinner og menn.

Nøyaktigheten var størst ved alvorlige voldsepisoder. V-RISK-10 gav signifikante resultater for pasienter uten kjent voldshistorie.

Resultatene for lipider og SRS var ikke gode nok til at disse metodene kan anbefales å bli brukt alene som screening instrumenter. De kan imidlertid vise seg nyttige som tillegg til etablerte prosedyrer. V-RISK-10 viste gode egenskaper som screeninginstrument. Resultatene bør bekreftes av annen forskning før metodene kan bli brukt med ønsket sikkerhet.

SYNOPSIS (English)

Risk assessment of violent, suicidal and self-injurious behaviour in acute psychiatry - a bio-psycho-social approach

by John Olav Roaldset

Recently, psychiatric hospitals in Norway have been criticised for premature discharges and for poor assessments of patients' risks of violence or self-harm. Due to the high turnover of patients and the obligation to admit all acutely ill patients who are in need of hospitalisation, the acute wards are particularly exposed to such criticism. Unstructured clinical judgements alone still appear to be the dominant approach to risk assessments. Currently used instruments for risk assessment are time consuming, and their use require special expertise. The goal of the "Risk Project" at Ålesund Hospital was early identification of patients in need of risk assessments. Various screening methods were tested in a prospective, naturalistic design. This dissertation is a part of the larger Risk Project. In the dissertation, different approaches towards risk analyses of violence, suicide and self-injury were examined: (i) *Biologically based*, in which lipids and serotonin are measured in the blood; (ii) *Patient based*, in which patients' self-reports of risk (SRS) are employed, and (iii) *Structured professional,* by applying a violence screening instrument developed for use in acute psychiatry (V-RISK-10).

SRS and V-RISK-10 were scored both at the time of admittance and discharge. Blood was drawn at admission. These measures were then compared with the episodes of violent, suicidal and self-injurious behaviour

recorded during the patient's hospital stay and also, during the first year after discharge. The study sample for the biological markers and the SRSs included all of the acutely admitted patients during one year (n=489) in one acute psychiatric unit. The V-RISK-10 study included all admissions of two units (n=1017). The numbers of patients who completed the study were 254 during their hospital stay and 196 after discharge, all with regard to lipids/serotonin, 429 and 266 for SRS, and 980 and 381 for V-RISK-10, respectively.

Similar to findings from other studies, low concentrations of total cholesterol were found to predict inpatient suicidal and violent behaviour and also, violent behaviour three months after discharge. Low HDL levels were predictive of violence repeaters. High triglyceride levels predicted self-injurious behaviour (SIB) during the hospital stay, and both suicidal behaviour and SIB during the first year after discharge. The best results were obtained among patients who had recorded episodes of both suicidal behaviour and SIB. This finding contradicts prior studies on self-harm but concurs with three recent studies that look at the effects of short-term and chronic psychological stress. No significant correlations between serotonin levels and violence, suicidal behaviour or SIB were found in our sample.

SRS predicted violence, suicidal behaviour and SIB both during the hospital stay and at three months after discharge. In addition, SRS of violence was also significant at 12 months after discharge. The accuracy was higher for self-harm during the hospital stays and for violence after discharge. We found no other validation studies of patients' self-reported risk of suicide or violence.

The predictive validity of the V-RISK-10 was equal to or better than those of the comprehensive risk assessment instruments, and it was very high in relation to severe violence. The screening instrument was sensitive to the risk of violence independent of gender and even for patients without any known history of violence. Despite significant findings for the lipids and SRS, these methods are not recommended for regular clinical use as single predictor variables, but they may be used together in combination with established risk procedures or clinical judgements. V-RISK-10 demonstrated good psychometric properties as a violence screening tool for acute psychiatry. Further research should be undertaken to confirm the findings.

2. INTRODUCTION

2.1. Topic

The aim of the larger ”Risk Project” at Ålesund Hospital was to examine four approaches to screen for the risks of violent, suicidal and self-injurious behaviours in acute psychiatric patients by looking at: **(i)** *biological markers*, lipids and serotonin drawn from the blood; **(ii)** *patient participation*, in which the patients rate their own risk; “Self-reported risk scale” (SRS); and **(iii)** *structured professional assessment*, in which two structured risk screening tools are employed, **(iii-a)** the Violence Risk Screen-10 (V-RISK-10) and **(iii-b)** the suicide risk part of the “MINI” neuropsychiatric interview (MINI suicidal scale); and finally, **(iv)** *structured professional judgements* (SPJ); overall clinical evaluations of low, moderate or high risk of violence and of suicide, based on clinical judgments, risk screening tools (V-RISK-10 and MINI suicidal scale) and other available information. Risk estimates were made for the hospital stay and for the first year after discharge.

This dissertation covers the **(i)** biological markers, **(ii)** SRS and **(iii-a)** V-RISK-10 parts of the larger Risk Project. The report on the V-RISK-10 results also includes findings from a corresponding project at Aker University Hospital.

2.2 Perspective

Violent, suicidal and self-injurious behaviours are expressions of human aggression. Several studies and reviews indicate increased violence among

persons with mental illnesses (Arseneault *et al.*, 2000, Brennan *et al.*, 2000, Choe *et al.*, 2008, Colasanti *et al.*, 2008, Hodgins, 1992, Tiihonen *et al.*, 1997). Such incidences appear to peak around the time of admission. A few weeks after discharge violence decreases, and falls to the level of the general population after a year (Monahan *et al.*, 2001). Including both threats and acts, 10% of the patients in acute psychiatric units show violent behaviours during their hospital stays (Hartvig *et al.*, 2006, Krakowski and Czobor, 2004, Mellesdal and Mellesdal, 2003) and 20-30% behave violently during the first year after discharge (Hartvig *et al.*, 2006).

Almost everyone who commits suicide has an ongoing mental illness; the majority have symptoms of depression (Hawton and van Heeringen, 2009). The incidence of suicide has increased by 50 times during hospital stays, and by 40 times during outpatient psychiatric treatment (Flechtner *et al.*, 1997). In hospitals, suicide rates peak during the first week after admission and in the first week after discharge (Mortensen *et al.*, 2000). About half of the inpatient suicides occur during regular leaves, despite clinical assessments that have assumed the suicide risks to be minor (Ajdacic-Gross *et al.*, 2009).

Research on the risk of aggression against self or others has focused on family, social, psychological, clinical and diagnostic factors (Hawton and van Heeringen, 2009, Norko and Baranoski, 2005). Since the 1990s, a body of studies has explored the connections between aggressive behaviour and biological markers. Significant correlations between lipids (mostly total cholesterol) and serotonin levels have been found for violent and suicidal behaviour in cross-over and retrospective studies (Alvarez *et al.*, 1999,

Hillbrand and Spitz, 1999, Marcinkoa *et al.*, 2007, Peres-Rodriguez, 2008). However, very few prospective studies exist.

Self-report questionnaires for patients have been developed for both suicidal and violence risk assessments (Helfritz *et al.*, 2006, Huth-Bocks, 2007, Kroner and Loza, 2001, Loza *et al.*, 2007, Nimeus *et al.*, 2006). Based on patients' responses, risk estimates are made by clinicians or by software programs. There has been some controversy about the reliability of such questionnaires (Doyle and Dolan, 2006, Gaynes *et al.*, 2004, Hart, 1995, Loza, 2007). No empirical studiy was found on patients' self-reported estimates of their future violent, suicidal or self-injurious behaviours.

Unstructured clinical judgements have proven to be a dubious method for assessing violence risk (Lidz *et al.*, 1993). Structured risk assessment instruments require skilled professionals, and thus are time-consuming. The use may be seen as inconvenient in general and in acute settings in particular; they are not routinely used in contemporary mental health services (Doyle and Dolan, 2002). The need for a suitable and simple violence screening tool in acute psychiatry led to the development of the Violence Risk Screening - 10 (V-RISK-10) instrument (Bjørkly *et al.*, 2009, Hartvig *et al.*, 2006).

A study within the frame of acute psychiatry that would focus on the early identification of risks for violent, suicidal and self-injurious behaviours seemed both desirable and timely.

2.3 Human aggression

This chapter reviews some of the scientific efforts to explain human aggression. Correlations between mental illness, violence and self-harm are explored.

2.3.1 Conceptualising aggression

The stimuli and motives precipitating human aggression are numerous and may include political, socioeconomic, cultural, environmental, biological and psychological factors. Aggression is often divided into two main categories: premeditated and impulsive aggression. Premeditated (predatory, instrumental or proactive) aggression represents a planned behaviour with clear goals that are not typically associated with frustrations, immediate threats or stress. Premediated aggression may not be accompanied by autonomic arousal (Siever, 2008b, Stanford *et al.*, 2003). Sometimes it is even socially accepted, as in wartime or in altruistic and political suicide (Pridmore and McArthur, 2009). Impulsive (reactive, hostile or affective) aggression, however, is characterised by high levels of autonomic arousal, and it is precipitated by triggers eliciting negative emotions, such as insults, anger, depression and fear. There is no clear distinction between pathological aggression and the accepted or defensive forms of aggression (Meloy, 2006, Siever, 2008b).

Conceptualising violence

The concept of violence as used in this dissertation, is based on definitions from recent studies (Dean *et al.*, 2006, Monahan *et al.*, 2005, Swanson *et al.*,

2006a) . Violence may be categorised as severe violent acts, less severe violent acts, or threats of violence. *Severe violent acts* encompass the intended infliction of injury upon another person that results in death or physical injury; the latter also includes sexual assaults, arson and any other assault involving fight sport techniques or the use of weapons. *Less severe violent acts* include kicks, blows, knocks and pushes that do not cause physical injury. *Threats of violence* are operationalised as verbal and non-verbal communication that clearly conveys the intention of inflicting death or physical harm, injury or assaults upon another person.

Prevalence of violence

In the Western world, homicides by persons with mental disorders and other homicides have increased in recent decades. Since the mid-1970s, there has been a relative decline in the rate of homicides that are related to mental disorders when compared with other homicides (Large *et al.*, 2008). A 13-year Swedish epidemiological study found that 45 violent crimes were committed per 1000 inhabitants in the general population. Five percent of the crimes were attributable to patients with major mental illnesses (MMI) (Fazel and Grann, 2006). Several cohort studies and reviews have revealed that violence rates among persons with major mental illnesses are increased 4 – 5 times as compared with the general population (Arseneault *et al.*, 2000, Brennan *et al.*, 2000, Choe *et al.*, 2008, Hodgins, 1992, Tiihonen *et al.*, 1997). Two studies, one from Sweden and one from Denmark, showed an increase in the relative risk of violence by women with major mental illness. When controlling for other factors, such as substance abuse, personality disorders and criminality in

the neighbourhood, the contribution to violence by the mentally ill has decreased considerably (Elbogen and Johnson, 2009, Pulay *et al.*, 2008, Silver *et al.*, 1999) or even disappeared (Monahan J, 2001).

Conceptualising suicidal and self-injurious behaviours

Self-inflicted harm has been conceptualised in different ways (Silverman *et al.*, 2007, Skegg, 2005). Suicidal and self-injurious behaviours are complex (Prinstein, 2008), and may be difficult to distinguish from each other (Silverman *et al.*, 2007). In this dissertation, *suicidal threats* are defined as verbal or non-verbal interpersonal communications indicating that suicide-related acts may occur in the near future. A suicidal attempt is defined as self-inflicted behaviour that is carried out with the intention to kill oneself (Kroner and Loza, 2001) (Klonsky, 2007). Correspondingly, *self-injurious behaviour (SIB)* is defined as the intention to injure oneself but without the wish to kill oneself (Klonsky, 2007, Kroner and Loza, 2001). Suicidal attempts and self-injurious acts are characterised as *severe* if followed by hospitalisation or death. Other attempts or acts are characterised as being *less severe*.

Prevalence of suicidal and self-injurious behaviours

Each year, approximately one million persons worldwide die due to suicide (WHO, 2002). The estimated mortality rate is 14.5 deaths per 100,000 people (WHO, 2002). Suicide rates vary according to region, gender, age, ethnic origin and probably also due to both death registration practices and the accuracy of reporting. In several countries, indigenous populations tend to have high suicide rates as compared with the rest of the population. Since the late

1990s, there has been a decline in suicide rates in many Western countries, especially among young men (Biddle *et al.*, 2008a, Morrell *et al.*, 2007). The cross-national lifetime prevalences of suicidal ideation, plans and attempts have respectively been found to be 9.2%, 3.1% and 2.7% (Nock *et al.*, 2008a). The corresponding one-year prevalences in a US national survey were 2.6%, 0.7% and 0.4% (Borges *et al*., 2006).

Self-injurious behaviours is estimated to occur in 4% of the adult population (Janis and Nock, 2009). In a large sample of college students, one-year prevalence rate was found to be 9.7% and lifetime prevalence 17% (Whitlock *et al.*, 2006).

2.3.2 Psychology of aggression – three theories

Theories about aggression may be grouped into three categories (Bjørkly, 2001). (i) *The instinct theory* refers to Freud's psychoanalytical approach and the conflict between Eros (life instinct) and Thanatos (death force), which gives rise to aggression against others and self. This is similar to evolutionary theory and to some biological theories that see aggression as a survival strategy. (ii) The second category encompasses theories that view aggression as a reactive phenomenon, of which *the frustration – aggression hypothesis* is best known. (iii) The third category is the *social learning theory* that does not attribute aggression to internal mechanisms but rather sees aggression as initiated by social behaviour through operant conditioning and social modelling; it is also viewed as being maintained by other mechanisms such as social reinforcement.

Aggression can also partly be understood from a group dynamic point of view. When people are in large groups or crowds, they tend to lose their sense of individual identity; they may take on the identity of the group (de-individuation) (Biddle *et al.*, 2008b, Scheidlinger, 1994, Silke, 2003), as illustrated in the famous 1954 novel by William Golding, *Lord of the Flies* (Golding, 1954).

2.3.3 Neurobiology of aggression

Some forms of pathological aggression, such as impulsive aggression related to emotional arousal in a context of provocation, seem to be characterised by an underlying neurobiology (Siever, 2008b). An imbalance between the prefrontal regulatory influences and hyper-reactivity of the amygdala and other limbic regions are implicated in such aggressive acts that are triggered by anger-provoking stimuli (Siever, 2008b, Troisi, 2009).

Insufficient serotonergic facilitation of the "top-down" control, catecholaminergic stimulation, pathology in neuropeptides (Siever, 2008b), and reduction of the GABA and enhancement of the glutaminergic systems (Lieving *et al.*, 2008, Lumley *et al.*, 2004) may add to aggressive behaviour. Some studies indicate that genetic factors contribute to impulsive violence (Beitchman *et al.*, 2006, Mann *et al.*, 2009, Marks *et al.*, 2007, Seroczynski *et al.*, 1999). Genetic effects are dependent on gene expression. Identifying specific suicide diathesis-related genes has proven difficult (Currier and Mann, 2008), and an e*ndophenocyte* model, which is an internal phenotype between the gene and the disease, has been suggested (Carballo *et al.*, 2008, Carpenter

et al., 2009, Mann *et al.*, 2009, Roth *et al.*, 2009). Functional magnetic resonance imaging (fMRI) studies have shown changes in the volumes of different parts of the brain that are related to violence and suicidal behaviour (Coccaro *et al.*, 2007, Lee *et al.*, 2009, Monkul *et al.*, 2007).

Indices of reduced serotonergic transmitter function have been associated with suicidal and violent behaviour, such as decreased serotonin transporter availability and increased serotonin (5-HT_{2A}) receptor binding in the prefrontal cortex (Coccaro *et al.*, 1997, Frankle *et al.*, 2005, Mann, 2003, Mann *et al.*, 2009, Nock *et al.*, 2008b, Pandey *et al.*, 1995, Winstanley *et al.*, 2004). Increased dopaminergic and noradrenergic functions have also been linked to aggression (Seo *et al.*, 2008, Siever, 2008b). Cortisol concentrations have generally been found to be low in individuals with high aggression (Carpenter *et al.*, 2009, Fetissov *et al.*, 2006). An imbalance in cholinergic activity may contribute to dysphoria or irritability (Steinberg *et al*., 1997).

Moreover, testosterone (Coccaro *et al.*, 2007, Hermans *et al.*, 2008) and vasopressin (Coccaro *et al.*, 1998) have been positively correlated with aggression, while deficits of the oxytocin function might contribute to hostility (Ditzen *et al.*, 2009, Kirsch *et al.*, 2005, Kosfeld *et al.*, 2005). Opiates in particular have been related to self-directed aggression (Coid *et al.*, 1983), and opiate antagonists have been shown to diminish self-injurious acts (Symons *et al.*, 2004).

Despite the great advances in the field, biological variables have only to a limited extent been studied as causal factors in relation to violence and self-harm.

2.3.4 Mental illness and violence

Across cultures in the general population, a long-standing opinion exists that persons with a major mental illness (MMI) have an increased risk of engaging in violent behaviours. Studies from the 1970s did not support this notion, and the academic view gradually evolved that no relation could be proven between violent behaviour and MMI. In the 1990s, this view was replaced by an acknowledgement of a small, yet significant and clinically relevant association between MMI and violent behaviour (Harris and Lurigio, 2007, Monahan, 1992).

When controlling for other risk factors, or when adjusting for population parameters, the correlation between MMI alone and violent behaviour is significantly reduced (Coid *et al.*, 2006, Elbogen and Johnson, 2009, Hiday, 2006, Pulay *et al.*, 2008, Swanson *et al.*, 2006b) or even non-significant (Monahan J, 2001). When the violence rate of other residents in the same community is controlled for, psychiatric patients with no substance abuse is statistically indistinguishable from other residents without substance abuse (Silver *et al.*, 1999, Steadman *et al.*, 1998). However, several violence risk factors may be active in subjects with MMI (Elbogen and Johnson, 2009). Some of them could be the consequences, rather than the causes (Douglas *et al.*, 2009).

Diagnoses

Studies have shown that increased rates of violence are found in persons diagnosed with alcohol misuse (Coid *et al*., 2006), substance abuse (Pulay *et*

al., 2008, Steadman *et al.*, 1998, Swanson *et al.*, 2006b), personality disorders (Coid *et al.*, 2006, Pulay *et al.*, 2008), MMI (Elbogen and Johnson, 2009), bipolar disorders (Corrigan and Watson, 2005), schizophrenia and other psychoses (Large *et al.*, 2009, Swanson *et al.*, 2006b, Wootton *et al.*, 2008). Some studies indicate that violence rates may be elevated among persons with anxiety disorders, dysthymia and major depression (Corrigan and Watson, 2005). Personality traits that are related to psychopathy (Coid *et al.*, 2006, Skeem *et al.*, 2007) and to antagonism (Skeem *et al.*, 2005) have also been correlated strongly with violence. Impulsive behaviors are also linked to violent offending (Stanford *et al.*, 2003).

Imminent risk of violence may be mediated and predicted by acute psychiatric symptoms, whereas long-term risk is associated with historical risk factors (e.g., diagnosis, a history of violence) (Norko and Baranoski, 2005). Contacts with family and friends are linked to greater risks of violence among patients with MMI and with a Global Assessment of Functioning score in the *lower* 20% range. The opposite was found among higher-functioning patients (Swanson *et al.*, 1998). Violent patients with schizophrenia show a significantly better ability to identify facial emotion cues than non-violent patients, but they are also less able to assess the intensity of the cues (Silver *et al.*, 2005).

Offenders with schizophrenia are more likely to use sharp instruments to commit homicides and to kill a family member or spouse in the home. Perpetrators with affective disorders are more likely to use strangulation or suffocation, while alcohol-dependent perpetrators use hitting or kicking.

Finally, drug-dependent offenders are more likely to use non-violent methods, particularly poisoning. The use of firearms is rare among psychiatric patients (Rodway *et al*., 2009).

Symptoms

MMI comprises a heterogenic group of diagnoses, which may give rise to some methodological problems. Psychotic episodes have been considered the most important link between MMI and violent behaviour (Monahan, 1992). A longer duration of untreated psychosis has been associated with a higher proportion of committed homicides prior to treatment (Large and Nielssen, 2008, Meehan *et al.*, 2006). In a meta-analysis, a psychosis was reliably associated with a 49-68% increased likelihood of violence (Douglas *et al.*, 2009).

In some patients, persecutory delusions appear to increase the risk of violence; co-occurring emotional stress may also increase the risk (Arango *et al.*, 1999, Bjørkly, 2002a). Associations have been found between the symptoms of "perceived threat and internal control override" (TCO) and violent behaviour (Bjørkly, 2002a, Chan, 2008, Link *et al.*, 1998, Nolan *et al.*, 2005, Swanson *et al.*, 1996, Teasdale *et al.*, 2006). TCO refers to beliefs that others will harm you and that they can control your thoughts or put thoughts into your mind. No evidence has been found that auditory command hallucinations alone are dangerous per se, but some evidence indicates that voices ordering acts of violence may manifest in violent behaviour in some patients (Bjørkly, 2002b). Individuals who believe their hallucinated voices to be all-powerful,

malevolent and irresistible were found to be more likely to engage in violent or self-harm acts on the inpatient service (Berman *et al.*, 2009).

2.3.5. Mental illness and risk of suicidal and self-injurious behaviours

Mental illness seems to be more strongly correlated with suicidal behaviour than with violence. Psychiatric disorders are present in about 90% of the people who kill themselves (Hawton *et al*., 1998). Psychiatric disorders contribute 47 -74% in the risk of suicide (Cavanagh *et al.*, 2003), but only 5% in the risk of violence in the general population (Fazel and Grann, 2006). Comorbidity is especially associated with elevated risk. In high-income countries, the strongest diagnostic risk factor is a mood disorder. Impulse control disorders matter most in low- and middle-income countries (Nock *et al.*, 2008a). Based on the person's age at their first suicide attempt, two groups of patients have been identified: the early onset subgroup (mean age of 19.5 years), which is characterised by more frequent comorbid anxiety disorders, cannabis misuse and a personal history of abuse; and the late onset subgroup (mean age of 38.5 years) suffering from major depressive disorders (Slama *et al*., 2009).

The mortality risk of depressive and bipolar disorders is several times higher than in the general population (Harris and Barraclough, 1997, Hawton and van Heeringen, 2009). More than half of all people who die of suicide meet the criteria for a current depressive disorder (Bethell and Rhodes, 2008, Cavanagh *et al.*, 2003). The risk is especially high early in the course of bipolar disorders (Bryan and Rudd, 2006).

Lifetime suicide risk in schizophrenia is estimated to be between 4% (Palmer et al., 2005) and 13% (Shields *et al.*, 2007a). The risk seems to be highest soon after the onset. Suicide is less likely to occur during active psychotic phases than during recovery (Bryan and Rudd, 2006). Auditory hallucinations that command suicide are considered to be a risk factor in persons with schizophrenia (Shields *et al.*, 2007b), and retrospective studies suggest that 4 - 10% of suicidal behaviour in schizophrenia is in response to command hallucinations (Harkavy-Friedman *et al*., 2003). In a prospective study, the presence of hallucinations did not predict suicide (Walsh *et al*., 2001). However, individuals who were already at risk for suicidal behaviour may be at increased risk when experiencing command hallucinations (Harkavy-Friedman *et al*., 2003) (Shields *et al.*, 2007a, Zisook *et al.*, 1995), and also patients who believed that their auditory hallucinations are all-powerful, malevolent and irresistible (Berman *et al.*, 2009).

Alcohol dependence and substance abuse are potent risk factors for suicide, while aggression or impulsivity, severe alcoholism or abuse, negative affect and hopelessness are key predisposing factors (Conner *et al.*, 2004, Sher *et al.*, 2009). Nearly half of all persons who die of suicide have been diagnosed with a personality disorder (Foster *et al.*, 1997), and nearly all persons with personality disorders who die of suicide have concurrent depression, substance abuse or both (Blasco-Fontecilla *et al.*, 2009, Lieb *et al.*, 2004, Tyrer, 2007, Tyrer *et al.*, 2004). Suicide risk is also elevated in adjustment disorders, panic and anxiety disorders, as well as in sleep disturbances (Bernert and Joiner, 2007, Harris and Barraclough, 1998). Post- traumatisk stress disorder (PTSD) has been significantly associated with suicide attempts, even after adjusting for

prior major depressive episodes, alcohol abuse or dependence, and drug abuse or dependence. In contrast, exposure to traumatic events without PTSD was not associated with an increased risk of attempted suicide (Wilcox *et al.*, 2009).

Self-injurious behaviour has been less studied than suicidality (Prinstein, 2008). It is estimated to occur in 21% of the adult psychiatric patients (Janis and Nock, 2009). A heightened prevalence has been documented among patients with depressive disorders, substance abuse, anxiety disorders, eating disorders and personality disorders (Brown, 2009). Symptoms of borderline, schizotypal, dependent and avoidant personality disorders have been identified as risk factors of self-injury (Wichstrom, 2009). Adolescents and young adults seem particularly vulnerable.

In adolescents, suicidality and self-injurious behaviour are associated with depression (Bethell and Rhodes, 2008). Suicide risk is elevated in eating disorders, especially in anorexia nervosa (Bridge *et al*., 2006). The effects of impulsive-aggressive traits are present in child and adolescent suicides, but decrease with age (McGirr *et al.*, 2008).

2.3.6. Relationship between violence and suicidal or self-injurious behaviours

Psychiatrists have long argued that in depressive patients there is a relationship between aggression and suicide. This is derived from the psychodynamic models viewing suicide as inverted homicide. This stance may also stem from

biological models showing decreased serotonergic activity in violent and suicidal behaviour (Castrogiovanni *et al.*, 1998).

Studies in forensic and general psychiatric settings have demonstrated links between violence and self-harm in the context of both psychological and biological factors (Hillbrand, 2001). Findings from health screenings and community samples suggest associations between high levels of lifetime aggression and suicidal behaviour (McGirr *et al.*, 2008, Pillai *et al.*, 2009). A correlation between aggressive behaviour and childhood trauma has been found in suicidal patients (Sarchiapone *et al*., 2009). However, no correlations between violence and self-harm have been found among inpatients (Krakowski and Czobor, 2004).

Impulsivity, suspiciousness, rebelliousness, and state and trait anxiety have been associated with both violence and self-harm (Apter *et al.*, 1991), but it is uncertain whether impulsivity increases the risk of suicidal behaviour independent of aggressive traits (Baud, 2005). No correlation was found between depressive subtypes and violence, in contrast to a significant association between depressive subtypes and suicide (Castrogiovanni *et al*., 1998). In violent patients, with the exception of arsonists (Virkkunen *et al.*, 1989), no significant correlation between sadness and risk of suicide has been found, and the prevalence of affective disorders in this group was low (Apter *et al.*, 1991).

The most dramatic connections between violence and self-harm are observed when homicide is followed by suicide. The risk increases with a closer relationship between the perpetrator and the victim (Flynn *et al*., 2009). The

most common diagnoses of homicide-suicide offenders are personality disorders or affective disorders. Significantly fewer offenders in the homicide-suicide group have been in contact with mental health services as compared with homicide offenders or with persons committing suicide (Flynn *et al*., 2009).

2.4. Scientific efforts to measure

2.4.1 Aggression, lipids and serotonin – biological markers

In the cerebrospinal fluid, 5-hydroxyindole acetic acid is the main metabolite of serotonin. Low concentrations of this substance have been associated with impulsive, destructive and self-harming behaviours, particularly when aggression and violence are involved (Brown and Linnoila, 1990, Carlborg *et al.*, 2009, Cooper *et al.*, 1992, Mann, 2003, Nordstrom *et al.*, 1994).

Significant associations between low serum cholesterol concentrations and violence have been found across many studies (Golomb, 1998, Hillbrand and Spitz, 1999), including health screenings (Boscarino *et al.*, 2009, Golomb *et al.*, 2000, Soeda *et al.*, 2006) and studies from psychiatric settings (Diaz-Sastre *et al.*, 2007, Hillbrand *et al.*, 2000, Mufti *et al.*, 1998, Paavola *et al.*, 2002). Serum cholesterol has also been found to be lower in suicidal attempters than in non-attempters (Florkowski *et al.*, 2001, Kim and Myint, 2004, Kunugi *et al.*, 1997, Lee and Kim, 2003, Marcinko *et al.*, 2008, Peres-Rodriguez, 2008, Vevera *et al.*, 2003) and also in violent suicidal attempters when compared with non-violent attempters (Atmaca *et al.*, 2003, Atmaca *et al.*, 2008). Decreased cholesterol has been related to impulsive aggression and anxiety

(Agargun *et al.*, 2004, Paavola *et al.*, 2002, Vevera *et al.*, 2003), in contrast to increased cholesterol levels, which have been related to premeditated aggression (Agargun, 2002, Conklin, 2006, Conklin and Stanford, 2008). In most hypotheses, the "aggression effect" of low cholesterol is related to low serotonin, which in turn is linked to various mood and behavioural disorders, violent and suicidal behaviour, impulsivity, cognitive dysfunction and affective disorders (Siever, 2008a, Troisi, 2009).

Both decreased platelet serotonin and serum cholesterol concentrations are found in individuals whose suicide attempts are characterised by violence and impulsiveness (Alvarez *et al.*, 1999, Crowell *et al.*, 2008), and also in the first psychotic episode of male patients (Marcinkoa *et al*., 2007). Another study found that self-harming patients, when compared with controls, had significantly lower total cholesterol, while platelet serotonergic measures did not differ (Garland *et al*., 2007).

Studies have shown significant associations between decreased triglyceride (TG) concentrations and suicidal or violent behaviours (Agargun *et al.*, 2004, Lee and Kim, 2003, Paavola *et al.*, 2002). However, the TG concentration has been found to *increase* after short-term psychological stress (Bachen et al., 2002), and also after chronic psychological stress (Chikani *et al.*, 2004, Melamed *et al.*, 1992). The rise in TG levels seems to be a direct effect of the psychological sympathetic activation, not a metabolic effect (Bachen et al., 2002). Other studies have found negative correlations between HDL and violent or suicidal behaviours (Buydens-Branchey *et al.*, 2000, Chen *et al.*, 2001).

Most studies that report lipids and serotonin to correlate with aggressive behaviour are cross-sectional or retrospective. In two prospective studies, no associations were found between serum cholesterol in depressed patients and subsequent suicide attempts (Deisenhammer *et al.*, 2004, Fiedorowicz and Coryell, 2007)

As risk markers, biological measures have increasingly been subject to systematic research, but their use in clinical risk assessments has so far been limited. We found no prospective studies of the predictive validity of lipids or serotonin in relation to subsequent violent or self-harming behaviours carried out in acute psychiatric units.

2.4.2 Self-report questionnaires – brief overview

Various self-report questionnaires not used in this study, but aiming to capture the risk of suicidal and violent behaviours will briefly be reviewed.

Self-report questionnaires of the risk of suicidal or self-injurious behaviours

The Suicide Probability Scale (SPS) (Cull J, 1988) is a 36-item questionnaire that is designed to assess four areas of general suicide risk: hopelessness, suicidal ideation, negative self-evaluation and hostility. Among adolescents who were hospitalised, the SPS contributed to predicting their future suicidality and suicide attempts (Huth-Bocks, 2007). The SPS is designed to supplement other sources of information when assessing suicide risk in this population.

The Suicide Assessment Scale (SUAS) is composed both of an expert rating scale and a self-report questionnaire (SUAS-S) to assess the suicide risk over time (Nimeus *et al.*, 2000). SUAS-S consists of 20 items that are scored from 0-4. The SUAS-S appears to be a valid, reliable assessment instrument that is simple and easy to use (Nimeus *et al*., 2006).

Self-rating scales have been found to improve the efficiency of the clinical determination of suicide risk (Joiner *et al.*, 1999). Self-reports of depressive symptoms are not reliable in acute episodes but concur with clinical assessments at follow-up (Prusoff *et al.*, 1972).

The Deliberate Self-Harm Inventory (DSHI) is a 17-item, behaviourally based, self-report questionnaire, with yes – no responses. Yes-responses were followed by questions of age at first time, the duration, frequency, the last time, and hospitalisation or medical treatment (Gratz, 2001).

Self-report questionnaires of the risk of violence

Many self-report instruments have been developed within forensic psychiatry, but to my knowledge, there exists no self-report instrument specifically developed for the risk assessment of violence. However, there are some instruments that may be relevant supplements, such as the Self-Appraisal Questionnaire (SAQ), the Baratt Impulsiveness Scale (BIS), and the Novaco Anger Scale (NAS).

The Self-Appraisal Questionnaire (SAQ) is an inventory of 67 true/false statements. It consists of six subscales: Criminal Tendencies, Antisocial

Personality Problems, Conduct Problems, Criminal History, Alcohol/Drug Abuse and Associates (Kroner and Loza, 2001). In a follow-up study of the first two years after release, the SAQ was comparable with established risk assessment tools for predicting violent and non-violent recidivism (Loza *et al.*, 2007).

The Baratt Impulsiveness Scale (BIS) is a 30-item measure of general impulsiveness.

The Novaco Anger Scale (NAS) is an 80-item questionnaire about various situations and explores whether the responder would get angry or annoyed. The BIS and the NAS have been compared with the presently employed risk assessment tools, such as the HCR-20 risk assessment scheme (see page 38) and the Violence Appraisal Risk Guide (Harris *et al.*, 1993). Both the BIS and the NAS have been found to be significantly predictive of subsequent violence (Doyle and Dolan, 2006).

In a meta-analysis of 22 prospective studies (Walters, 2006), both risk assessment tools for clinicians and self-report measures with content relevant to violence risk assessment, such as SAQ and NAS were found to be valid. Although risk assessment tools displayed an advantage over self-reports concerning predictive validity, both sets of measures accounted for criminal justice outcomes beyond the variance that is attributable to the alternate method.

In this field, there has been a controversy about the reliability of self-report questionnaires (Doyle and Dolan, 2006, Gaynes *et al.*, 2004, Hart, 1995, Loza,

2007). The criticism has been that patients will answer more favourably in self-reports if the responses will be used, for example, in making decisions about their release to the community (Hart, 1995, Helfritz *et al.*, 2006). Others have found self-reports useful (Doyle and Dolan, 2006, Loza, 2007). It has been underlined that responders may be more honest in research than in clinical settings (Doyle and Dolan, 2006).

The instruments described above are too time-consuming to serve as screening tools in acute settings. A literature search failed to locate any empirical studies of patients' self-reported risk estimates as predictors of future violent, suicidal or self-injurious behaviour. Hence we wanted to explore this topic in the "Risk Project".

2.4.3 Structured professional risk screening and risk assessment tools

For closer understanding of the concepts of risk, prediction, screening and assessment used in this thesis, see "Central concepts and designations", page 9.

This dissertation includes a structured professional screening tool for the assessment of risk of violence (V-RISK-10, see page 55), but not one for suicidal behaviour. The MINI suicidal scale (Sheehan *et al.*, 1998) was included in the Risk Project of Ålesund, but results from this part of the project are not yet available. Accordingly, structured professional assessments and screening tools of suicidal behaviour are only briefly discussed in this chapter, while assessments and screenings of the risk for violence are dealt with in more detail.

Unstructured professional clinical judgments, rather than structured risk assessment tools, seem to be the general rule in assessing suicidal and self-injurious behaviours. Many factors are associated with the risk of suicide (Hawton and van Heeringen, 2009). Previous suicidal attempts (Gaynes *et al.*, 2004, Yoshimasu *et al.*, 2008) and suicidal ideation (Mann *et al.*, 2008, Olfson *et al.*, 1996) have proven to be among the strongest factors. Suicidal "ladders" that explore suicidal ideation and previous suicide attempts have been recommended in the clinical guidelines for screening suicidal risk in depressive patients (NICE, 2004). Such ladders have also been used in recent studies that examine public mental health (Crawford *et al.*, 2005, Thomas *et al.*, 2002). A full clinical judgment of suicide risk is rather time-consuming if all aspects are to be covered (Bryan and Rudd, 2006).

Assessing risk of violence - historical overview

The idea of the dangerous psychiatric patient evolved in the 1960s and 1970s in parallel with deinstitutionalisation, the increased use of voluntarily hospitalisations and the civil rights movement (Norko and Baranoski, 2005). Historically, the most common approach to assess risk was by unstructured clinical judgement (Doyle and Dolan, 2002). In this framework, there are no constraints on the information the assessors may use to reach their decision. Studies in the early 1970s revealed that the ability of psychiatrists and psychologists to predict violent episodes was overestimated (Monahan, 1981). More recent research has led to a general consensus that predictions based on unstructured clinical judgements are only slightly better than chance, and also

that the predictive competence varies considerably between clinicians (Lidz *et al*., 1993).

In the mid-1980s, a "second generation" of theories and policies of risk assessment evolved (Doyle and Dolan, 2002). This approach aimed at identifying an array of actuarial risk markers. The integration of statistical evidence into the violence risk prediction has been called the actuarial approach (Monahan, 1981, Monahan, 1984). Research demonstrated that this approach was superior to unstructured clinical judgements (Grove and Meehl, 1996). Nevertheless, there were limitations; the numbers of risk factors used were limited, and there was a tendency to focus on immutable or static factors. Moreover, crucial risk factors may be excluded if their value has not been empirically proven. The decisions can be non-optimal when applied in different settings. Furthermore, predictions do not include the important task of risk management (Hart, 1998).

A third generation, referred to as structural clinical decision making, or structural professional judgement (SPJ), attempts to draw from the strengths of both generations (Douglas *et al.*, 1999a, Hart, 1998) "to integrate the almost separate worlds of research on the prediction of violence and the clinical practice of assessment" (Webster, 1997). Clinicians incorporate risk assessment schemes into their clinical routines to ground their assessments upon factors that have empirically been linked to violence (Douglas *et al.*, 1999a). Hence, SPJ also moves the emphasis from prediction to risk management; the latter is considered to be a more dynamic and continuous

process (de Vogel *et al.*, 2004, Douglas *et al.*, 2003, Doyle and Dolan, 2006, Webster *et al.*, 2002).

Risk assessment tools were developed in forensic and prison settings (Monahan, 1984) but have proven to be valid in general psychiatry as well (Douglas *et al.*, 1999b, Edens *et al.*, 2006, Harris *et al.*, 2004). As already stated, they are time-consuming, require trained and skilled professionals, and they are not routinely used in contemporary mental health services (Doyle and Dolan, 2002).

Screening of violence risk

Violence risk screening procedures are employed to detect who should and should not be selected for further comprehensive risk assessments. Such procedures have to be simple and easy, but also population specific. In addition, they should be able to identify low levels of risk.

The Violence Screening Checklist (VSC) is a four-item screening tool based on historical records; significant indicators include a history of physical attacks and/or fear-inducing behaviours during the last two weeks prior to hospital admission, but also a diagnosis of schizophrenia or mania, male gender and the absence of recent suicidal behaviour (McNiel and Binder, 1994, McNiel *et al.*, 2003).

The M55 form is a part of the "alert system", which is used to identify potentially violent inpatients in a large hospital for acute care (Kling *et al*., 2006). A high-risk patient is characterised by a history of violence, by being physically or verbally aggressive, or by making threats. The risk is also seen as

high when three or more of the following indicators are present: shouting or demanding, displaying signs of drug or alcohol intoxication, suffering from auditory or visual hallucinations, threatening to leave, being confused or cognitively impaired, suspicious, withdrawn or agitated.

The base rate of violence was very high in the validation studies of the VSC and M55 screenings. Their use in patient samples with base rates of violence below 40% is associated with some uncertainty.

The Clinical Assessment of Risk Decision Support (CARDS) is a two-stage risk assessment instrument used for both in- and outpatients, and that includes a screening and a full risk assessment phase (Watts *et al*., 2004). To our knowledge, there exists no validation of CARDS.

A screening tool for psychotic patients in the community that involves four easily available items (age, gender, history of assault in the last two years and drug abuse within the last year) showed a two-year predictive accuracy comparable to those of the more detailed risk assessment tools (Wootton *et al*., 2008). However, only psychotic patients were included, and patients with a primary diagnosis of substance abuse or a diagnosis of organic brain damage were excluded.

Violent risk assessment tools

The Brøset Violence Checklist (BVC) (Almvik *et al.*, 2000) and the Dynamic Appraisal of Situational Aggression: Inpatient Version (DASA-IV) (Ogloff and Daffern, 2006) predict violence within the next 24 hours. The Short-Term Assessment of Risk and Treatability (START) is a recently developed 20-item

tool with a screening and an assessment version in which the risk factors are weighted against protective factors (Nicholls *et al.*, 2006).

Systematic risk assessment studies on community violence committed by patients discharged from civil psychiatric hospitals may be divided into three subgroups (Bjørkly *et al.*, 2009): (i) semi-structured risk assessment interviews (Klassen and O'Connor, 1989); (ii) structured risk assessment instruments, such as the HCR-20 risk assessment scheme (Douglas *et al.*, 1999a, Webster, 1997); and (iii) actuarial instruments, such as the Psychopathy Checklist: Short Version (PCL:SV) (Hart, 1995), the Violence Risk Appraisal Guide (VRAG) (Harris *et al.*, 2004), and the Classification of Violence Risk (COVR) (Monahan *et al.*, 2000, Monahan *et al.*, 2005, Otto and Douglas, 2010, Snowden *et al.*, 2009).

The HCR-20 Risk Assessment Scheme consists of three subscales: *H*istorical (10 items), *C*linical (5 items) and *R*isk management (5 items). The historical items are as follows: 1. previous violence, 2. young age at first violent incident, 3. relationship instability, 4. employment problems, 5. substance use problems, 6. major mental illness, 7. psychopathy, 8. early maladjustment, 9. personality disorder, and 10. prior supervision failure.

The clinical items are the following: 11. lack of insight, 12. negative attitudes, 13. active symptoms of major mental illness, 14. impulsivity and 15. unresponsive to treatment.

The risk management items are the following: 16. plans lack feasibility, 17. exposure to destabilisers, 18. lack of personal support, 19. non-compliance with remediation attempts, and 20. stress. Risk assessment and risk

management involving the HCR-20 can be considered as a structural professional judgement.

COVR is an interactive software program that is based on an iteration classification tree procedure and consists of 106 items. It is designed to estimate risk over the first several months after discharge, and the program guides the evaluator through a brief chart review and a 5- to 10-minute interview with the patient.

2.4.4. Closing words on assessment methods

Here ends the brief review of the instruments and methods not included in the thesis.

Lately, a review stated that "risk assessment instruments of intra-institutional and post-release violence in acute psychiatric patients are rare, and no easy-to-use screening instrument has been validated so far" (Bjørkly *et al*., 2009). Moreover, the self-report questionnaires described (section 2.4.2.) seem too time-consuming for acute settings, and the use of biological measures (2.4.1.) in clinical risk assessments have so far been limited.

Accordingly, the efforts to develop screening tools for violence risk assessment for use in acute wards (but also in general psychiatry) seem well justified.

3. OBJECIVES AND OUTLINE OF THESIS

3.1 Aims of study

The main topic of this dissertation is the risk assessment of violence and self-harm in acute psychiatry with an emphasis on early identification of patients at risk. Three different methods were tested: **(i)** biological markers, which include serum total cholesterol, low density lipoprotein, high density lipoprotein, triglycerides and blood platelet serotonin; **(ii)** "Self-report risk scale" (SRS); patients' estimates of their own risks of future violent, suicidal and self-injurious behaviours, and **(iii)** structured professional violence screening instrument (V-RISK-10).

The following research questions (RQ) will be addressed:

(i) Are serum lipids or platelet serotonin valid predictors of violent behaviour, suicidal behaviour or self-injurious behaviour?

(ii) Are patients' self-rated risk estimates (SRS) valid predictors of violent behaviour, suicidal behaviour or self-injurious behaviour?

(iii) Is V-RISK-10 a valid predictor of violent behaviour?

Data collection for the three RQs took place during the patients' hospital stays and during the first three and twelve months after discharge.
The findings were analysed stratified by gender and by dividing the outcome variables into threats, less severe acts and severe acts. Also, the relationships between violence and suicidal and self-injurious behaviours were explored.
The findings are presented in four papers. They are summarised below in the Results section.

4. METHODS

4.1 Design and sample size

The study design is prospective and naturalistic. Baseline risk assessments at both admittance and discharge, and blood measures at admittance were compared with the occurrence of episodes that were recorded during the hospital stay and also after three and twelve months following discharge.

A previous study conducted at the acute ward of Aker University Hospital, showed that sufficient statistical power was obtained when all acutely admitted patients in one year were included (Hartvig *et al.*, 2006). This was true both for the hospital stay and at one year after discharge, with an outpatient follow-up rate of about 20%. The acute wards at Aker and Ålesund Hospitals had approximately the same number of admissions annually.

Approval and consent

The project was approved by the Norwegian Social Science Data Services, the Regional Committee for Medical Research Ethics and the Ministry of Health and Care. With the exception of the consent for blood sampling, the approval granted exemption from obtaining the patients' consent to participate in the study.

4.2 Participants

Patients from Ålesund Hospital were recruited from 07.03.2006 - 06.03.2007, and subsequently, they were follow-up until 30.06.2008. Patients from Aker University Hospital were recruited from 01.01.2006 - 31.12.2006; they were followed up one

year. The two hospitals are located in rather different parts of Norway. Both cover all acute psychiatric hospitalisations in their catchment areas, which include 160,000 inhabitants for Aker and 130,000 for Ålesund.

The lipids - serotonin study

Clinical and demographic characteristics are displayed in table 1 of patients who consented to have their blood drawn, and of those who were followed up after discharge,.

Table 1. Comparison between inpatients consenting to give blood samples and those not consenting, and between the patients who were followed up after discharge and those not followed up

	Inpatients, *n* = 489			Post-discharge consenting, *n* = 254		
	Consent *n* = 254	Not consent *n* = 235	*p*-value	Follow-up *n* = 199	Missing *n* = 55	*p*-value
Male/female, %	54/46	54/46	0.938	52/48	60/40	0.328
Mean age, years	43.5	45.6	0.242	42.5	46.9	0.018
Hospital stay, days[1, 2]	20/13	14/5	0.006 [4]	21/14	16/12	0.270
Violent inpatients	6.7%	8.0%	0.328	9.0%	0	0.016
Suicidal inpatients	3.4%	0	0.015	4.4%	0	0.115
Self-mutilation inpatients	2.4%	0	0.062	2.9%	0	0.198
Involuntarily admitted[1]	18%	25%	0.039	18%	16%	0.706
Mandatory aftercare	6.3%	10%	0.162	6.7%	5.3%	0.702
F10-19 substance abuse	16%	16%	0.982	15%	16%	0.761
F20-29 psychotic disorders	14%	20%	0.062	16%	7.3%	0.126
F30-31 bipolar disorders	14%	9.3%	0.094	17%	3.6%	0.013
F32-39[3] depressive disorders	31%	20%	0.004	29%	38%	0.217
F40-49 anxiety disorders	19%	17%	0.453	17%	27%	0.097
F60-62 personality disorders	6.0%	4.7%	0.555	6.1%	5.5%	0.860
Other diagnostic groups	4.0%	15%	<0.001	3.0%	7.3%	0.156

[1] all admittances included, [2] mean / median, [3] F34.0 and F38.0 not included, [4] Mann-Whitney *U* = 16865

The mean values of the lipid concentrations are given in mmol/litre (95% CI): total cholesterol, 5.04 (4.89-5.20); low density lipoprotein (LDL), 3.30 (3.15-3.45); high

density lipoprotein (HDL), 1.33 (1.26-1.41); and triglycerides (TG), 1.34 (1.24-1.34). There were no significant gender differences in mean lipid levels, or between the nine patients who were statin users and the rest. The mean platelet serotonin content in patients who used serotonin reuptake inhibitors (SRIs) was 0.86 nmol/10^9 platelets (95% CI= 0.65-1.1), which is significantly different ($p < 0.001$) from those on medication but not using SRIs (3.3 nmol/10^9 platelets, 95% CI= 2.9-3.7) and from patients with no medication or substance abuse at admittance (2.9 nmol/10^9 platelets, 95% CI= 2.5-3.3). When serotonin was included as a variable, the sample was subdivided into SRI users, and non-SRI medication users. Table 1 shows characteristics of the sample of the lipid – serotonin study.

Consenting patients had significantly lower violence rates after discharge than the non-consenting patients (three months: 14% versus 27%, $p = 0.005$; one year: 19% versus 33%, $p = 0.002$). No significant differences between the samples were found for self-harm.

The self-report study (SRS)

Table 2 shows the clinical and demographic characteristics of the "Self-report risk scale" (SRS) study. The sub-sample of patients (n = 28) who reported "*Won't answer about the risk* of violent threats or acts" was characterised by more involuntary admissions ($p < 0.001$), more mandatory aftercare ($p = 0.001$), more substance abuse ($p = 0.050$), more psychotic disorders ($p = 0.056$ *ns)* and less affective disorders ($p = 0.002$) when compared with the rest of the sample. The sub-sample reporting *"Don't know the risk* of suicide and self-injurious behaviour" (n = 29) was characterised by a higher frequency of readmissions ($p = 0.042$). Including

all readmissions in the analyses (n = 63), this group accounted for more personality disorders (p = 0.015) and anxiety disorders (p = 0.008).

Table 2. "Self-reported risk scale" (SRS) study. Comparison of the included and the missing sample at admission, and the included and missing sample at follow-up after discharge

	At admission n = 489			At discharge n = 489		
	Included n = 429	Missing n = 60	*p*	Follow-up n = 266	Missing[1] n = 223	*p*
Male / female, %	55 / 45	47 / 53	ns	55 / 46	54 / 47	ns
Mean age	43.9	48.9	0.036	42.8	46.9	0.013
Hospital stay mean/median, days	15.6 /10	19.0 /12	ns	18.4/10	13.3/8	0.004
Involuntary admission, n / (%)	79 / 19	17 / 30	0.052	65 / 21	38 / 21	ns
Mandatory aftercare, n / %	30 / 7.0	6 / 11	ns	31 /10	8 / 4.5	0.037
Inpatient violence, n / %	28 / 6.9	8 / 9.0	ns	21 / 7.6	4 / 2.3	0.019
Inpatient suicidality, n / %	10 / 2.5	0	ns	5 / 1.6	0	ns
Inpatient self-mutilation, n / %	7 / 1.7	0	ns	4 / 1.3	0	ns
F10-19 substance abuse %	16	15	ns	16	16	ns
F20-29 psychotic disorders %	16	17	ns	19	13	ns
F30-31 bipolar disorders %	12	12	ns	15	6.2	0.003
F32-39 depressive disorders[2] %	26	28	ns	24	29	ns
F40 anxiety disorders %	18	15	ns	17	20	ns
F60 personality disorders %	5.9	3.8	ns	6.5	2.9	ns
Other diagn. (F, Z, somatic) %	6.0	11	ns	7.1	15	0.007

[1] include missing (n=60) and dropouts (n=163) during follow-up, [2] F34.0 and F38.0 excluded.

V-RISK-10

The clinical and demographic characteristics are displayed in table 3. During the one-year inclusion period, the two hospital units treated a total of 1,017 patients (528 in Aker and 489 in Ålesund).

During their hospital stays, 980 patients (528 and 452, respectively) completed the inpatient part of the study, while 37 patients were missing. There were no

significant differences between the completers and those missing, or between the two hospitals. The mean score at admission for forms with three or fewer omitted items (n=886, 87.1%) was 7.2 (median=7, SD=5.0, range 0-20). The mean score at discharge was 6.5 (median = 6, SD=4.5, range 0-18), and no significant difference was found between follow-ups and drop-outs.

Table 3. V-RISK-10 study. Characteristics of inpatient sample, and of the outpatient sample at follow-up and for those missing

	Inpatient sample			Outpatient sample		
	Completers			Follow-up	Missing	
	n = 980	Men/women	*p*	n = 381[3]	n = 609[3]	*p*
Male/female, %		52 / 47.3	ns	55.3/44.7	51.5/48.5	ns
Mean age, years	42.6	41.8 / 43.8	ns	42.0/43.3	41.6/44.1	ns
Mean/median days	19.3 / 8			8.8 /10	19.8 / 7	0.036[2]
Violent inpatients %	9.0	9.6 / 8.5	ns	9.2	8.9	ns
Involuntarily admitted[4] %	20	24 / 17	0.044	21	19	ns
Mandatory aftercare[4]%	6.8	10 / 5	0.038	8.8	2.1	0.008
F1x substance abuse[4] %	16	22 / 9	<0.001	16	17	ns
F10.x alcohol abuse[4] %	8	12 / 4	<0.001	7	8	ns
F2x psychotic disorders [4] %	16	22 / 9	<0.001	19	11	0.036
F30-31 bipolar disorders[4] %	12			14	7.1	0.046
F32-39[5] depressive disorders[4] %	25	30 / 39[1]	0.034	23	28	ns
F4x anxiety disorders.[4] %	18	15 / 23	0.016	17	22	ns
F60.x personality disorders[4] %	5.6	3.1 / 8.9	0.010	7.0	1.4	0.013
Other diagnosis[4] %	6.4			4.0	13	<0.001

[1] = F30-39, [2] = Mann-Whitney test, [3] = schemes with more than three omitted items were excluded, [4] = from the Ålesund sample; the Aker sample had the same diagnostic distribution, but the diagnosis could not be differentiated in the follow-up/dropout samples, [5] = F34.0 and F38.0 not included

Separate analyses were conducted for patients at discharge with "zero" or "Don't know" scores on the two violence items. The mean total V-RISK-10 score for this group was 4.0 (*median* = 3.0, *range* = 0 - 12, *SE* = 0.20).

Participants and written consent

The first 287 patients who were admitted to Ålesund Hospital were asked if they would give written consent to participation in the study. The characteristics of the patients who consented and who would not are displayed in table 4.

Table 4. Significant differences between the consenting patients and those not willing to consent to be included in a risk prediction study

	Consenters n = 189 (63%)	Not willing to consent n = 98 (37%)	p
Violence rate after 3 months	12%	26%	0.021
Violence rate after 12 months	17%	38%	0.001
F2x psychotic disorders	13%	26%	0.006
F3x affective disorders	39%	14%	<0.001
Median length of stay	13 days	4 days	<0.001

4.3 Procedures

During the examination and data collection at admittance, the physician on duty recorded the patient's risk estimates about their future violent, suicidal or self-injurious behaviours on the "Self-report risk scale" (SRS). The physician also scored the V-RISK-10. Patients received written and verbal information about the project. Consenting patients gave permission to draw a fasting blood sample during the first to third day of the hospitalisation in order to measure their serum lipids and platelet serotonin concentrations.

As a part of the discharge procedure, the therapist (physician, psychiatrist or psychologist) and the patient completed a second SRS for the first three months after discharge. Also, the therapist did a second V-RISK-10 assessment. In accordance with the hospital routines, the scores were based on clinical and

collateral information that was obtained during the hospital stay, and it was gathered from all staff members.

Patients were followed up at three, six, nine and twelve months after discharge. The patient's therapist at the outpatient psychiatric clinic and the district psychiatric wards recorded violent episodes at each measurement point, for the 0-3, 4-6, 7-9 and 10-12 month periods. Psychiatric nurses at the acute wards followed up on the phone those patients who had been discharged to their communities. The local research coordinator collected data from the hospital records. Information about violent crimes was gathered from criminal records, but only for the 489 patients at Ålesund Hospital.

If a patient was readmitted to the acute ward during the study period, the violent, the suicidal and the self-injurious episodes in the prior post-discharge period were recorded by the ward staff, and the trial file was closed. The patient was then included in the study again with a new file number. The same procedure took place for each readmission.

Before the project started, all of the V-RISK-10 raters underwent a brief training. This was followed by a preliminary inter-rater reliability test, in which 15 short cases that were extracted from the medical records were rated by each participant. All new raters followed the same tutorial procedure before entering the project. Prior to the study, the staff members at all of the sites were trained in recording suicidal, self-injurious and violent behaviours on the instruments used. "Super-users" were trained to supervise on request other ward staff members who were involved in the study.

4.4 Baseline measures

Demographic and clinical data

Information about age, gender, length of the hospital stay, legal status at admission and discharge, medication and substance abuse at admission, and ICD-10 diagnoses at discharge were obtained from the hospital records.

Lipids

The central nervous system comprises 2% of the body mass but contains 25% of the free cholesterol in the body (Dietschy and Turley, 2001). Cholesterol is a part of the cell membranes and an important component of myelin. It plays a role in the development, stability and functioning of the synapses (Chattopadhyay *et al.*, 2007). Total cholesterol consists of different fractions: low density lipoprotein (LDL), high density lipoprotein (HDL) and the fraction of triglycerides (TG) which belongs to the very low density lipoproteins (VLDL). The total cholesterol, LDL, HDL and TG were measured in mmol/litre in fasting blood serum. The blood samples were analysed at the hospital laboratory with a reflexion photo-spectrometric method (VITROS 5.1 FS).

Platelet serotonin

Platelets share characteristics with serotonergic neurons. They are considered to be suitable for studying central serotonergic mechanisms (Verkes *et al.*, 1998). Platelets in platelet-rich plasma from citrated whole blood were counted before samples were prepared for serotonin determination. Proteins in the samples were precipitated by perchloric acid in DTT; the supernatant was neutralised with

K_2HPO_4 and kept frozen at – 80º C until liquid-chromatographic analyses for serotonin were completed at Haukeland University Hospital, Bergen (Hervig *et al.*, 1999, Ingebretsen *et al.*, 1985). All samples were divided into two parts (parallels). Both were analysed to control for accuracy, and the mean value used in further applications.

"Self-report risk scale" (SRS)

A four-item screen (SRS) was constructed to measure the patients' judgements about their subsequent risk for self-harm or violence (Figure 1). On admission and before discharge, the patients were asked the four SRS-questions: "For the time you

Figure 1. Self-report risk scale (SRS)

What is your opinion about the risk that you will:

	During hospital stay (asked at admission)	3 months after discharge (asked at discharge)
A: try to hurt yourself, without the intention to kill yourself ?	0 - 1 - 2 - 3 - 4 - 5 - 6	0 - 1 - 2 - 3 - 4 - 5 - 6
B: try to kill yourself ?	0 - 1 - 2 - 3 - 4 - 5 - 6	0 - 1 - 2 - 3 - 4 - 5 - 6
C: threaten other people by acting violently ?	0 - 1 - 2 - 3 - 4 - 5 - 6	0 - 1 - 2 - 3 - 4 - 5 - 6
D: act violently against others ?	0 - 1 - 2 - 3 - 4 - 5 - 6	0 - 1 - 2 - 3 - 4 - 5 - 6

0 = No risk, will definitely not happen
1 = Low risk, will hardly happen
2 = Moderate risk, limited to certain situations
3 = High risk, in many situations
4 = Very high risk, almost permanent risk
5 = Don't know the risk
6 = Will not answer about the risk

are staying in the ward / for the first three months after discharge from the ward; what is your opinion about the risk that you: (A) will try to hurt or injure yourself, without the intention to kill yourself ? (B) will try to kill yourself ? (C) will threaten other people by acting violently ? (D) will act violently against others?" For each of the questions, the patients endorsed one of seven response options to express their

risk estimates about themselves: *no risk, low risk, moderate risk, high risk, very high risk, don't know the risk* and *will not answer about the risk.*

Violence Risk Screening -10 (V-RISK-10)

V-RISK-10 (Bjørkly *et al.*, 2009, Hartvig *et al.*, 2007) consists of 10 items, and it is rated by doctors or psychologists. The first five items focus on historical data, and the last five focus on dynamic aspects: 1. previous or current violent threats, 2. previous or current violent acts, 3. previous or current substance abuse, 4. previous or current major mental illness, 5. personality disorders, 6. lack of insight into their illness or behaviour, 7. expressed suspicion, 8. lack of empathy, 9. unrealistic planning, and 10. future stress situations. All items are rated as follows: *No - not present, May be or moderately present, Yes – definitely present or Don't know the answer*. The scheme contains brief scoring instructions for each item.

To assess the inter-rater reliability, 30 of the raters who participated in the study independently scored 15 case stories. This procedure yielded an intra-class correlation coefficient (ICC) of 0.87 for the whole instrument. The inter-item correlation of the instrument, as measured by Cronbach's alpha, was 0.79. A recent study of V-RISK-10 has shown an ICC with an average measure of 0.85 (95% CI: 0.74-0.90), and a single-item ICC measure of 0.72 (95% CI: 0.58-0.82) (Bjørkly et al., 2009). The time required to complete ratings of the instrument after the examination and information gathering at admission was retrospectively estimated by the raters to be approximately five minutes (Bjørkly *et al*., 2009).

4.5 Outcome measures

Violent, suicidal and self-injurious behaviours

The definitions used in this study of violence against others (Dean *et al.*, 2006, McNiel *et al.*, 2003, Monahan *et al.*, 2005) and of suicidal and self-injurious behaviour (Klonsky, 2007, Kroner and Loza, 2001, Skegg, 2005) were in accordance with those used in recent studies (see chapter 2.2.1).

Recording episodes

Violence during hospitalisation was monitored by the Report Form for Aggressive Episodes (REFA) (Bjørkly, 1996, Bjørkly, 1998, Bjørkly, 2000), and self-harm was monitored by a corresponding Report Form of Suicidal and Self-injurious Episodes (RESUS). Shortly after the occurrence of a self-injurious, suicidal or violent episode on the ward, information about the time and characteristics of the event, the precipitating factors, the persons involved and the severity of the episode were all recorded.

After discharge, violent, suicidal and self-injurious episodes were categorised as threats, less severe acts and severe acts; other characteristics were not recorded. The scores were given as follows: *No, not present*; *Yes, present; Don't know if present*. The suicidal, self-injurious and violence record forms included scoring instructions.

Data from criminal and police records regarding violent threats or acts (such as convictions, charges and the withdrawal of charges for violent crimes for reasons related to insanity) were combined with the hospital data into one single violence outcome variable.

4.5 Statistics

The data were analysed by using SPSS, version 16.0. Statistics were computed for hospital stays, for the first three months after discharge, and for the first year after discharge. For persons with more than one hospitalisation, the inpatient and post-discharge periods with the most severe episode(s) were chosen. If two or more episodes of similar severity had occurred, the first episode was chosen as the positive identification of violence or self-harm in the analyses. Computations were also carried out for the readmissions. For some of the computations, the episodes of threats or physical acts were combined into one dichotomous variable in order to obtain a larger number of outcome episodes and higher statistical power.

For the SRSs, *no risk* and *low risk* were categorised as negative predictions, while *moderate, high* and *very high risk* were categorised as positive predictions. Over one third of the episodes were recorded as either *don't know* or *won't answer*. The *don't know* and *won't answer* responses at the *no risk* or *low risk* levels were recorded as negative predictors, and responses at the *moderate risk* or *higher risk levels* as positive predictors, respectively.

For the V-RISK-10 items, *No, Maybe* and *Yes* were scored as 0, 1 and 2, respectively. Schemes with four or more missing items were excluded. *Don't know* and the missing items were handled in one of two ways; they were scored as zero or they were "prorated". In the prorating formula: $prorated\ score = \frac{a}{b}\ c$; the following factors were taken into account (for example when items 2-10 are valid and item 1 is missing): *a* = that patient's total score (on his valid items 2-10), *b* = the mean score for the whole sample (on that patient's valid items 2-10), and *c* =

the mean score on the omitted item for all patients (with a valid score on the actual missing item 1).

"Don't know if present" responses in the outcome measures were handled as missing.

To compare the different samples, chi-square tests for categorical variables were used. T-tests and Mann-Whitney U-tests were used for continuous variables. The area under the curve (AUC) of the receiver operating characteristic analyses (ROC) was used to assess the predictive validity and the effect size of the instruments and its procedures. The ROC-AUC is less dependent on the base rate of the criterion variable than other measures of predictive accuracy and is considered suitable for risk assessments (Buchanan, 2008, Douglas *et al.*, 1999b, Rice and Harris, 1995). The AUC is rather to be taken as an index to interpret the overall accuracy of the predictor and is a true positives / false positives (sensitivity / 1-specificity) plot. The AUC for an ideal prediction is 1.0 and is reflected in a value of 0.5 for chance prediction. An AUC value between 0.7 and 0.8 is considered as an acceptable discrimination, a value between 0.8 and 0.9 is excellent, and an AUC value ≥ 0.9 is outstanding (Hosmer and Lemeshow, 2000). It has been argued that these interpretations of the ROC-AUCs give overly flattering judgements of risk assessment tools and that the criterion values should be more conservative: an AUC value between 0.7 and 0.8 is modest, between 0.8 and 0.9 is moderate, and an AUC value above 0.9 is high (Sjostedt and Grann, 2002).

Logistic regression analyses were conducted to measure the multivariate effect sizes and to control for confounders; Exp (B) was used as the odds ratio (OR) for the violent and self-harm episodes that occurred. A stepwise procedure was used to

monitor the progression of the χ^2 values in order to test whether each of the factors would add significantly to the variance of the model. To address the relative importance of the various contributing factors, two R^2 approximations (Cox & Snell and Nagelkerke) were used as the lower and upper limits of the "model fit" (Brace *et al.*, 2006). They give an estimate of how much of the total variance (violence or self-harm) could be explained by the predictor(s). The R^2 estimates in the logistic regressions are not as accurate as in the linear regressions, but they may be used to compare predictor(s) within the same data set (Hosmer and Lemeshow, 2000).

The analyses of the true and false positives and negatives provide important information about the hit rate of the predictor variable. A positive predictive value (PPV) shows how many of the patients with a "positive test" who actually turned to be violent or self-harming. A negative predictive value (NPV) expresses how many of the patients with a "negative test" were actually not violent or not self-harming. The "number needed to detain" (NDD) is analogous to the "number needed to treat". The NND indicates how many patients have to be detained for every true violent or self-harming patient identified. The NND is the inverse of the PPV.

5. RESULTS

At the outset, the prevalence of violence and self-harm will be presented, followed by the findings in relation to each of the aims of this study; finally, the relationship between violence and self-harm will be dealt with.

5.1 Prevalence of violence and self-harm

The prevalence of the recorded violent, suicidal and self-injurious behaviours (SIB) are shown in table 5.

Table 5. Prevalence of recorded episodes of violent, suicidal and self-injurious threats and acts for inpatients, and also at the follow-up at three and at twelve months

	Inpatient			3 months			12 months		
	n	Threats[1]	Acts	n	Threats[1]	Acts	n	Threats[1]	Acts
Violent	1017	19 (2%)	73 (7%)	327	35 (11%)	35 (11%)	381	48 (12%)	55 (15%)
Suicidal [2]	489	-	9 (2%)	299	35 (12%)	36 (12%)	339	45 (13%)	56 (16%)
SIB [2, 3]	489	-	7 (1,5%)	299	9 (3%)	18 (6%)	339	22 (6%)	46 (13%)

[1] patients recorded with both threats and acts were counted as acts, [2] 14 patients were recorded to have engaged in suicidal and self-injurious behaviour after 3 months and 23 patients after 12 months, [3] SIB = self-injurious behaviour

There were no significant gender differences regarding inpatient violence and suicidal behaviour. Men had a significantly higher violence rate at three months (χ^2=8.8. df=1, p = 0.003). Women were significantly more self-injurious both in the inpatient setting (χ^2=8.3, df=1, p = 0.004) and at three months after discharge (χ^2=9.3, df=1, p = 0.002). After three months, more women than men were recorded with *suicidal behaviour and SIB* (χ^2=6.4, df=1, p= 0.011). The group with *suicidal*

behaviour and SIB had a mean of 3.0 readmissions preceded by self-harm, while the means for readmissions in the suicidal and SIB groups were 2.2 and 1.6, respectively. The corresponding figures after one year were 2.4, 1.4 and 1.6, respectively. Eighteen patients were recorded to have repeated inpatient or outpatient violent behaviour in two or more admissions.

The rates of the recorded violent episodes were markedly higher in the psychiatric follow-up than in the criminal and police records. In the latter, only a total of 12 patients (4%) were identified three months after discharge and 21 patients (6%) after 12 months. However, five patients who dropped out during the follow-up period were identified as having been violent in the criminal records.

5.2 Research question (RQ) (i): Are serum lipids or platelet serotonin valid predictors of violent behaviour, suicidal behaviour or self-injurious behaviour? (Dealt with in paper I)

The platelet serotonin was not found to have any significant association with violence, suicidal behaviour or self-injurious behaviour (SIB). Table 6 shows the AUC values for the total cholesterol, triglycerides, LDL and HDL.

For the subgroup of patients who were involuntarily admitted, the AUC values for low total cholesterol and inpatient violence were 0.67 (95% CI = 0.51-0.83, p = 0.064). When all of the involuntary readmissions were included AUC was 0.68 (95% CI = 0.54-0.83, p = 0.029). The total cholesterol was not a significant predictor of violence in the voluntarily admitted patients. However, only five patients from this group were recorded with violent behaviour during their hospital stay.

The low HDL predicted violence after 12 months (AUC = 0.62, 95% CI=0.53-0.72, $p = 0.021$), and the repeated inpatient or outpatient violent behaviours were also predicted in the 12 patients with two or more admittances (three months AUC = 0.86, 95% CI = 0.75-0.96, $p < 0.001$, 12 months AUC = 0.74, 95% CI = 0.74, $p = 0.001$).

The high TG predicted "suicidal + SIB" after 12 months (AUC = 0.66, 95% CI = 0.53-0.79, $p = 0.016$).

Table 6. AUC values of lipids for recorded violent, suicidal and self-mutilating behaviours during hospital stay and at three-month follow-up after discharge

		During hospital stay		3 months outpatient	
		AUC (95%CI)	*p*	AUC (95%CI)	*p*
Violence	Total cholesterol	0.68[1] (0.55-0.82)	0.013	0.72 (0.61-0.81)	0.001
	HDL	0.62[1] (0.48-0.75)	0.112	0.64 (0.52-0.76)	0.027
	LDL	0.63[1] (0.51-0.76)	0.067	0.69 (0.59-0.80)	0.003
Suicidal behaviour [4]	Total cholesterol	0.76[1] (0.63-0.89)	0.009	0.58[2] (0.45-0.72)	0.199
SIB [3, 4, 6]	Triglycerides	0.83[2] (0.72-0.94)	0.006	0.51[1] (0.26-0.77)	0.899
Suicidal + SIB [3, 5]	Triglycerides	(no inpatients)		0.75[2] (0.58-0.93)	0.007
	HDL	"		0.69[1] (0.54-0.84)	0.034

[1]negative prediction, [2] positive prediction, [3] SIB = self-injurious behaviour, [4] only suicidal or SIB, [5] patients recorded with both suicidal and SIB, [6] 4 of 7 SIB inpatients were "suicidal + SIB" 3 months after discharge

A *positive* significant association was found between the total cholesterol and suicidal behaviour at the three-month follow-up (OR = 1.5, 95% CI = 1.1-2.1, $p = 0.044$). Positive and negative predictions by the lipids are shown in table 7.

Multivariate logistic regression analyses were used to control for confounders and to examine whether the lipids could add a significant explanation of the variance in the amount accounted for by the demographic and clinical factors of violent,

suicidal or self-injurious behaviours. Entering the total cholesterol after the other significant factors in the multivariate analysis of the reported violence at three months yielded a χ^2 value of 11.2 (df =1, p = 0.001). Model fit estimates indicating the amount of the violence that could be explained by the factors increased from 17% to 25%.

Table 7 Positive predictive values (PPV), negative predictive values (NPV) and the numbers needed to detain (NND) when mean lipid concentrations are used as "cut offs" for positive and negative predictions

Lipids	Recorded episodes	PPV	NPV	NND
Total cholesterol[1]	Inpatient violence	0.09	0.97	11
	Inpatient violence by involuntary admittances	0.36	0.85	2.8
	Inpatient suicidality	0.06	1.00	17
	Violence 3 months post-discharge	0.23	0.96	4.3
TG[2]	Inpatient SIB[3]	0.05	0.99	20
	Suicidal+ SIB[3] 3 months post-discharge	0.13	0.97	7.7
	Suicidal+ SIB[3] 12 months post-discharge	0.23	0.88	4.3
HDL[1]	Violence 12 months post-discharge	0.17	0.90	5.9
	Violence repeaters	0.23	1.00	4.3

[1, 2] predictive values, [1] lower and [2] higher than the mean concentration, [3] SIB = self-injurious behaviour

Entering TG after the significant factors at three months with "suicidal + SIB" as the dependent variable yielded a χ^2 of 7.0 (df =1, p = 0.008). The corresponding value of χ^2 at 12 months was 9.1 (df =1, p = 0.003). The model fit increased from 23% to 35% and from 23% to 29%, respectively.

Neither the medication at admission nor a diagnosis of alcohol misuse or diabetes affected the predictive significance of the lipids.

5.3 RQ (ii): Are patients' self-rated risk estimates (SRS) valid predictors of violent behaviour, suicidal behaviour or self-injurious behaviour? (Dealt with in paper II)

The distribution of recorded episodes as compared with the patients' risk estimates (SRS) at admission and at discharge are shown in Table 8. The predictive validities of the SRSs are shown in Table 9. The AUC values of the SRSs for violent threats and acts were practically identical for the recorded violent behaviour. In the following, we give only the results of the SRS of violent threats in order to avoid duplicated results.

The SRS predictions for all three outcome measures remained significant and practically unchanged when the statistics were re-computed with all of the readmissions included in the analyses.

Table 8. Distribution of recorded episodes of violent, suicidal and self-injurious behaviours as compared with patients' risk estimates during the hospital stay and at three months after discharge

Risk prediction: SRS of:	No risk	Low risk	Moderate risk	High risk	Very high risk	Don't know	Won't answer	Threats + acts episodes (%)
DURING HOSPITAL STAY (episodes / predictions)								
Suicide	0 / 322	2 / 47	2 / 6	0 / 3	0 / 1	3 / 15	2 / 16	0 + 9 (2.2%)
Self-injury	1 / 306	0 / 43	3 / 21	3 / 5	0 / 2	0 / 17	0 / 16	0 + 7 (1.7%)
Violent threats	9 / 338	2 / 27	4 / 13	1 / 4	1 / 2	0 / 7	7 / 19	12 +12 (5.9%)
Violent acts	13 / 355	1 / 24	3 / 5	0 / 1	1 / 2	0 / 5	6 / 18	12 +12 (5.9%)
3 MONTHS POST- DISCHARGE (episodes / predictions)								
Suicide [1]	28 / 200	6 / 34	4 / 8	2/ 4	0 / 1	4 / 12	1 / 7	31 +14 (17%)
Self-injury [1]	10 / 187	3 / 33	3 /16	3 / 4	1 / 5	3 / 13	0 / 7	9 +14 (8.6%)
Violent threats	22 / 211	6 / 26	4 / 9	1 / 1	2 / 2	3 / 8	4 / 9	26 +16 (16%)
Violent acts	24 / 221	6 / 22	2 / 4	0 / 0	2 / 2	3 / 8	5 / 9	26 +16 (16%)

[1] = 14 patients (5.3%) were recorded with both suicidal and self-injurious behaviour three months after discharge

Multivariate analyses were used to control for significant demographic and clinical factors of the reported episodes. During the hospital stay, the SRSs with *moderate or higher risk* remained a significant predictor of violent behaviour (OR = 9.1, 95% CI=2.1-39, $p = 0.003$), of SIB (OR = 58, 95% CI=4.3-784, $p = 0.002$), and of suicidal behaviour (OR = 36, 95% CI=4.0-323, $p = 0.001$).

In the multivariate analyses at three months, the patients at *moderate or higher risk* of violence were the only SRS that remained significant when other significant factors were controlled for (OR = 22, 95% CI=5.1-99, $p < 0.001$). It remained significant even after one year (OR = 4.3, 95% CI=1.2-16, $p = 0.027$). *Won't answer about risk* of violence (OR= 5.2, 95% CI = 1.2-23, $p = 0.029$), *Don't know the risk* of suicide (OR = 3.4, 95% CI = 1.3-9.6, $p = 0.032$) and *Don't know the risk* of SIB (OR = 3.4, 95%CI = 1.1-11, $p = 0.033$) were also significant at three months in the multivariate analyses.

Table 9. The predictive validity of Self-report risk scale (SRS) for violent, suicidal and self-injurious behaviours during the hospital stay and at three months after discharge

		During hospital stay [2]			3 months after discharge [3]		
Prediction	Outcome	n[1]	AUC (95% CI)	*p*	n[1]	AUC (95% CI)	*p*
Violence	violent behaviour	24	0.73 (0.61-0.85)	<0.001	54	0.67 (0.58-0.61)	<0.001
Suicidality	suicidal behaviour	9	0.92 (0.88-0.96)	<0.001	57	0.63 (0.55-0.72)	0.002
SIB [4]	SIB	7	0.82 (0.67-0.98)	0.003	37	0.66 (0.57-0.76)	0.001
Suicidality	suicidal+SIB [4]	0			13	0.71 (0.54-0.90)	0.019
SIB [4]	suicidal+SIB [4]	0			13	0.83 (0.72-0.95)	<0.001

[1] number of patients with recorded episodes, [2] 410 patients, [3] 266 patients, [4] SIB = self-injurious behaviour,

In the multivariate analyses, the SRS accounted for 14% of the total variance (or "model fit") of the recorded violent behaviour during the hospital stays, 16% of the

model fit of suicidal behaviour, and 19% of SIB. After three months, the values were 13% for violent behaviour, 6.5% for suicidal behaviour, and 10% for SIB. The different effect sizes that were derived from the false and true predictions are shown in table 10.

Table 10 Self-report risk scale (SRS) and positive predictive values (PPV), negative predictive values (NPV), and "numbers needed to detain" (NND) in relation to violent, suicidal and self-injurious behaviours during the hospital stay and at three months after discharge

	During hospital stay			3 months post-discharge		
	PPV	NPV	NND	PPV	NPV	NND
Violent behaviour	0.32	0.97	3.2	0.43	0.88	2.3
Suicidal behaviour	0.14	0.99	7.1	0.36	0.86	2.8
Self-injurious behaviour	0.20	0.99	5.0	0.25	0.93	4.0

5.4 RQ (iii): Is V-RISK-10 a valid predictor of violent behaviour? (Dealt with in papers III and IV)

For the inpatient part of the study, when schemes with three or fewer missing items were included, the AUCs of the sum scores for the V-RISK-10 of any violence were almost identical to the AUCs of the prorated scores. The results for the hospital stay are given based on computations without prorated scores.

After discharge, the AUCs of the V-RISK-10 scores showed minor changes (for gender and for severe violent acts) as compared with the results of the prorated sum scores. The post-discharge results are based on computations of the prorated scores (see 4.6 Statistics). The fully completed schemes predicted better than the schemes with 1-3 omitted items both before and after prorating.

Violence during hospitalisation

AUC of any violence was 0.83 (95% CI = 0.79-0.87). With gender stratification, the AUC for women was 0.87 (95% CI = 0.81-0.92) and 0.80 for men (95% CI = 0.74-0.85). For patients with no history of violence ("No" scores on items 1 and 2) AUC was 0.74 (0.62-0.86), and for those without any known violence history ("No" or "Don't know" scores on items 1 and 2) AUC was 0.80 (0.71-0.89). All results were highly significant ($p < 0.001$).

The best combination of sensitivity and specificity was obtained by a sum score of 9.5. This yielded a sensitivity of 81.0% and a specificity of 73.2%. The corresponding positive predictive value (PPV) was 24.0% and the negative predictive value (NPV) was 97.3%. This signifies that 69 persons were correctly classified as violent (true positives), 215 were wrongly classified as violent (false positives), and also, 686 were correctly classified as not violent (true negatives) and 17 wrongly classified as not violent (false negatives).

With the exception of item 3 (previous/current substance abuse) and item 5 (personality disorder) not found to be significant, all of the remaining items were highly significant ($p < 0.001$). These results remained unchanged when adjusting for age and gender.

When all ten items were entered into the multivariate logistic regression analyses, item 2 (previous/current violent threats, $p < 0.001$), item 6 (lack of insight, $p < 0.001$) and item 7 (suspiciousness, $p < 0.05$) remained significant. Item 1 (previous/current violence) did not reach significance in the model, mainly due to the confounding effect of item 2. We performed a separate analysis of the patients

with major mental illness that are indicated by a score of 2 on item 4 (n= 412). Sixty-two of them had committed at least one act of violence. Items 2 (violent threats, $p < 0.001$) and 9 (unrealistic plans, $p = 0.030$) remained significant in the multivariate analyses.

Violence after discharge

The predictive validities of V-RISK-10 and recorded post-discharge violence are shown in table 11. The three months post-discharge model fit was 33% for V-RISK-10 alone and 37% when including all of the demographics and clinically significant factors of violent behaviour. The one-year post-discharge model fit was 29% for V-RISK-10 and 34% when all significant factors were included.

When entering the five dynamic items (items 6-10) after the five historic items (items 1-5) of V-RISK-10 in the multivariate analyses, the chi-square value was 11.5 (df = 5, $p = 0.040$) at 3 months and 5.0 (df = 5, $p = 0.490$) at 12 months.

A cut-off value of 4.5 gave estimates of the sensitivity and specificity at the 3 and 12 month follow-ups of 0.96/0.48 and 0.89/0.49, respectively. The corresponding PPVs at 3 and 12 months were 0.33 and 0.40, respectively, the NPV values were 0.98 and 0.92, respectively, and the NNDs were 3.0 and 2.5 patients, respectively.

For the patients with no known history of violence, the significant predictors of violence at three months when adjusted for age and gender were the following: unrealistic planning (OR = 3.1, 95% CI = 1.4-6.5, $p = 0.004$), stress exposure (OR = 2.6, 95% CI = 1.01-4.3, $p = 0.016$), and suspicion (OR = 2.1, 95% CI = 1.2-4.3, $p = 0.040$). After 12 months, substance abuse (OR = 2.0, 95% CI =1.3-3.2, $p = 0.002$)

was the only significant single item. Major mental illness got close to significance at three months (OR = 3.5, 95% CI = 0.96-11, $p = 0.059$).

Table 11 V-RISK-10: Recorded episodes of violence and the predictive validity of V-RISK-10 for the whole sample and for patients without a known past history of violence at 3 and 12 months

	3 months			12 months		
	Violent patients	AUC (95% CI)	*p*	Violent patients	AUC (95% C)	*p*
A. All patients						
Violent threats	35	0.77 (0.69-.084)	<0.001	46	0.71(0.63-0.78)	<0.001
Less severe acts	27	0.83 (0.78-0.89)	<0.001	38	0.76 (0.69-0.84)	<0.001
Severe violent acts	7	0.87 (0.78-0.85)	0.001	17	0.86 (0.80-0.91)	<0.001
Any violence	69	0.80 (0.75-0.86)	<0.001	101	0.75 (0.70-0.80)	<0.001
Male	48	0.77 (0.70-0.84)	<0.001	66	0.73 (0.67-0.80)	<0.001
Female	21	0.83 (0.75-0.92)	<0.001	35	0.75 (0.67-0.84)	<0.001
B. Patients without a known past history of violence (outcome variable: any violence)						
No violence [a]	9	0.66 (0.52-0.80)	0.106	22	0.66 (0.56-0.76)	0.014
No *or* Don't know [b]	13	0.75 (0.61-0.88)	0.003	28	0.68 (0.59-0.80)	0.002

[a.] No previous violent history; zero scores on item 1 and item 2, 166 patients at three months,186 at 12 months, [b.] No or Don't know scores on item 1 and item 2, 187 patients at three months, 211 at 12 months

5.5 Relationship between violence and self-harm

Inpatient violence was significantly correlated with inpatient suicidal behaviour (Pearson $r = 0.311$, $p < 0.001$). A significant relation was also found between violence at three months and suicidal behaviour at three months ($r = 0.202$, $p < 0.001$), and between violence at twelve months and suicidal behaviour at twelve months ($r = 0.136$, $p = 0.013$). No correlation was found between violence and self-injurious behaviour. Inpatient violent behaviour did not predict outpatient suicidal or self-injuring behaviours or vice versa.

Inpatient violence was significantly and *negatively* related to suicidal behaviour after one year (OR = 0.45, 95% CI = 0.20-0.98, $p = 0.045$). Table 12 shows the relationships between demographic and clinical variables, and recorded violent and suicidal behaviour. Since no relationship was found between violence and self-injurious behaviour (SIB), risk factors for SIB were not explored further.

Table 12 Correlations between violent behaviour [a] and suicidal behaviour [b] in relation to demographic and clinical variables during hospital stay (inpatient), at 3 months and 12 months after discharge.

	Violent behaviour [a]			Suicidal behaviour [b]		
Pearson *r*	Inpatient	3 months	12 months	Inpatient	3 months	12 months
Demographic variables						
Male gender	0.057	0.155**	0.154**	- 0.065 [5]	- 0.099*	- 0.041
Age	- 0.040	0.000	- 0.026	- 0.085*	- 0.137**	- 0.088
Length of stay	0.290***	- 0.076	- 0.062	0.070 [6]	- 0.146***	- 0.120*
Involuntary admission	0.411***	0.328***	0.271***	0.118**	- 0.042	0.013
Mandatory aftercare	0.357***	0.203***	0.151**	0.073 [7]	- 0.131**	0.040
Clinical variables						
F10 Alcohol abuse	- 0.086 [1]	0.006	- 0.062	- 0.037	0.090*	0.100 [9]
F1x Substance abuse	0.070	0.137*	0.112*	- 0.021	- 0.044	0.013
F2 Psychosis	0.104*	0.102 [2]	0.134*	- 0.032	- 0.206***	- 0.155**
Psychosis of F1,F2,F3	0.193***	0.111 [3]	0.129*	- 0.024	- 0.246***	- 0.184***
F3 Affective disorders	- 0.072	- 0.216***	- 0.233***	0.021	- 0.085 [8]	- 0.110*
F4 Anxiety disorders	- 0.074	- 0.132*	- 0.096 [4]	0.031	0.094*	0.116*
F60 Personality disorders	0.000	0.074	0.056	- 0.004	0.324***	0.228***
Total cholesterol	- 0.146*	- 0.278**	- 0.193*	- 0.145*	0.043	0.153*
Triglycerides	- 0.034	0.084	0.005	0.063	0.264***	0.272***

[a] violent threats and acts, [b] suicidal threats and acts, * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, [1] $p = 0.059$, [2] $p = 0.073$, [3] $p = 0.051$, [4] $p = 0.077$, [5] $p = 0.082$, [6] $p = 0.063$, [7] $p = 0.052$, [8] $p = 0.056$, [9] $p = 0.065$

5.6 Summary of results

Table 13 shows a summary of main results

Table 13 Summary of results

Predictive validity (ROC-AUC [1]) of biological markers, patients self-predictions (SRS) and professional judgement (V-RISK-10) for violent, suicidal and self-injurious behaviours during hospital stays, and at 3 months and 12 months after discharge

		Inpatient				After 3 months				After 12 months			
	Patient population	n	Violence	Suicidality	SIB [2]	n	Violence	Suicidality	SIB [2]	n	Violence	Suicidality	SIB [2]
BIOLOGICAL MARKERS - consent only													
Low cholesterol	Whole sample	254	0.68 *	0.76 **	ns	178	0.72 ***	ns	ns	199	ns	ns	ns
	Involuntary admitted	44	0.68 * [3]	0.77 *	ns	28	ns	ns	ns	35	ns	ns	ns
Low HDL	Whole sample	254	ns	ns	ns	178	0.64 *	ns [4]	ns [4]	199	0.62 *	ns	ns
	Violence repeaters	12	-	-	-	12	0.86 ***	-	-	17	0.74 ***	-	-
High TG	Whole sample	254	ns	ns	0.83 **	178	ns	0.64 *	ns	199	ns	0.60 *	ns
	Suicidal+ SIB [2]	0	-	-	-	11	-	0.75 **	0.75 **	23	-	0.65 *	0.65 *
Platelet serotonin	Whole sample	254	ns	ns	ns	178	ns	ns	ns	199	ns	ns	ns
PATIENTS' SELF-PREDICTIONS (Self-prediction scale, SRS) - all patients													
	Whole sample	429	0.73 ***	0.92 ***	0.82 **	241	0.67 ***	0.63 **	0.66 ***	266	0.61 **	ns	ns
Suicidal +SIB [2]	when suicide predicted	0	-	-	-	14	-	0.71 *	0.71 *	27	-	ns	ns
Suicidal +SIB [2]	when SIB predicted	0	-	-	-	14	-	0.83 ***	0.83***	27	-	ns	ns
PROFESSIONAL JUDGEMENT (V-RISK-10) - all patients													
	Whole sample	980	0.83 ***	-	-	327	0.80 ***	-	-	367	0.75 ***	-	-
No known violence history [5]		535	0.80 ***	-	-	187	0.75 **	-	-	211	0.68 **	-	-
	No violence history [6]	421	0.74 ***	-	-	166	0.66 ns	-	-	186	0.66 **	-	-

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$, [1] area under the curve of the receiver operating characteristics analyses, [2] SIB = self-injurious behaviour, [3] all admittances included, [4] low HDL was also significant of "suicidal + SIB" after 3 months: 0.69 *, [5] "No" or "Don't know" scores on items 1 (violent acts) and 2 (violent threats), [6] "No" score on items 1 (violent acts) and 2 (violent threats)

6. SUMMARY OF PAPERS I – IV

6.1 Paper I: A prospective study of lipids and serotonin as risk markers of violence and self- harm in acute psychiatric patients

The paper covers the biological part of the study, namely the predictive validity of serum lipids and platelet serotonin in relation to violent, suicidal and self-injurious episodes. Patients were asked for written consent to be included in this part of the study, which comprised 254 of all (489) involuntarily and voluntarily acutely admitted patients to a psychiatric hospital during a period of one year. Of these, 199 patients completed the follow-up after discharge, while 55 dropped out.

Lower serotonin levels were found for patients taking serotonin reuptake inhibitors (SRIs) as compared with those who were not on SRIs. This group of psychotrophic drugs include selective serotonin reuptake inhibitors (SSRIs), serotonin-noradrenalin reuptake inhibitors (SNRIs) and tricyclic antidepressants (TCAs). No associations between platelet serotonin and violence or self-harm were found when stratifying SRI users and non-users.

The predictive validity was estimated by the area under the curve (AUC) of the Receiver Operating Characteristics (ROC). Low total cholesterol had significant relationships with inpatient suicidal behaviour, AUC = 0.76; with inpatient violent behaviour, AUC = 0.68; and with violent behaviour three months post-discharge, AUC = 0.72. The association was stronger for involuntary than for voluntary admitted patients. High levels of triglycerides (TG) were a significant marker of inpatient self-injurious behaviour (SIB) (AUC = 0.83) and also of SIB in combination with suicidal

behaviour at the three-month (AUC = 0.75) and at the twelve-month (AUC = 0.66) follow-ups. Low levels of high density lipoprotein (HDL) predicted violence at 12 months (AUC = 0.62), and violence in 12 patients with repeated violent behaviour at two or more admissions / post-discharge periods (AUC = 0.86 at three months and 0.74 at twelve months).

The AUC values in the poor to acceptable range indicated that lipids were not suitable as screening variables, but they may be useful for subgroups of patients, and also in combination with established risk assessment procedures.

6.2 Paper II: Patients' own statements of their future risk for violent and self harm behaviour: A prospective inpatient and post-discharge follow up study in an acute psychiatric unit

This paper explores the predictive strength of patients' risk estimates (Self-report risk scale, SRS) with regard to future violent, suicidal and self-injurious behaviours. A total of 489 acutely admitted patients were recruited; 429 (88%) completed the inpatient part of the study, while data for 60 were missing. The follow-up after discharge was completed by 266 patients, and the remaining 173 dropped out.

The patients' SRSs were significant predictors of violence, suicidal behaviour and self-injurious behaviour. During the hospital stays, the AUC values were 0.73, 0.92 and 0.82, respectively. Three months after discharge, the corresponding AUCs were 0.67, 0.63 and 0.66.

"Moderate or higher risk" had the highest predictive accuracy and remained significant in the multivariate analyses. Moreover, "Won't answer about the risk of violence",

"Don't know the risk of suicide" and "Don't know the risk of self-injurious behaviour" were significant in the multivariate analyses. SRS of violence remained significant after gender stratification, and predictions of suicidal and self-injurious behaviour were significant for women. The results of the SRSs were approximately the same when all admissions were included.

With the exceptions of inpatient suicidal and self-injurious behaviour, low sensitivity may limit the clinical value of the SRS as a screening tool, but its high positive predictive values indicate that the SRS could be used in combination with the current risk assessment procedures.

6.3 Paper III: The first step in the validation of a new screening for violence risk in acute psychiatry: The inpatient context

This paper reports the predictive validity of the Violence risk screening - 10 (V-RISK-10) in an inpatient context. The population consisted of all of the hospitalised patients (N = 1.017, n = 980 completers and 37 drop-outs) who were admitted to two acute psychiatric units in Norway during one year.

Risk screening at admission were compared with recorded violent threats and acts during the hospital stay. Nine percent of the patients were violent during their hospital stays. The predictive validity of the V-RISK-10 estimated by ROC-AUC was 0.83, with a sensitivity and specificity of 0.81 and 0.73, respectively. There were two percent false negative predictions. The predictions were significant irrespective of gender, and also of those without a history of violence.

At the item level, all of the factors but “drug abuse” and “personality disorder” were significant predictors of violence. Item 2, “Previous or current violent threats”, predicted recorded violent acts at least as well as Item 1, “previous or current violent acts”.

The predictions were equal to or better than what have been found in validation studies by other contemporary risk assessment tools. Thus, the V-RISK-10 seems valid and clinically useful within the inpatient context of acute psychiatry.

6.4 Paper IV: V-RISK-10: A screening instrument for violent behaviour after discharge from two acute psychiatric wards. A prospective naturalistic study

This paper reports from the outpatient part of the validation study of V-RISK-10, i.e. from the time after discharge. After one year, 381 (37%) of the 1017 discharged patients had completed the follow-up. The majority of the 636 drop-outs had been discharged to their communities without any further contact with psychiatry.

Violet threats or acts were recorded in 69 patients (21%) after three months, and in 101 patients (27%) after one year. The ROC-AUC values for any violent behaviour were 0.80 after three months and 0.75 after 12 months. The most accurate AUCs were obtained for severe violence. The results remained significant when stratified for gender, and when controlling for other risk factors. For persons without a known history of violence prior to the screening, AUCs for any violence were 0.74 after three months and 0.68 after one year. The five dynamic factors of the V-RISK-10 added significant variance to the five historic factors after three months, but not after one year. A cut-off value of 4.5 gave estimates of the sensitivity and specificity at the 3 and 12 month follow-ups of 0.96/0.48 and 0.89/0.49, respectively.

Results indicate that the V-RISK-10 is a valid and clinically useful tool for predicting violence during the first three months and the first year after discharge.

7. DISCUSSION

7.1 Main findings

Low levels of total cholesterol was found to be a predictor of inpatient violent and suicidal behaviour, and also, of violent behaviour during the first three months after discharge. The association was strongest for involuntary patients. Low HDL was predictive of repeated acts of violence in patients with more than one admission. High triglycerides were predictive of inpatient self-injurious behaviour (SIB) and of suicidal behaviour and SIB during the first year after discharge. The strongest association was achieved for persons with instances of both suicidal behaviour and SIB.

The platelet serotonin content was significantly lower for patients on serotonin reuptake inhibiting drugs. No significant prospective associations were found between the platelet serotonin and suicidal, self-injurious or violent behaviours.

The patients' self-reports of risk were predictive of suicidal, self-injurious and violent behaviours during the hospital stay, and also during the first three months after discharge. Self-reports of the risk of violence were significant even after 12 months. The patients' risk estimates were sensitive to violence independent of gender at the three-month follow-up. Self-reports of suicidal and self-injurious behaviours were predictive for women, but not for men. With the exception of suicidality and self-injury during the hospital stay, about half of the violent, suicidal and self-injuring episodes were recorded among patients who rated themselves as being at no risk. The positive predictive values of self-reports were relatively high for the first three months after discharge.

The predictive validity of the V-RISK-10 was found to be equal to or better than those of other comprehensive risk assessment instruments. The accuracy was quite high for both genders. For the post-discharge year, the accuracy was very high for severe violence, and the screening had an acceptable predictive value even for patients without any known history of violence. The results were practically unchanged when controlling for other significant factors.

The predictions of risk from lipids, self-reports and V-RISK-10 showed only minor changes when readmissions were included into the analyses.

7.2 Validity and reliability of results

Prevalence of violence and self-harm

In the present study, the base rate of violence of 9% of all inpatients is quite similar to what has been found in other studies from acute psychiatric facilities in Norway and other countries (Krakowski and Czobor, 2004, Mellesdal and Mellesdal, 2003). However, it is lower than the rates of 30-40% in studies from forensic and general psychiatry (McNiel and Binder, 1994, McNiel *et al.*, 2003, Nicholls *et al.*, 2004). The lower rate in our study may be explained by the short durations of the hospital stays; they had a median of eight days. The low rate may also stem from a selection bias; there were more violent patients in the other studies. We found no gender differences in inpatient violence. This supports recent research that questions the notion of men being more prone to violence than women (Hiday *et al.*, 1998, Robbins *et al.*, 2003).

The follow-up rate of violence after one year (27%) is comparable with the findings in prior studies that have used both clinical follow-ups and criminal records to identify the target episodes (Doyle and Dolan, 2006, Monahan J, 2001, Wootton *et al.*, 2008). In contrast to the inpatient findings, being male was identified as a significant predictor of violence after discharge, which is in accordance with many other studies (Corrigan and Watson, 2005, Norko and Baranoski, 2005). Violence among women has become a subject of increasing interest (Dean *et al.*, 2006, Hiday, 2006, Hodgins *et al.*, 1996). Women are more likely to target family members and to be violent in their homes. Men are more likely to drink excessively or use street drugs.

The prevalence of suicide attempts and SIB (3%) during the hospital stays seems comparable to the findings of one earlier study (Mortensen *et al*., 2000). The rate of suicide attempts and SIB one year after discharge (34%) appears to be high when compared with the reported prevalence of suicide attempts in psychiatric outpatient treatment (Flechtner et al., 1997). Nevertheless, it concurs with the findings from psychiatric hospitals of an elevated suicide risk during the first week(s) after discharge (Mortensen *et al.*, 2000, Qin and Nordentoft, 2005). A higher incidence of self-injury in women supports some prior studies, but other studies have found no gender difference (Klonsky, 2007). Suicidal behaviour was equally distributed between men and women, which is in contrast to community findings showing that woman are in the majority of suicide attempters. In this setting, suicidal threats were more common among men than women. Also, alcohol abuse was significantly correlated with being male and with suicidal behaviour.

Lipids and serotonin

No prospective associations were found between platelet serotonin and suicidal, self-injurious or violent behaviours. This concurs with Garland (Garland et al., 2007) but is in contrast to the findings of others (Alvarez *et al.*, 1999, Crowell *et al.*, 2008). Previous studies have measured serotonin "post-episodically", when the patients were hospitalised *after* an episode occurred. This complicates comparisons with this prospective study.

The finding of lower total cholesterol concentrations as a risk factor for violence concurs with earlier findings from case-control studies (Diaz-Sastre *et al.*, 2007, Golomb, 1998, Golomb *et al.*, 2000, Hillbrand and Spitz, 1999, Hillbrand *et al.*, 2000, Mufti *et al.*, 1998, Paavola *et al.*, 2002). High model fit estimates and significance when controlling for other risk factors indicate independent validity at three months after discharge. The predictive association between low total cholesterol and the increased risk of inpatient violent behaviour in the subsample of involuntarily admitted patients may prove to be of clinical relevance. With the very low NND of 2.8 and a relatively high specificity, this finding may enhance the accuracy of risk screenings and assessments if confirmed by future research.

The finding that low total cholesterol is a risk factor of inpatient suicidal behaviour supports prior studies (Atmaca *et al.*, 2003, Atmaca *et al.*, 2008, Florkowski *et al.*, 2001, Kunugi *et al.*, 1997, Lee and Kim, 2003, Peres-Rodriguez, 2008, Vevera *et al.*, 2003). The significant but low *positive* association between total cholesterol and suicidal behaviour at three months is consistent with the findings from another prospective study (Fiedorowicz and Coryell, 2007) and also, with Conklin's hypothesis about possible differences in the cholesterol levels of people who carry

out the predatory violence (high values) and impulsive violence (low values) (Conklin and Stanford, 2008).

Low high density lipoprotein (HDL) was the only significant biological predictor of violence after one year, and it was significant for repeated violence in patients with more than one admission. Low HDL was also a significant predictor of "suicidal + self-injurious behaviour" after three months. This is consistent with findings of low HDL in aggressive patients (Buydens-Branchey *et al.*, 2000), in aggressive and hostile women (Chen *et al.*, 2001) and in suicidal women (Zhang et al., 2005), but contradicts findings of high concentrations of HDL in suicidal and violent forensic patients (Paavola *et al*., 2002). With the exception of the findings about HDL, the total cholesterol seems to be a stronger risk predictor than HDL and LDL. The results indicate an additive effect of HDL and LDL in the risk prediction of violence and self-harm, which is in contrast to the effects of HDL and LDL ("good and bad cholesterol") in risk assessments of cardiovascular disease (Troisi, 2009).

The high triglycerides (TG) in patients exhibiting "suicidal + SIB" are in contrast to previous case-control and retrospective studies that have shown significant associations between *low* TG and suicidal behaviour (Agargun *et al.*, 2004, Lee and Kim, 2003, Paavola *et al.*, 2002) or violence (Paavola *et al*., 2002). However, the findings concur with the results of studies on psychological stress (Bachen *et al.*, 2002, Chikani *et al.*, 2004, Melamed *et al.*, 1992). In this context, the high TG values could indicate that these patients were under continuous psychological stress. This group was also characterised by more frequent hospitalisations during the study period and by more serious suicidal and self-injuring acts. The associations between the self-predictions (SRS) and the suicidal and self-injuring

episodes were also stronger for this group when compared with other suicidal and self-injurious patients.

In our samples, no associations were found between lipids and alcohol abuse or diabetes. The significant relationship of increased risk between low total cholesterol and violence, and between TG and self-harm did not change when the current medication at admission was controlled for. However, the impact of body weight and stress indicators (such as pulse and blood pressure) was not explored.

Patients' self-reported risk statements (SRS)

The findings that SRSs were predictive of violent, suicidal and self-injurious behaviours support some prior research based on self-report questionnaires (Huth-Bocks, 2007, Kroner and Loza, 2001, Loza, 2007, Nimeus *et al.*, 2006, Walters, 2006). The high number of false negatives is consistent with other studies; some have therefore questioned the reliability of such tools in assessing the violence risk (Doyle and Dolan, 2006, Hart, 1995). Self-reports provided limited help in guiding primary care physicians in their assessment and management of suicide risk (Gaynes *et al*., 2004). Interestingly, these ratings applied *both* to violent, suicidal and self-injurious behaviours. The high occurrence of false negatives might have various explanations, such as relapses, environment, or denial. Denial as a defence mechanism has been found to correlate positively with suicidal and violent behaviours in adolescents (Apter *et al.*, 1997), and it may constitute a risk factor in relation to aggression. It should also be considered that clinicians' knowledge about self-reported risks may have affected their decisions about the patient's discharge or continued hospitalisation.

Over time, the predictive validity of the self-reports with regard to suicidal and self-injurious behaviours decreased, in contrast to the self-reports of violence. One may hypothesise that this indicates that suicidal and self-injurious behaviours are more related to fluctuating or dynamic factors, and therefore, more difficult than violence to anticipate and control over time.

The predictive validity did not change when all re-admissions were included. This suggests that SRSs are independent of the patients' frequency of admittance, and also of the possibility that the patients' condition may vary substantially from stay to stay.

Interestingly, the responses of *won't answer the risk* of violence and *don't know the risk* of suicide and of self-injury were also significant predictors even when controlling for other factors. This suggests that unwillingness to respond is a risk factor of violent, suicidal and self-injurious behaviours.

V-RISK-10

For both men and women, a history of violence is one of the strongest predictors of future violence (Buchanan and Leese, 2006, Dean *et al.*, 2006, Hartvig *et al.*, 2006, Klassen and O'Connor, 1988, Tardiff *et al.*, 1997). In the multivariate analyses, Item 2, *previous or current violent threats*, was a more accurate predictor of "any violence" (violent threats or acts) than Item 1, *previous or current violent acts*. This finding suggests that threats of violence should be taken seriously, both during hospital stays and after discharge.

Information is often limited in acute psychiatric settings, and a 100% hit rate for all items is neither likely nor feasible due to the complexity of such phenomena.

Prorating the V-RISK-10 screenings with one, two or three missing items did not affect the predictive validity of the V-RISK-10 with regard to "any violence". In relation to the feasibility issue, it is promising that screening seems useful even with three omitted items.

A history of violence has been demonstrated to be one of the strongest predictors of future violence. Patients with no previous violence are more difficult to assess. The predictive validity of V-RISK-10 for the group without any known history of violence offers some promise for the future of the instrument, despite the fact that AUC values were lower for this group than in patients with an identified history of violence prior to the assessment. Nevertheless, we have to take into consideration that previous violence in this group may have been underreported.

Single-item regression analyses showed some differences between inpatients and outpatients; item 3, *substance abuse,* was only predictive after discharge; item 4, *severe mental illness,* and item 7, *suspiciousness*, were stronger predictors for inpatients than for outpatients. Item 5, *personality disorders,* did not predict violence, for inpatient or for outpatient.

Most other studies have found substance abuse and personality disorders to be highly significant predictors of violence (Elbogen and Johnson, 2009, Pulay *et al.*, 2008, Skeem *et al.*, 2005). Due to limited observation time in the acute psychiatric settings, there is a risk that personality disorders may go undetected in our naturalistic prospective study. In our acute sample, borderline personality disorder accounted for more than 75% of the primary diagnoses of personality disorders, in contrast to forensic samples in which dyssocial (antisocial) personality disorder is the most prevalent. In our total sample, persons diagnosed with substance abuse or

personality disorders, or persons having no psychiatric diagnosis accounted for 35% of the recorded post-discharge violence. In the subsample gathered from the criminal records, however, the same groups of patients accounted for 80% of the recorded violence. The majority of prior studies have investigated criminal records only retrospectively and without using health care information. Furthermore, acute violent individuals with personality disorders or with substance abuse are often taken care of by the police. Their admittance to psychiatric or somatic hospitals depends on the examination by a community physician.

If they are suicidal or self-injuring, however, psychiatric admittance is more likely in this group, even without any concurrent psychiatric symptoms. In our sample, both personality disorders and alcohol abuse predicted significantly suicidal and self-injurious behaviours, but not violent behaviour.

V-RISK-10 during hospital stays

A seemingly optimal cut-off value of 9.5 gave only 3% false negative predictions. This indicates a high sensitivity, which is a strong point for the screening function of the instrument. However, its low positive predictive value leaves a high number of false positives, which calls for ethical, judicial, cost-benefit and treatment issues to be discussed (see chapter 6.4).

V-RISK-10 and follow-up after discharge

Dynamic factors added significant validity to the historical factors in the three-month predictions but not after one year. This is in line with prior findings that show the historical factors to be predictive in the long-term, while the dynamic

factors are predictive within shorter time frames (Doyle and Dolan, 2006, Norko and Baranoski, 2005).

Stress exposure, unrealistic plans, suspiciousness and substance abuse were significant predictors of violence for patients with no previous violence. These risk factors may successfully be integrated into intensive risk management strategies.

An outpatient V-RISK-10 cut-off value of 4.5, which gives a sensitivity of 0.90 and a specificity of 0.50, seems optimal for screening. This would imply that all of the patients with a total score of 5 or more are in the risk group. With this cut-off value, the NND value of 3.0 at three months would imply that 2.0 non-violent patients should be kept in the hospital for every correctly detained violent patient. The corresponding value at one year is 1.5 patients. With successful risk management, violence could ideally be limited to those who act violently and have a V-RISK-10 score *below* the actual cut-off value (false negatives). No *severe* violent episodes were recorded among the false negatives. The lowest V-RISK-10 sum score for severe violence was 7. Still, the false positive and false negative predictions constitute a major challenge (chapter 6.4).

Relationship between violence and suicidal or self-injurious behaviours

During the hospital stay and during the first three and twelve months after discharge, there was a significant correlation between violence and suicidal behaviour, which is in accordance with earlier research (Hillbrand, 2001, McGirr *et al.*, 2007, Pillai *et al.*, 2009, Sarchiapone *et al.*, 2009). However, inpatient violence *negatively* predicted suicidal behaviour after one year. No relationships were found between violence and self-injurious behaviour.

With very few exceptions, risk factors of violence were not significant in relation to suicidal behaviour and vice versa. Moreover, some risk factors of violence were even significantly correlated *negatively* with suicidal behaviour and vice versa. This concurs with a retrospective study of inpatients that showed no risk factors to be common to violent and suicidal behaviours (Krakowski and Czobor, 2004).

The interpretations of these findings are uncertain; they indicate that both suicidal and violent behaviours may occur in the same persons within short time-frames. Beyond this, there is no evidence of any relationship between violence and suicidal behaviour in this acute psychiatric sample.

7.3 Limitations and strengths

A study in acute settings will often be far away from the ideal "gold-standard" of research conditions, but it is hard to envision alternative ways to address the salient RQs of this thesis. Most other validation studies of violence risk screening or assessments but also, a substantial proportion of the suicidal risk research, as well as the studies of lipids and serotonin on aggression have all used retrospective, pseudo-prospective or cross-sectional designs. Our study was carried out with a prospective naturalistic design, which adds substantial strength to the project.

The inpatient and outpatient violence rates, suicidal rates and self-injurious rates may have been influenced by the ward characteristics. The quality and characteristics of the follow-up work, the community care that was provided, and the environment at large may in various ways have affected the rates of violent, suicidal and self-injurious behaviours after discharge. A high screening score may have instigated prevention management from the staff, and thus, episodes may have

been avoided. Scientifically speaking, this may have caused confounding. Accordingly, the study design may indirectly have affected the base rates of the outcome. Another important aspect to keep in mind is that incorrect predictions are not necessarily incorrect assessments.

The treatment staff was responsible for recording the outcome variables, which may have violated the "rule of neutrality" in research, and thus biased the results. However, the collaboration between staff, clinicians and patients may also have ensured valid recordings of episodes, especially during outpatient follow-up. Assessments of violent, suicidal and self-injurious behaviours, especially threats, might differ among the recorders even if the outcomes were accurately operationalised. The same goes for the discrimination between suicidal behaviour and self-injurious behaviour.

For the inpatient part of the self-report and the V-RISK-10 study, the number of completers was high (88 - 96%), and only a minor significant difference between completers and dropouts was found. This indicates that the study is quite representative of the whole population of acutely admitted psychiatric patients.

The dropout rate of 63% of the included patients for the outpatient part of the V-RISK-10 study appears to be high. However, the number of follow-ups was compared to all admissions without a selection or consenting procedure. Other prospective follow-up studies show similar, or even higher, dropout rates (Monahan J, 2001, Silver *et al.*, 1999). A dropout rate of 22% in the consenting sample seems comparable with other studies of selected patients (Doyle and Dolan, 2006). Discharges at an inappropriate time or immediately after admission and "runaway"

patients who were not returning to the wards might contribute to the shorter hospital stays found among the dropouts.

Most of the risk factors of suicidal, self-injurious and violent behaviours showed no differences between those who were participants in the follow-up studies and those who were dropouts. The few risk factors that differed between the two samples were more frequently occurring among those in the follow-up group. This adds strength to the study. Yet, the differences in the characteristics between the follow-ups and dropouts may limit the validity of the results.

Possible confounders of the validity of the biological markers (such as weight, height, blood pressure and pulse rate) were not controlled for. The sample size was too small for some of the inpatient analyses of the prediction validity of serotonin, and also too small to control for drugs that may have affected the lipid levels. This implies an increased risk of type II errors.

Since the appropriate tools for measuring the patients' self-predictions are lacking, we constructed a new one for this study (the SRS). Accordingly, it is difficult to relate our results directly to those of others. The therapists' evaluations of the risk may have influenced the way the questions were posed in order to obtain the patients' risk assessment. The same goes for the interpretation of the responses.

Conducting a study without patients' consent has ethical implications (see 6.4 Ethics), but may also have some advantages from a research point of view. Explorations at the beginning of the study showed that approximately one third of the patients would not have provided written consent to participate in the study. A majority of the violent episodes were initiated by patients unwilling to consent.

There were significant differences between the two groups regarding the risk factors of violent behaviour; patients unwilling to consent had significantly more psychotic disorders, less affective disorders, and shorter median hospital stay.

The analyses of the true and false predictions showed relatively high numbers of false predictions, which is in contrast to the high odds ratios, the model fit estimates and the AUC values. The use of more than one statistical method seemed to bring additional nuances into the results (Buchanan, 2008). It should also be emphasised that the results at the group level are not a strong guarantee for accuracy on the individual level.

Regarding the study at the Ålesund Hospital, information on violent behaviour was gathered from independent sources: the patients, both the hospital's case-notes and patient records, and the criminal records. In line with other studies, we found that the use of multiple data sources was beneficial and reduced underreporting (Doyle and Dolan, 2006, Wootton *et al.*, 2008).

7.4 Ethical issues

One main obstacle in a naturalistic study is that ethics and common sense prohibit that risk management is ignored. If we had conducted this study with an ideal controlled research design, we would have instructed the raters not to inform the clinical staff and the nursing staff about the imminent violence and self-harm risks, even if someone had been identified as high-risk patients. This would violate the clinicians' duty to warn and prepare the staff.

The almost inevitable inverse relationship between false negatives and false positives is a challenge in risk assessments. In the screening procedures, it is important to keep false negative rates as low as possible without having too many false positives. Ethical, human rights, judicial and cost-benefit issues about risk assessment and high proportions of false predictions have been addressed in previous research (Buchanan, 2008, Maden, 2003, Palmstierna, 1999, Szmukler, 2003). A violence, suicidal or self-injurious risk screening procedure that turns out to be a false positive may have serious negative consequences for the patient, such as a prolonged involuntary stay in the hospital, but also other restraints, and even stigmatisation as being "dangerous" or "self-harming". However, in an acute psychiatric unit with high patient circulation, an initial positive identification of risk by the use of screening instruments would probably lead to increased attention and care from the ward staff. In addition, this could eventually lead to more comprehensive risk assessments, more focused treatment and better risk management. If implemented immediately after admission, risk assessment and management should not lead to significantly longer hospital stays than expected. Accordingly, the possible harm caused by positive identifications of risk by screening instruments in an acute ward could be reduced. Even from the patient's point of view, it would be beneficial, if episodes could be prevented.

The stigmatisation of biological risk markers of violent, suicidal or self-injurious behaviours could be substantial. Even testing for it could cause discomfort. Since lipids have been widely used to monitor cardiovascular risks, we assume that the associated stigma would be low.

With the exception of the blood sampling, this project was conducted without asking the patients' for written consent. This was approved by the ethical committee and the health authorities. Patients unwilling to consent were characterised by significantly higher violence rates after discharge, significantly more psychotic disorders, fewer affective disorders, and shorter median stays than the consenters. The fact that violent patients were overrepresented in the group unwilling to consent indicates that it is crucial to include this group in violence risk research. Thus, conducting parts of the study without the patients' consent may be seen as ethically justifiable.

8. CONCLUSION

Clinical implications

The predictive values of lipids were in the poor to acceptable range, and the relatively high numbers of false positives and false negatives assign limited value to them as screening tools. However, lipids could be useful in combination with structured risk assessment procedures. Moreover, the lipid levels could be of clinical relevance to subgroups of patients: involuntarily admitted patients, repeaters of violent behaviour, and patients with frequent readmissions after serious suicide attempts or serious self-injuries.

No predictive associations were found between platelet serotonin and suicidal, self-injurious or violent behaviours, which indicates that this biological marker is not related to the risk of future aggression.

With the exception of suicidal and self-injurious episodes during the hospital stays, about half of all violent, suicidal and self-injurious episodes were observed among patients who rated themselves at no risk; the low sensitivity suggests that self-reports are not a reliable screening method as the sole source of information. However, the relatively high violence, suicidal and self-injury rates of patients who rated themselves as being *at risk* could be of clinical importance, especially when combined with established risk assessment procedures.

Clinicians found the V-RISK-10 screening easy to use and not particularly time consuming; the measure is of clinical value for predictions both during the stay and

after discharge. Acceptable predictive values even for patients without a known history of violence, offer some promise for its future use in acute settings.

A moderate relationship was found between suicidality and violence during the hospital stay, and also during the first year after discharge. Few other risk factors were shared, and some risk factors even showed an inverse relationship. This indicates that there in acute settings are limited relationship between violence and self-harm.

Future research – some suggestions

(i) Regarding the lipids: The confounding effects of body mass index, medication, and physiological and psychological stress factors should be controlled for, as should the effects of possible fluctuations in the serum concentrations over time. The association between the subgroup of violence repeaters and the low HDL could be of clinical value and should be explored further, and the same applies to the association between involuntary admitted patients and low total cholesterol. The possible differences of cholesterol levels in relation to planned (predatory) vs. impulsive aggression should also be investigated further.

Patients combining high levels of triglycerides, high SRS validity, and severe suicidal and self-injurious behaviours at multiple admissions, may prove to require special treatment and follow-up procedures. This should be further explored.

(ii) Since the SRS method has not been used before, its clinical significance must be validated also in other settings. If the use of the patients' risk

estimates proves valuable, further development of the SRS schemes is warranted.

(iii) The results of the V-RISK-10 need to be confirmed by future prospective studies in several psychiatric settings. It would be of particular interest to test the predictive accuracy of V-RISK-10 for patients without any known history of violence. Further explorations of the predictive validity for various personality disorders is crucial to improve Item 5, addressing *Personality disorders*.

Ideally, a controlled study comparing risk assessment by the V-RISK-10 and an unstructured risk assessment would be the ultimate test of the validity of the screening. However, the feasibility of such testing design seems hampered by ethical, clinical and research issues.

Future research may also focus on the possible additive effects of biological markers and patients' self-reports. A possible next step of the "Risk Project" would be to explore the incremental validity obtained by combining three risk assessment approaches, - a screening (V-RISK-10 or MINI suicidal scale), a biological marker (lipid), and the patients' self-prediction – into two comprehensive risk assessment batteries, one for the risk of violence and one for self-injury and suicidality. If supported by empirical findings, they could enhance the quality of the work in the field which would benefit the patients, the staff and society in general.

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10. PAPERS I – IV

Paper I

Is not included due to copyright

Paper II

Psychiatry Research 178 (2010) 153–159

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

Patients' own statements of their future risk for violent and self-harm behaviour: A prospective inpatient and post-discharge follow-up study in an acute psychiatric unit

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ARTICLE INFO

Article history:
Received 25 May 2009
Received in revised form 27 November 2009
Accepted 11 April 2010

Keywords:
Assessment
Screening
Self-report
Suicidal
Self-injurious
Aggression
Mental disorders

ABSTRACT

Recently patients' responsibility for and ownership of their own treatment have been emphasised. A literature search on patients" structured self-reported assessment of future risk of violent, suicidal or self mutilating behaviour failed to disclose any published empirical research. The present prospective naturalistic study comprised all involuntary and voluntary acutely admitted patients ($n=489$) to a psychiatric hospital during one year. Patients' self-reported risks of violence and self-harm at admission and at discharge were compared with episodes recorded during hospital stay and 3 months post-discharge. Patients' predictions were significant concerning violent, suicidal and self-injurious behaviour, with AUC values of 0.73 (95% CI = 0.61–0.85), 0.92 (95%CI = 0.88–0.96) and 0.82 (95%CI = 0.67–0.98) for hospital stay, and 0.67 (95% CI = 0.58–0.76), 0.63 (95%CI = 0.55–0.72) and 0.66 (95%CI = 0.57–0.76) after 3 months, respectively. Moderate or higher risk predictions remained significant in multivariate analysis, and risk of violence even after gender stratification. Self-harm predictions were significant for women. Moderate or higher risk scores remained significant predictors of violence one year post-discharge. Controlling for readmissions the results remained the same. Low sensitivity limits the clinical value, but relatively high positive predictive values might be clinically important. Still future research is recommended to explore if self prediction is a valid adjuvant method to established risk assessment procedures.

1. Introduction

Self-harm and violent behaviour by psychiatric patients are important. Several studies and reviews have revealed increased violence among persons with major mental illnesses (Brennan et al., 2000; Colasanti et al., 2008; Fazel and Gann, 2006). Most persons who commit suicide have a present mental illness, and a majority have symptoms of depression (Hawton and van Heeringen, 2009). Recently the focus on patients' responsibility for and ownership of their own treatment has increased. Traditionally, the patients' own opinion has been taken into account in the clinical risk management of suicidal behaviour. Self-report questionnaires for patients have been developed for both suicidal and violence risk assessment (Helfritz et al., 2006; Huth-Bocks et al., 2007; Kroner and Loza, 2001; Loza et al., 2007; Nimeus et al., 2006). However, instead of measuring patients' perception of their own risk, these tools have been developed to obtain risk estimates by clinicians, or by computerized soft-ware programs. Moreover, there has been controversy about the reliability of self-report questionnaires (Doyle and Dolan, 2006; Gaynes et al., 2004; Hart, 1995; Loza, 2007). Our literature search failed to show any empirical research on patients' self-reported "direct" opinion of subsequent violent and self-harm behaviour. Hence we set up a prospective study in the acute psychiatric unit at Ålesund Hospital. Other parts of the study were biological markers (serum lipids and platelet serotonin) and two risk assessment screens (Hartvig et al., 2007; Sheehan et al., 1998).

2. Methods

2.1. Setting and population

The design was a naturalistic prospective inpatient and outpatient follow-up study at the acute psychiatric ward at Ålesund Hospital in Norway with a catchment area of 125,000 persons. The target group were all involuntary and voluntary acute admitted patients during one year, from March 7th 2006 to March 7th 2007. A very few patients who did not understand Norwegian language were not included.

The sample size ($n=489$ patients/716 hospitalisations) was determined by the total number of patients admitted during this period. Demographic and clinical data are shown in Table 1.

2.2. Procedure

During the initial examination at admittance, the physician on duty recorded the patients' risk estimates of violence, suicide and self-injury for hospital stay in the "Self-

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doi:10.1016/j.psychres.2010.04.012

Table 1
Demographic data. Comparison between study samples and missing samples.

	At admission $n=489$			At discharge $n=489$		
	Included	Missing	*P*-value	Follow-up	Missing[a]	*P*-value
	$n=429$	$n=60$		$n=266$	$n=223$	
Male/female %	55/45	47/53	ns	55/46	54/47	ns
Mean age	43.9	48.9	0.036	42.8	46.9	0.013
Hospital stay mean/median	15.6 /10	19.0 / 12	ns	18.4 / 10	13.3 / 8	0.004
Involuntary admission, *n*/%	79/19	17/30	0.052 ns	65/21	38/21	ns
Mandatory aftercare, *n*/%	30/7.0	6/11	ns	31/10	8/4.5	0.037
Inpatient violence[b], *n*/%	28/6.9	8/9.5	ns	21/7.6	15/6.7	0.085 ns
Inpatient suicidality[b], *n*/%	9/2.3	0	ns	5/1.6	4/1.8	ns
Inpatient self-injury[b], *n*/%	7/1.7	0	ns	4/1.3	3/1.3	ns
F10–19 substance abuse %	16	15	ns	16	16	ns
F20–29 psychotic disorders %	16	17	ns	19	13	ns
F30–31 bipolar disorders %	12	12	ns	15	6.2	0.003
F32–39 depressive dis.[c] %	26	28	ns	24	29	ns
F40-43 anxiety disorders %	18	15	ns	17	20	ns
F60 personality disorders %	5.9	3.8	ns	6.5	2.9	ns
Other diagn. (*F*, Z, somatic)%	6.0	11	ns	7.1	15	0.007

[a] Include missing (60) and dropouts during follow-up (163).
[b] Patients that were recorded with episodes during their hospital stay.
[c] F34.0 and F38.0 excluded.

report risk scale" (SRS, see chapter 2.4 and Fig. 1). As part of the discharge procedure the physician, psychiatrist or psychologist in charge did a second recording for the subsequent three months after discharge. Patients received written and verbal information about the project at admission.

The ward staff recorded violent, suicidal and self-injuring episodes continuously during hospital stay.

The outpatient follow-up was organised in this way: At 3, 6, 9 and 12 months after discharge, the project assistant sent the forms for recording episodes of violent, suicidal and self-injurious behaviour to the therapists at the outpatient clinics and the district psychiatric wards. For the patients discharged into community, the project assistant sent the recording schemes to the patient's primary nurse at the acute ward. The nurse then contacted the patient by phone, and recorded occurred episodes. The respective recording periods were 0–3, 4–6, 7–9 and 10–12 months.

The recording schemes contained scoring guidance for all items. Before the study the staff at all sites was educated in recording violent, suicidal and self-injurious behaviour. At the acute ward "super-users" were trained to guide the other staff. The project leader collected systematically data taken from hospital records, records from district psychiatric wards, and outpatient clinic records. Data concerning violent threats and acts were also collected from criminal records.

If a patient was readmitted to the acute ward during the study period, his trial file was closed after recording the occurrence of violent, suicidal and self-injurious episodes in that post-discharge period. The patient was then included with a new file number. The same procedure was repeated for each readmission.

2.3. Definitions of violent, suicidal and self-injurious behaviour

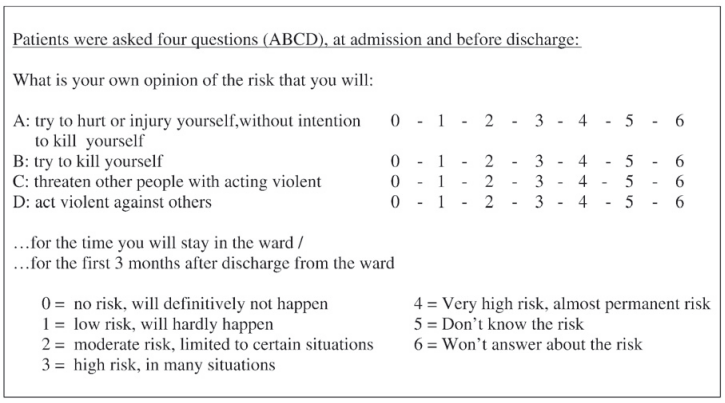
The same definitions were used for the inpatient and the follow-up part of the study. *Violent behaviour* included violent threats and violent acts. *Violent threats* were operationally defined as verbal and non-verbal communication conveying a clear intention to inflict physical injury upon another person, and *violent acts* defined as the intended infliction of bodily injury upon another person (Bjrkly, 1996; Dean et al., 2006; McNiel et al., 1988; Monahan et al., 2005). Post-discharge recording categorised violent acts into less severe and severe acts. *Less severe acts*: kicks and blows without injuries. *Severe acts*: weapon, arson, and assaults causing injuries.

Self-inflictive behaviour has many terms (Silverman et al., 2007; Skegg, 2005). In this study, self-inflictive behaviour was divided in two categories; with and without the intention to die. *Suicidal threats* were defined as verbal or non-verbal interpersonal actions that communicate a suicide-related action to occur in the near future, and a *suicidal act* defined as a self-inflicted behaviour with the intention to kill oneself (Kroner and Loza, 2001; Klonsky, 2007). *Suicidal behaviour* (SUB) refers to suicidal threats and suicidal acts. *Self-injurious behaviour* (SIB) was defined correspondingly, as the intention to injure oneself but without the wish to kill oneself (Klonsky, 2007; Kroner and Loza, 2001). Post-discharge suicidal attempts and self-injurious assaults were categorised as *severe acts* when followed by hospitalisation or being fatal. Other acts were characterized as *less severe acts*.

2.4. Baseline measures

Information concerning age, gender, hospital stay, judicial status at admission- and discharge, and ICD-10 diagnosis at discharge was obtained from records and included as demographic and clinical variables (Table 1).

Due to lack of other available instruments, a four-item self-report screen (SRS) with a seven-point scoring scale was constructed to measure the patients' judgements of their subsequent risk for self-harm or violence (Fig. 1). The patients were asked to respond to four of the four items A–D: For the time you are staying in the ward/for the first three months after discharge from the ward; what is your opinion about the risk that you: (A) will try to hurt or injure yourself, without the intention to kill yourself? (B) will try to kill yourself? (C) will *threaten* other people by acting violently? (D) will act violently against others? For each question, the patients choose one of the seven respond options to express their risk estimate: *no risk* (will definitely not happen), *low*


Patients were asked four questions (ABCD), at admission and before discharge:

What is your own opinion of the risk that you will:

A: try to hurt or injury yourself,without intention to kill yourself	0 - 1 - 2 - 3 - 4 - 5 - 6
B: try to kill yourself	0 - 1 - 2 - 3 - 4 - 5 - 6
C: threaten other people with acting violent	0 - 1 - 2 - 3 - 4 - 5 - 6
D: act violent against others	0 - 1 - 2 - 3 - 4 - 5 - 6

…for the time you will stay in the ward /
…for the first 3 months after discharge from the ward

0 = no risk, will definitively not happen
1 = low risk, will hardly happen
2 = moderate risk, limited to certain situations
3 = high risk, in many situations
4 = Very high risk, almost permanent risk
5 = Don't know the risk
6 = Won't answer about the risk

Fig. 1. Self-report risk scale (SRS).

risk (will hardly happen), *moderate risk* (limited to certain situations), *high risk* (in many situations), *very high risk* (almost permanent risk), *don't know the risk, and, will not answer about the risk.*

2.5. Outcome measures

During hospital stay, violence was monitored by the Report Form for Aggressive Episodes (REFA) (Bjørkly, 1999, 2000; Bjrkly, 1996). Suicidal and self-injurious behaviour were monitored by a corresponding Report Form of Suicidal and Self-injurious episodes (RESUS). Shortly after the occurrence of an episode in the ward, information about the time and the characteristics of the situation, the precipitating factors, the persons involved, and the severity of the episode, were recorded. The inpatient episodes were recorded as threats or acts.

Violent, suicidal and self-injurious episodes that occurred after discharge were recorded in scoring schemes. The episodes were categorised into threats, less severe acts, and severe acts with operational definitions of each category. The scores on each category were: *No*, *not present*, *Yes*, *present* or, *Don't know if present*. Other characteristics were not recorded in the outpatient follow-up.

2.6. Statistics

Data were analysed using SPSS version 16.0. Statistics were computed for hospital stay and for 3 and 12 months post-discharge. For persons with more than one hospitalisation, the inpatient and the post-discharge period with the most serious episode(s) was chosen. If two or more episodes with similar severity had occurred the first episode was chosen as positive identification of violence and self harm for the analysis. Statistics were also computed to control for the effect of readmissions. The episodes of threats and physical acts were combined in one dichotomous variable to give statistical strength to the outcome variables (violence, suicidal behaviour and self-injurious behaviour).

Chi² tests were used for categorical variables, and *t*-tests and Mann–Whitney tests for continuous variables. The area under the curve (AUC) of the receiver operating characteristic analysis was used to assess the predictive validity, and logistic regression and R^2 estimates were used for effect size measures. Demographic and diagnostic factors that were significant of violent, suicidal or self-injurious behaviour were used as confounders in multivariate analysis.

Other predictive characteristics were positive predictive value (PPV; how many of the patients with a "positive test" were violent/self harm), negative predictive value (NPV; how many of the patients with a "negative test" were not violent/self harm), and number needed to detain (NDD = the inverse value of PPV; how many negatives have to be detained for every true positive). In our study, "no risk" and "low risk" were negative predictors and "moderate, high and very high risk" positives.

Over one third of the episodes were recorded among *don't know* and *won't answer* SRS-ratings at baseline. Then, *don't know* and *won't answer* predictions at the *no risk* or *low risk* level were recorded as negative predictors, and the others as positive predictors. Also, statistics were computed when *don't know* and *won't answer* were excluded.

For the outcome measures of recorded episodes, the don't know responses were handled as missing and excluded.

The project was approved by The Norwegian Social Science Data Services, The Regional Committee for Medical Research ethics and The Ministry of Health and Care. The approval granted exemption from asking for patients' consent to participate in the study.

3. Results

3.1. Characteristics of the samples

The demographic and clinical characteristics of included and missing patients at hospital stay and after discharge are shown in Table 1. One hundred and forty nine (31%) patients had a history of previous suicidal attempts, 127 (26%) had a history of previous violence, and 277 (57%) had experienced suicidal ideation the last months before admission.

The sub-sample of patients ($n=28$) reporting *won't answer the risk of violent behaviour* was characterized by more involuntary admissions ($P<0.001$), mandatory aftercare ($P=0.001$), substance abuse ($P=0.050$), and less affective disorders ($P=0.002$) compared to the rest of the sample. Gender, age, hospital stay, anxiety disorders and personality disorders did not differ. More psychotic disorders in the "won't answer" sample were close to significance ($P=0.056$).

The subsample of patients reporting *don't know the risk of suicide* ($n=29$) had a significant higher frequency of readmissions ($P=0.042$) than the rest of the sample. Including all admissions ($n=63$) in the analyses, the *don't know* group had also more patients with personality disorders ($P=0.015$) and anxiety disorders ($P=0.008$).

3.2. SRS ratings and prevalence of episodes

A great majority (60–82%) of the patients rated "no risk" on all SRS for the hospital stay and the first 3 months post-discharge, and 1.9–7.0% rated the risk as high or very high. "Don't know" and "won't answer" made a total of 5.3–10%.

The rates of occurred episodes, and the distribution of episodes related to the SRSs, are shown in Table 2. Two patients, one discharged into the community and one to a district psychiatric centre, committed suicide during the first three months after discharge.

3.3. Predictive validity and characteristics

The SRS for violent threats and SRS for violent acts predicted violent behavior with equal accuracy (Table 3). In the following we give only the results of SRS of violent threats. For hospital stay and at 3 months after discharge, SRSs of suicidal, self-injurious (SIB) and violent behavior correlated significantly with occurred episodes (Table 3). The correlations remained unchanged when data from all readmissions were included in the analyses. SRS predicted violent behaviour for both genders. Sucidal and self-injurious behaviours were predicted significantly only for women.

SRS of violence was significant even after one year (AUC = 0.61, 95%CI = 0.53–0.69, $P=0.005$), and with severe violent acts as the only significant category (AUC = 0.69, 95%CI = 0.51–0.88, $P=0.024$). For the subgroup patients recorded with both suicidal and self-injurious behavior, AUC values at 3 months were 0.71 (0.54–0.90, $P=0.019$) when predicted by the SRS of suicide, and 0.83 (0.72–0.95, $P<0.001$) when predicted by the SRS of SIB. This subgroup ($n=14$) was more frequently rehospitalised than the subgroups with suicidal behaviour only ($n=31$) or SIB only ($n=9$); the mean number of rehospitalisations for these patients at 3 months were 2.0, 1.0 and 0.3, respectively.

Table 2
Distribution of the recorded episodes (threats and acts) compared with patients' risk estimates.

Risk prediction SRS	No risk	Low risk	Moderate	High	Very high	Don't know	Won't answer	Threats + acts all episodes (%)
At hospital stay (episodes/predictions)								
Suicide	0/322	2/47	2/6	0/3	0/1	3/15	2/16	0 + 9 (2.2%)
Self-injury	1/306	0/43	3/21	3/5	0/2	0/17	0/16	0 + 7 (1.7%)
Violent threats	9/337	2/27	4/13	1/4	1/2	0/7	7/19	12 + 12 (5.9%)
Violent acts	13/353	1/24	3/5	0/1	1/2	0/5	6/18	12 + 12 (5.9%)
3 months post-discharge (episodes/predictions)								
Suicide[a]	28/200	6/34	4/8	2/4	0/1	4/12	1/7	31 + 14 (17%)
Self-injury [a]	10/187	3/33	3/16	3/4	1/5	3/13	0/7	9 + 14 (8.6%)
Violent threats	22/211	6/26	4/9	1/1	2/2	3/8	4/9	26 + 16 (16%)
Violent acts	24/221	6/22	2/4	0/0	2/2	3/8	5/9	26 + 16 (16%)

[a] 14 patients (5.3%) had been recorded with both suicidal and self-injurious behaviour after discharge.

Table 3
Predictive validity of self-prediction (SRS) at hospital stay and 3 months post-discharge.

Prediction of	At hospital stay						3 months post-discharge					
	Patients, $n=422$			All admissions, $n=582$			Patients, $n=266$			Readmissions only, $n=160$		
	n[a]	AUC (95%CI)	P	n[a]	AUC (95%CI)	P	n[a]	AUC (95%CI)	P	n[a]	AUC (95%CI)	P
Violent threats	24	0.73 (0.61–0.85)	<0.001	31	0.69 (0.58–0.80)	<0.001	42	0.67 (0.58–0.76)	<0.001	20	0.70 (0.60–0.83)	0.005
men	15	0.68 (0.52–0.84)	0.016				24	0.64 (0.51–0.77)	0.024			
woman	9	0.82(0.64–0.99)	0.002				18	0.72 (0.57–0.87)	0.006			
Violent acts	24	0.68 (0.55–0.81)	0.003	31	0.65 (0.53–0.76)	0.006	42	0.64 (0.55–0.73)	0.001	20	0.67 (0.53–0.81)	0.015
Suicidality	9[b]	0.92 (0.88–0.96)	<0.001	9	0.90 (0.85–0.94)	<0.001	45	0.63 (0.55–0.72)	0.002	54	0.61 (0.53–0.71)	0.012
woman	7	0.91 (0.85–0.97)	<0.001				18	0.65 (0.53–0.77)	0.023			
Self–injurious	7[b]	0.82 (0.67–0.98)	0.003	10	0.82 (0.71–0.93)	<0.001	23	0.66 (0.57–0.76)	0.001	38	0.65 (0.58–0.79)	0.003
Woman	7	0.80 (0.65–0.95)	0.007				18	0.67 (0.60–0.77)	0.002			

[a] Number of recorded episodes of violence, suicidal behavior and self-injurious behaviour, respectively.
[b] Suicidal and self-injurious acts.

3.4. Controlling for other factors

For each of the outcome measures, all univariate significant factors were entered in a multivariate analysis. The factors that remained significant were again entered in multivariate analysis. The results from the last analyses are shown in Table 4. SRS for all three outcome measures remained significant at hospital stay in multivariate analyses. SRS of violent behaviour remained significant after 3 months, and *moderate or higher risk* of violence was even significant after one year (OR = 4.3, 95%CI = 1.2–16, $P=0.027$).

SRS counted for 7–20% of the "model fit" of violent behavior during hospital stay, 5–27% of suicidal behaviour and 7–40% of SIB. After three months the corresponding values were 10–16%, 5–8% and 7–13%, respectively.

3.5. Other predictive measures

At hospital stay, false positives and false negatives for violent behaviour were 26 patients (68%) and 12 patients (50%); for suicidal behaviour 37 patients (86%) and 2 patients (25%), and for SIB 24 patients (80%) and 1 patient (14%). Corresponding sensitivity/specificity was 0.50/0.93, 0.75/0.91 and 0.88/0.94 (Table 5).

Three months post-discharge false positives and false negatives were 16 (57%) and 28 (79%) for violent behaviour, 21 (64%) and 33 (73%) for suicidal behaviour, and 18 (75%) and 16 (73%) for SIB. Corresponding sensitivity/specificity was 0.30/0.93, 0.27/0.91 and 0.27/0.93.

Excluding "don't know" and "won't answer" increased the PPV's of suicidal behaviour to 0.20 and 0.46, respectively, and to 0.50 for 3 months violent behaviour, but it had no effect on the results for SIB and inpatient violence.

4. Discussion

4.1. Main findings

SRS was a significant predictor of inpatient and 3 months post-discharge violence, also when stratified for gender and in multivariate analyses. Accuracy was higher for woman than for men.

SRSs were significant of self-injurious and suicidal behaviour, and significant for females only with gender stratification. Inpatient accuracy was very high, but accuracy decreased the first three months after discharge.

SRSs had equal accuracy also when all admissions were included. "Moderate or higher risk" had the highest predictive accuracy, but also *won't answer about the risk of violence* and *don't know the risk of suicide* and *self-injurious behaviour* were significant predictors.

Table 4
Significant factors in multivariate analyses.

	Inpatient			3 months outpatient		
	OR	(95%CI)	p	OR	(95%CI)	p
A. Violent behaviour[a]						
SRS scale (no risk = baseline)			0.026			0.014
Moderate or higher risk	6.3	(1.5–23)	0.011	8.1	(1.6–40)	0.010
Won't answer about risk	5.7	(1.5–22)	0.011	5.2	(1.2–23)	0.029
Involuntary admission	15	(1.5–45)	<0.001	4.8	(2.2–10)	<0.001
History of violence	3.6	(1.0–13)	0.043	4.9	(2.0–13)	<0.001
B. Self-injurious behaviour[b]						
SRS scale (no risk = baseline)			0.085			0.218
Moderate or higher risk	24	(2.2–256)	0.009	2.5	(0.88–7.0)	0.085
Don't know risk	35	(2.4–510)	0.009	3.4	(1.1–11)	0.033
Female		all female		2.0	(0.88–4.8)	0.097
Bipolar disorders	63	(6.6–601)	<.001	1.3	(0.48–3.3)	0.643
C. Suicidal behaviour[c]						
SRS scale (low risk[1] = baseline)			0.021			0.129
Moderate or higher risk	9.6	(1.1–78)	0.040	3.3	(0.88–12)	0.078
Don't know risk	12	(1.7–84)	0.012	3.3	(1.1–9.6)	0.032
Won't answer risk	19	(2.3–149)	0.006	0.78	(0.07–6.7)	0.749
Personality disorder	0.27	(0.03–2.5)	0.255	6.6	(2.1–21)	0.001
Inpatient suicidality				8.9	(0.85–94)	0.069
History of suicide attempts	8.3	(0.90–78)	0.062	1.6	(0.83–3.3)	0.158

[a b c] Univariate significant factors, but not significant in multivariate analysis: a = length of stay (inverse), involuntary hospitalisation, involuntary aftercare, F1 × substance abuse, F2 × psychotic disorders, F3 × affective disorders (inverse), F4 × anxiety disorders (inverse), gender, inpatient violence, b = history of suicidal attempts, suicidal ideation last month, personality disorders, age, bipolar disorders (inpatient significant), inpatient violence, –suicidality, –self-injury, c = bipolar disorders, alcohol abuse, age, gender, inpatient violence, – suicidality, –self-injury, suicidal ideation the last month, length of stay (inverse), [1] = no recorded episodes among no risk ratings.

With exception of SRSs of inpatient suicide and self-injury, low sensitivity limits the value of SRSs as screenings on their own, but the relatively high positive predictive values could be of clinical importance.

4.2. Self harm

Despite very low inpatient rates of occurred episodes the SRS was a significant predictor of both suicidal behavior and SIB, with high AUC values. AUC is less dependent of violence base rate than other statistics, and has been considered suitable for validating risk predictions (Buchanan, 2008; Douglas et al., 1999; Mossman, 1994; Rice and Harris, 1995). Remaining significant in multivariate analysis with minor changes in odds ratios and *P*-values indicated an independent predictive accuracy of SRS of self harm.

For the first 3 months after discharge, SRS of self harm had lower accuracy than for inpatients', and predicted only for women when stratified for gender. Of interest was that *don't know the risk of suicide* was the only multivariate significant SRS single item at 3 months. The *don't know group* was characterized by more readmissions, more personality disorders and more anxiety disorders, than the rest of the patients.

To address the relative importance of the contributing factors, two R^2 approximations (Cox and Snell and Nagelkerke) of "model fit" were used; how much of the outcome variance that could be explained by the predictor(s). R^2 estimates in logistic regression is questionable, but can be used to compare predictor(s) in the same data set (Hosmer and Lemeshow, 2000). Model fit estimates of self-harm SRS were in the moderate to high region for inpatients and in the moderate after discharge. The results of self-harm SRS confirm earlier findings of the validity of self-reporting scales (Huth-Bocks et al., 2007; Kroner and Loza, 2001; Nimeus et al., 2006). However, the use of self-reports was found to be limited in guiding primary care physicians assessment and management of suicide risk (Gaynes et al., 2004).

Certain demographic and clinical items are predictive of suicidal risk, and a past history of suicidal behaviour, suicidal ideation and mental illness are among the most consistent in the general population (Gaynes et al., 2004; Kemball et al., 2008; Mann et al., 2008; Olfson et al., 1996; Oquendo et al., 2006). Also environmental factors such as health care organization influence suicidal rates; the prominence of outpatient mental health services has been associated with a low suicide rate (Pirkola et al., 2009), and rapid changes in mental health services seemed to have an opposite effect (Hawton and Saunders, 2009). In our sample of acutely admitted patients several items were significant of suicidal behaviour and SIB (Table 4), but only personality disorders, history of suicide attempts, and inpatient suicidal behaviour of 3 months suicidal behaviour, and women and bipolar disorders of inpatient SIB, remained significant in multivariate analyses.

Characteristics and correlates of SIB are poorly understood and there is a lack of validated treatment programs (Prinstein, 2008). Past findings have demonstrated that regulation of negative emotions seems to be the most commonly reason for SIB (Klonsky, 2007; Prinstein, 2008). Lately, a self-report study of adolescents suggested a role for emotional literacy programs in school (O'Connor et al., 2009).

Table 5
Predictive characteristics of self predictions: inpatient and 3 months post-discharge.

	Inpatient			3 months post-discharge		
	PPV	NPV	NND	PPV	NPV	NND
Violent behaviour	0.32	0.97	3.2	0.43	0.88	2.3
Suicidal behaviour	0.14	0.99	7.1	0.36	0.86	2.8
Self-injurious behaviour	0.20	0.99	5.0	0.25	0.93	4.0

Our findings of a subgroup of patients with both suicidal behaviour and SIB, characterized by frequent hospitalisations, twice or more compared with the suicidal- and SIB groups, indicate possible subgroups within this field.

4.3. Violence

An inpatient violence rate of 7.6% was low compared to results from the only Norwegian study that had been conducted on this patient group in Norway prior to our research (Mellesdal, 2003), but the rate after discharge confirmed other studies (Hartvig et al., 2006; Monahan et al., 2001). Results from multivariate analysis and model fit estimates in the moderate to high region indicate an independent significance for the SRS of violence both inpatient and 3 months outpatient, and support some earlier findings from forensic psychiatry (Loza et al., 2007; Walters, 2006). SRS of 3 months was even significant after one year, with severe violence as the only significant item when categorizing for severity. The positive correlation between predictive accuracy and severity has also been found in studies of post-discharge risk assessment in general psychiatry (Harris et al., 2004; Roaldset et al., submitted).

SRS of violence was significant for both genders, but seemed to be more accurate for woman than for men. Also, it seemed to be more accurate than the SRS of self harm for the post-discharge period. If confirmed this "long-time" effect could indicate that self harm is more related to changeable or fluctuating factors than violence, and more difficult for patients to anticipate over time. This concurs with prior research underlining that the concept of "short term factors" (days or hours) of suicide risk is important in clinical practice (Cassells et al., 2005; Deisenhammer et al., 2009), and that unchangeable (historical) factors have been found to be the most accurate for risk assessments of violence (Doyle and Dolan, 2006).

False positive and negative predictions and their seemingly inverse relationship are a great challenge in risk assessment, and have ethical, judicial, cost-benefit and treatment issues (Buchanan, 2008; Palmstierna, 1999). A considerable number of outcome episodes were recorded among patients rating themselves with "no risk of violence". Consequently, the false negatives were high and sensitivity decreased. The NND value of 2.3 for the first three months after discharge implies that a mean of 1.3 patients had to be unnecessarily detained in hospital for further risk assessment and management, for every truly violent patient detained and treated. Ideally, violence rates could then be reduced to false negatives. Correspondingly results were found for SRSs of suicide and SIB after discharge. If confirmed by others, this indicates that negative SRS predictions are characterized by uncertainty, but that the accuracy of positive predictions could be clinical useful and should be taken seriously. The analysis of true and false predictions seemed to balance a seemingly high effect size of odds ratio and model fit, and using more than one statistical method was useful for exploring the predictive validity of SRS in this sample (Buchanan, 2008).

Patients reporting "won't answer the risk" on SRS of violence were characterized by items significant predictive of violent behavior which could have explained the high violence rate in this sub-sample. However, remaining significant at the $P = 0.05$ level in multivariate analysis, both inpatient and after discharge, "won't answer" seemed to have some degree of independent accuracy.

When statistics was computed for readmissions only (outpatient), and when readmissions were included (inpatient) (Table 3), results were almost equal with the results of the study sample for all outcome measures. This indicates that the accuracy of SRS seemed to be independent of the patients' admittance frequency and of the possibility that patients' condition both at admission and at discharge may vary substantial from stay to stay.

The high rate of false negatives may have different explanations, such as unpredicted relapses, environmental factors, or denial. Denial

as a defence mechanism has been found to correlate positively with suicidal and violent behaviours in adolescents (Apter et al., 1997). One should also take into consideration that clinicians' knowledge of the self-reported risks may have affected decisions about discharge or continued hospitalisation. Also, these factors might apply to the *Don't know* and *Won't answer* options.

Few patients were missing ($n=60$) compared with the completers ($n=429$) at admission, and the mean age was the only significant difference between these groups. Hence we assume that the study sample can be considered as representative of the whole sample of acutely admitted patients in this period.

Significantly more inpatient violence and mandatory aftercare in the follow-up sample ($n=310$) may explain a higher risk of violent behavior, and a lower age mean and more bipolar disorders may have caused a higher risk of self harm, compared to the outpatient missing sample ($n=223$). Shorter hospital stay in the missing group was also a risk factor of violence. There is reason to question whether premature discharges may have caused systematic error in our data on violence.

4.4. Limitations

A naturalistic study in an acute setting is far from "gold-standard" research conditions. However, the clinical validity for acute and adjacent settings is beneficial. Given that we lacked appropriate tools for measuring SRS we constructed new ones for this study, and so our results cannot be compared to others. Patients' varying conditions at admittance and at discharge may influence ratings of the SRS, as well as the therapists' own opinion of the risk. The occurrence of inpatient episodes were influenced by ward characteristics in addition to patient related factors, and the occurrence of post-discharge episodes were influenced by the hospital stay, further treatment and management, and community qualities. These circumstances may influence whether episodes occurred or not.

A high number of staff recorded outcome measures, and most of them were treatment staff. This may bias results, but nearness to the patients may also secure valid recordings during follow-up. Episodes of violence and self harm may have been under-reported. Judgement of violent and self-harm behaviour, especially threats, might differ among recorders, as well as the differentiation between suicidal behaviour and self-injurious behaviour. Some of the AUCs were poor, and others only in the "adequate to good" area. We did not control for other measures of severity of psychopathology than diagnosis. The low incidence of occurred episodes (especially during hospital stay) increases the risk of type II errors, and it would take a larger sample to obtain sufficient statistical power in the analyses. Differences between the follow-up and outpatient missing sample limit the external validity of the results. Hence our findings cannot be generalised directly to other (acute) psychiatric units or community without further studies.

4.5. Suggestions for future research

With exception of SPSs of inpatient suicide and self-injury, a low sensitivity suggests that SRSs are not suitable as screenings. An important task would be to investigate what is behind these false negative predictions. The relatively high positive predictive values indicate that patients' positive risk predictions could be of clinical importance and should be confirmed. Further research should control for other factors, such as the severity of psychopathological factors. One important aim for future research might be to explore whether SRSs add incremental validity to established risk assessment tools and risk assessment procedures of violence, suicide and self-injury.

Acknowledgements

We gratefully acknowledge the staff at the Psychiatric Department and especially the staff at the acute ward, Ålesund Hospital, for data recording and collection. We also thanks Dr. Stephen P. Lock for help and advice in writing the paper, and Director Bjørn Østberg and Mona Skjønberg, Centre of Research and Education in Forensic Psychiatry at Oslo University Hospital, and Professor Petter Laake, Faculty of Medicine, Oslo University, Norway, for valuable help and support.

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Paper III

Is not included due to copyright

Paper IV

Is not included due to copyright

Appendix

Appendix

Violence risk screening – 10 (V-RISK-10)

☐ At admission ☐ At discharge ☐ In policlinic

Patients name: Date of birth:

Female: Male: Patient number:

Date of admittance: Date of discharge: Registration number:

Signed by: Date:

Scoring instruction: The rater collects information about each of the ten risk factors on the V-RISK-10 checklist. Some examples of important scoring information are described under each item. Put a check in the box to indicate the degree of likelihood that the risk factor applies to the patient in question:

- **No:** Does not apply to this patient
- **May be / moderate:** May be applies / present to a moderately severe degree
- **Yes:** Definitely applies to a severe degree
- **Do nor know:** Too little information to answer

1. Previous and / or current violence

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

Severe violence refers to physical attack (including with various weapons) towards another individual with intent to inflict severe physical harm. **Yes:** The individual in question must have committed at least 3 moderately violent aggressive acts or 1 severe violent act, Moderate or less severe aggressive acts such as kicks, blows and showing that does not cause severe harm to the victim is rated **Maybe / moderate.** ☐

2. Previous and / or current threats (verbal or physical)

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

Verbal: Statements, yelling and the like, that involve threat of inflicting other individuals physical harm.

3. Previous and / or current substance abuse

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

The pasient has a history of abusing alcohol and / or other Substances (e.g. amphetamine, herion, cannabis). Abuse of solvents or glue should be included. To rate **Yes**, the patient must have and /or have extensive abuse / dependence; with reduced occupational functioning, reduced health and / or reduced participation in leisure activities

4. Previous and / or current major mental illness

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

NB: Whether the patient ha or has had a psychotic disorder (e.g. Schizophrenia, delusional disorder, psychotic affective disorder. See item 5 to rate personality disorders.

5. Personality disorder

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

Of interest here are eccentric (schizoid, paranoid) and impulsive, Uninhibited (emotionally unstable, antisocial) types.

6. Shows lack of insight into illness and behaviour

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

This refers to the degree to which the patient lacks insight in his / her mental illness, with regard to for instance need of medication, social consequences or behaviour related to illness or personality disorder.

7. Express suspicion
The patient express suspicion towards other individuals either verbally or nonverbally. The person in question appears to be ”on guard” towards the environment.

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

8. Shows lack of empathy
The patient appears emotionally cold and without sensitivity Towards others’thoughts or emotional situation.

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

9. Unrealistic planning
This assesses to to which degree the patient him / herself has unrealistic plans for the future (inside or outeasy access to weapons etc.side the inpatient unit). Is for instance the patient realiric with regard to what he/ she can expect of support from professional and social network? It is important to assess whether the patient is cooperative and motivated with regard to following plans.

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

10. Future stress-situations
This evaluates the possibility that the patient may be exposed to stress and stressful situations in the furure and his / her ability to cope with stress. For example (in and outside inpatient unit): reduced ability to tolerate boundaries, physical proximity to possible victims of violence, homelessness, spending time in violent environment, easy access to weapons etc.

No	Maybe/moderate	Yes	Do not know
☐	☐	☐	☐

Overall clinical evaluation:

- **Based on clinical judgement, other available information and the checklist:**
- **How great do you think the violence risk is for his patient:**

LOW	MODERATE	HIGH

- **Suggestion following overall clinical evaluation:**

NO MORE ETAILED VIOLENCE RISK ASSESSMENT	MORE DETAILED VIOLENCE RISK ASSESSMENT	IMPLEMTATION OF PREVENTIVE MEASURES

Justifications / reasons / arguments should be detailed in patient record and / or discharge summary

Pasientnavn: Fødselsdato:

BPS-10: Screening sjekkliste for vurdering av voldsrisiko

Risikovurdering ved innkomst (BPS-Inn)

Kjønn:: Kvinne ☐ Mann ☐ Alder:

Pasientnummer: Løpenummer:

Utfylling av skjemaet:

Prøv å samle informasjon i forhold til hver av de ti risikofaktorene i sjekklisten BPS-10.
Under hvert ledd er det eksempler på hva som er viktig informasjon for å kunne svare.
Sett ett kryss i boksen som angir grad av tilstedeværelse av et problem eller en tilstand:

Nei, leddet er ikke til stede, eller er ikke relevant
Kanskje, moderat eller mindre alvorlig
Ja, definitivt alvorlig
Vet ikke, eller for lite informasjon til å kunne svare

1.Tidligere og/eller aktuell vold	**Nei**	**Kanskje**	**Ja**	**Vet ikke**
Med alvorlig vold menes fysisk angrep (inkludert evt. bruk av kniv eller skytevåpen) mot annen person, for å påføre alvorlig fysisk skade. For å skåre Ja må vedkommende ha gjort minst en alvorlig voldshandling eller tre moderate voldshandlinger. Moderat eller mindre alvorlige aggresjonshandlinger som spark, slag og dytting som ikke forårsaker alvorlig/varig skade hos offeret skåres Kanskje.	☐	☐	☐	☐
2. Tidligere og/eller aktuelle trusler (verbale/fysiske)	**Nei**	**Kanskje**	**Ja**	**Vet ikke**
Verbale: Utsagn, rop og lignende som innebærer trussel om å påføre andre personer fysisk skade. Fysiske: Bevegelser og gester som varsler fysisk angrep.	☐	☐	☐	☐
3. Tidligere og/eller aktuelt rusmisbruk	**Nei**	**Kanskje**	**Ja**	**Vet ikke**
Pasienten har en historie med misbruk av alkohol, medikamenter og/eller narkotiske stoffer (amfetamin, heroin, hasj f.eks). Misbruk av løsemiddel eller lim skal inkluderes her. For å skåre Ja må pasienten ha (hatt) omfattende og alvorlig misbruk/avhengighet, med nedsatt funksjon i arbeids-, skole-, helse- og/eller fritidsliv.	☐	☐	☐	☐
4. Tidligere og/eller aktuell alvorlig psykisk lidelse	**Nei**	**Kanskje**	**Ja**	**Vet ikke**
Her må en finne ut om pasienten har hatt psykotiske symptom, en alvorlig ICD eller DSM diagnose (schizofreni, paranoid psykose, bipolar lidelse, psykotisk depresjon, f.eks.). Se ledd 5 for skåring av pers.forstyrrelser.	☐	☐	☐	☐

5. Personlighetsforstyrrelse En personlighetsforstyrrelsesdiagnose må klassifiseres etter ICD-10 eller DSM-IV kriterier.	Nei	Kanskje	Ja	Vet ikke
	☐	☐	☐	☐
6. Mangler innsikt Her menes i hvilken grad pasienten har innsikt i sin psykiske lidelse eller personlighetsforstyrrelse, og i forhold til evt behov for medikasjon, sosiale konsekvenser, eller mulig økt voldsrisiko i aktiv sykdomsfase.	Nei	Kanskje	Ja	Vet ikke
	☐	☐	☐	☐
7. Mistenksomhet Pasienten gir uttrykk for mistenksomhet overfor andre personer enten verbalt eller nonverbalt. Vedkommende virker å være "på vakt" overfor omgivelsene.	Nei	Kanskje	Ja	Vet ikke
	☐	☐	☐	☐
8. Viser manglende innlevelse (empati) Pasienten virker følelseskald, uten innlevelse i andres tankemessige eller følelsesmessige situasjon.	Nei	Kanskje	Ja	Vet ikke
	☐	☐	☐	☐
9. Urealistisk planlegging Faktoren måler i hvilken grad pasienten selv har realistiske framtidsplaner. Er f.eks pasienten selv realistisk i forhold til hva han kan vente av støtte fra familie, og profesjonelt og sosialt nettverk? Det er viktig å vurdere om pasienten er samarbeidsvillig og motivert når det gjelder å følge planene videre. Vurderingen gjelder for oppholdet i avdelingen.	Nei	Kanskje	Ja	Vet ikke
	☐	☐	☐	☐
10. Stress (-situasjoner) Her vurderes muligheten for at pasienten kan bli utsatt for framtidige påkjenninger og belastende situasjoner, og hans/hennes evne til stressmestring. Eksempler kan være at personen kommer i høyrisikosituasjoner for vold, som i situasjoner med grensesetting eller kommunikasjons-problem. Vurderingen gjelder for oppholdet i avdelingen.	Nei	Kanskje	Ja	Vet ikke
	☐	☐	☐	☐

Samlet klinisk vurdering ved innkomst:

Basert på klinisk skjønn, annen tilgjengelig informasjon og sjekklisten: Hva tror du er risikograden for denne pasienten under oppholdet i avdelingen?
Sett et kryss i boksen som indikerer relativ risikograd

LAV ☐
MODERAT ☐
HØY ☐

Utfylt av: _____ **Dato:**_____

Pasientnavn: Fødselsdato:

Skjema for pasientens egen vurdering av risiko for aggressiv atferd under oppholdet i akuttavdeling. (Selvprediksjon Inn).

Kjønn: Kvinne ☐ Mann ☐ Alder:

Pasientnummer: Løpenummer:

Fylles ut av vakthavende (eller mottakende) lege / psykolog.

0= ingen risiko
1= liten risiko
2= moderat risiko = en viss risiko, for eksempel begrenset til få og spesielle situasjoner.
3= stor risiko, i mange situasjoner
4= svært stor risiko

Spørsmål A (selvskading):

Hvor stor tror du selv at risikoen er for at du vil komme til å skade deg selv under oppholdet?
0 1 2 3 4 Vet ikke Vil ikke svare

Spørsmål B (suicidalitet):

Hvor stor tror du selv at risikoen er for at du vil komme til å ta livet ditt under oppholdet?
0 1 2 3 4 Vet ikke Vil ikke svare

Spørsmål C (trusler om vold mot andre)

Hvor stor tror du selv at risikoen er for at du vil komme med trusler mot andre under oppholdet?
0 1 2 3 4 Vet ikke Vil ikke svare

Spørsmål D (vold mot andre):

Hvor stor tror du selv at risikoen er for at du vil komme til å skade andre (personale eller medpasienter) under oppholdet?
0 1 2 3 4 Vet ikke Vil ikke svare

Innleggelsesparagraf (sett ring rundt x):

X Tvang (§3-6,§ 3-1) **X Frivillig** (§2-1, §2-2)

Utfylt av:
Dato:

Pasientnavn: Fødselsdato:

Skjema for blodprøvesvar, medikamenter og rusbruk.

Pasientnummer: **Løpenummer:**

	Dato	Svar
KOLESTEROL		
LDL		
HDL		
KOL / HDL ratio		
Triglycerider		
Serotonin		
TSH* (hvis tatt)		
Fritt T4* (hvis tatt)		

Skriv medikament nr. og mg pr døgn i medisinruta (A,B,C

Innleggelsesdato:	A. Fast medisin ved innleggelse	B. Under oppholdet (regelmessig med.)	C. Medisiner ved utskriving	Ev kommentar
1. SSRI, SNRI, TCA, ECT 1.Cipralex, 2.Cipramil, 3.Zoloft, 4.Fontex 5.Seroxat, 6. Efexor, 7..Cymbalta 8.TCA, 9. ECT				
2. Andre antidepressiva 1.Remeron 2.Tolvon 3.Edronax,				
3. Nevroleptika 1.Cisordinol 2.Trilafon 3.Haldol 4. Fluanxol 5.Nozinan 6.Truxal 7. Largactil 8.Esucos 9.Solian				
4. Atypiske nevroleptika 1.Zyprexa 2.Risperdal 3.Seroquel 4.Zeldox 5.Abilify 6.Klozapin, Leponex				
5. Litium 1.Lithionit				
6. Stabilisatorer 1.Orfiril 2.Lamictal 3.Tegretol 4.Topimax 5.Nevrontin				
7. Statiner 1.Liptitor, 2.Simvastatin 3.Zocor 4.Pravachol5. Lescol 6.Mevacor				
8. "Gamle" antihistamin 1.Phenergan 2.Vallergan				
9. B-preparater 1.Vival, Stesolid, Valium 2.Alopam, Sobril 3.Xanor 4.Rivotril 5.Stillnoct 6.Zoplicone, Imovane				
10. Rus (siste uke) 1.Alkohol 2.Cannabis 3. Amfetamin 4.Ecstacy 5.Kokain 6.Heroin 7. GHB 8.Andre (spesifiser) Medisinmisbruk: 8.Benzodiazep. 9.Hypnotika, 10.Opiater 11.Smertestillende B-prep 12.Andre (spesifiser)				

Utfylt av:	Dato:

Pasientnavn: **Fødselsnr:**

A-skjema: Aggresjonsskjema for DPS/DPA

Registrering av aggressiv eller voldelig atferd mot person etter utskrivelse fra akuttavdeling

Fylles ut av kontorpersonalet:

Kjønn: Kvinne ☐ Mann ☐ Alder:

Pasientnummer: Løpenummer:

Utskrivelse fra akuttavdelingen regnes som starttid for 12 måneders registrering av aggresjon eller vold ved inntil fire tidspunkter. Ved reinnleggelse og ny utskrivelse brukes nytt A-skjema, og ikke det forrige. Sett ett kryss for hvilken tidsperiode registreringen gjelder for:

0-3 måneder ☐ 3-6 måneder ☐ 6-9 måneder ☐ 9-12 måneder ☐

Fylles ut av behandler:

Behandler bør snakke direkte med pasienten om forhold knyttet til aggresjon og vold, for å kunne avklare eller presisere. Det oppfordres til å innlede med et spørsmål om pasienten selv har opplevd å være offer for andres aggresjon. Det kan registreres flere aggresjonsepisoder i løpet av hver tidsperiode på 3 måneder. Det er viktig å klassifisere alvorlighetsgraden til aggresjonsepisodene, og ikke bare krysse av for den mest alvorlige. Skjemaet skal særlig fange opp aggresjon som er rettet mot andre personer som fysisk er tilstede i situasjonen.

Spørsmål A:

Har pasienten vært utsatt for aggresjon eller vold fra andre mennesker siden utskrivelsen fra akuttavdelingen, eller siden siste registrering? (se definisjoner på neste side)
Sett antall aggresjonsepisoder (1, 2, 3, osv) i registreringsperioden i JA svarboksene. Sett kryss i NEI og VET IKKE svarboksene.

	Verbal eller fysisk trussel	Fysisk vold
NEI	☐	☐
JA	☐	☐
VET IKKE	☐	☐

Spørsmål B:

Har pasienten utsatt andre mennesker for trusler eller fysisk vold siden utskrivelsen fra akuttavdelingen, eller siden siste registrering?
Sett antall aggresjonsepisoder (1, 2, 3, osv) i registreringsperioden i JA svarboksene. Sett kryss i NEI og VET IKKE svarboksene.

	Verbal eller fysisk trussel	Lettere til moderat fysisk vold	Alvorlig fysisk vold
NEI	☐	☐	☐
JA	☐	☐	☐
VET IKKE	☐	☐	☐

Spørsmål C: Hvordan fikk du tak i informasjon?
Sett ett kryss, eventuelt flere om det er brukt flere informasjonskilder.

Har spurt pasienten direkte	☐
Har snakket med andre (kollegaer, familie, pårørende f.eks.)	☐
Har funnet opplysninger fra journal f.eks.	☐

Hva ønsker vi å registrere med A-skjemaet?
I denne fasen av prosjektet ønsker vi å registrere hvilke pasienter som har reagert aggressivt eller voldelig etter utskrivelse fra akuttavdelingen, og hvordan.

Utfylling av skjemaet:
Vi oppmoder behandler om å spørre pasienten om han/hun har opplevd aggresjonsepisoder i det siste. Ved å spørre på en empatisk måte, kan man komme i dialog med pasienten om dette. I noen tilfeller kan det være nødvendig å finne informasjon på alternativ måte (komparentopplysninger, journal, skademeldingsskjema, f.eks.).
Det er tre responskategorier, NEI, VET IKKE , JA. **VET IKKE** inkluderer også tilfeller der pasienten ikke vil snakke om temaet eller svare på spørsmålene.
Aggresjonsepisoder registreres med tall i JA svarboksene (for eksempel 1, 2, 3, eller 4), mens det settes kryss i NEI og VET IKKE svarboksene.

Verbal eller fysisk trussel:
Den verbale trusselen er rettet mot en person som fysisk sett er tilgjengelig i situasjonen.
Eksempel: "Jeg skal slå deg", "Jeg vet hvor du bor, jeg skal ta deg", "Jeg skal drepe deg".
Den fysiske trusselen er rettet mot en person som fysisk sett er tilgjengelig i situasjonen. Innebærer fysiske bevegelser og truende kroppsholdning som gir et klart bilde av et nært forestående fysisk vold eller angrep. Grov aggresjon mot gjenstander i annen persons nærhet registreres som fysisk trussel.
Eksempel: Knytter nevene og holder de opp mot en annen person. Har løpt mot, fektet med armene. I mer ekstreme tilfeller fektet med våpen.

Lettere til moderat fysisk vold:
Inkluderer aggresjonshandlinger som ikke forårsaker alvorlig eller varig skade på offeret.
Eksempel: Dytting, kloring, ørefik, sparket etter eller kastet gjenstander mot person, slag, spark, skalling.

Alvorlig fysisk vold:
Inkluderer aggresjonshandlinger som kan påføre offeret alvorlig fysisk skade.
Eksempel: Kvelertak, bruk av slagredskap som balltre eller lignende, knivstikking, avfyrt skytevåpen, angrep med bruk av kampsportteknikker, seksualisert vold.

Utfylt av:
Dato:

Pasientnavn: ***Fødselsdato:***

S-skjema: Registrering av suicidal- og selvskadeatferd

Kjønn: Kvinne ☐ Mann ☐ Alder:

Pasientnummer: Løpenummer:

Utskrivelse fra akuttavdelingen regnes som starttid for 12 måneders registrering av suicidal-/ selvskadeatferd ved fire tidspunkt. Ved reinnleggelse og ny utskrivelse brukes nytt S-skjema, og ikke det forrige. Kryss av i boksen for hvilket tidspunkt registreringen gjelder for:

0-3 måneder ☐ 3-6 måneder ☐ 6-9 måneder ☐ 9-12 måneder ☐

Fylles ut av behandler:
Behandler bør snakke direkte med pasienten om forhold knyttet til suicidal- og selvskadeatferd, for å kunne avklare eller presisere. Det kan registreres flere episoder i løpet av hver tidsperiode på 3 måneder. Sett en strek for hver episode Det er viktig å klassifisere alvorlighetsgraden til de enkelte episodene, og ikke bare krysse av for den mest alvorlige

Spørsmål A (selvskade):
Har pasienten utsatt seg for selvskade siden utskrivelsen fra akuttavdelingen, eller siden siste registrering? (se definisjoner på neste side)
Sett antall episoder (1, 2, 3, osv) i registreringsperioden i JA svarboksene. Sett kryss i NEI og VET IKKE svarboksene.

	Verbal eller fysisk trussel om selvskade	Lettere til moderat selvskadeatferd	Alvorlig selvskadeatferd
NEI	☐	☐	☐
JA	☐	☐	☐
VET IKKE	☐	☐	☐

Spørsmål B (suicidalatferd):
Har pasienten truet med eller utført suicidalhandlinger siden utskrivelsen fra akuttavdelingen, eller siden siste registrering?
Sett antall episoder (1, 2, 3, osv) i registreringsperioden i JA svarboksene. Sett kryss i NEI og VET IKKE svarboksene.

	Verbal eller fysisk trussel om suicid	Lettere til moderat suicidalatferd	Alvorlig suicidalatferd
NEI	☐	☐	☐
JA	☐	☐	☐
VET IKKE	☐	☐	☐

Spørsmål C: Hvordan fikk du tak i informasjon? Sett ett eller flere kryss

Har spurt pasienten direkte	☐
Har snakket med andre (kollegaer, familie, pårørende f.eks.)	☐
Har funnet opplysninger fra journal f.eks.	☐

Medisiner:

Er medisineringen endret siden utskriving? JA NEI

Hvis JA: Hva er endret?…….

Utfylling av skjemaet:

I noen tilfeller kan det være nødvendig å finne informasjon på alternativ måte (komparentopplysninger, journal, skademeldingsskjema, f.eks.).

Det er tre responskategorier, Nei, Ja eller Vet ikke. **"Vet ikke"** inkluderer også tilfeller der pasienten ikke vil snakke om temaet eller svare på spørsmålene.

Skjemaet fanger ikke opp eventuelle psykiske skadevirkninger.

Verbal eller fysisk trussel om selvskade/suicid:

Den **verbale** trusselen er gitt til en annen person.

Den **fysiske** trusselen er gjort i nærvær av en person som fysisk sett er tilgjengelig i situasjonen. Innebærer fysiske bevegelser og truende kroppsholdning som gir et klart bilde av et nært forestående suicidalforsøk eller selvskade..

Lettere til moderat selvskade:

Innebærer mindre alvorlige former for selvskade som f.eks. risping og mindre kutt som ikke trenger å sys, samt andre former for selvskade (f.eks. mindre alvorlig brenning) som ikke er potensielt livstruende eller kan gjøre større fysisk skade.

Alvorlig selvskade:

Innebærer alvorlige former for selvskade, som f.eks. dype kutt som må sys, svelging av gjenstander med påfølgende operative inngrep for behandling, alvorlige brenne og etseskader, samt alvorlige kvelningsforsøk

Lettere til moderat suicidalforsøk

Innebærer forsøk hvor intensjon om å ta eget liv var usikker, eller forsøket var "et rop om hjelp", og forsøket var relativt ufarlig.

Alvorlig suicidalforsøk:

Klar intensjon om å ta eget liv, et forsøk hvor risikoen for å dø var stor, eller gjennomført suicid.

Utfylt av:
Dato:

REGISTRERINGSSKJEMA FOR AGGRESSIV ATFERD (REFA)

NAVN: FØDT: KJØNN: PASIENTNR: LØPENR DATO KL

SITUASJON SOM GIKK FORUT FOR DEN AGGRESSIVE ATFERDEN	VERBAL TRUSSEL	FYSISK TRUSSEL	FYSISK ANGREP	ANGREP SOM MEDFØRTE ALVORLIG FYSISK SKADE
A. FYSISK KONTAKT 1. Fra pasient til kjente personer 2. Fra pasient til ukjente personer 3. Til pasient fra kjente personer 4. Til pasient fra ukjente personer				
B. GRENSESETTING 1. Avslag på ønsker / forespørsler 2. Avvisning / fikk ikke oppmerksomhet nok 3. Grensesetting / korrigering 4. Press på pasient om å utføre praktiske handlinger 5. Manglende struktur / grenser 6. Omgivelsene viste usikkerhet / redsel				
C. KOMMUNIKASJONSPROBLEM 1. Pasienten forsto ikke det som ble formidlet 2. Pasienten ble ikke forstått 3. Pasienten virket styrt av befalende stemmer o.l.				
D. OMSTILLINGER 1. Fast personal sluttet / ble permittert / dro på ferie o.s.v. 2. Andre nære personer «trakk seg unna» pasienten 3. Pasienten kom fra perm, tur e.l. 4. Skremmende ytre begivenheter (formidlet via massemedia, eller selvopplevde ulykker) 5. Uro i avdelingen 6. Komplikasjoner i forhold til familie				
E. PERSONER 1. Ukjent betjening / vikarer 2. Kontakt med visse personer (medpasienter, venner, slektninger) 3. Kontakt med barn 4. Kontakt med eldre / uføre / fysisk «hjelpeløse» 5. Enekontakt med kvinner 6. Enekontakt med menn				
F. RISIKO - KONTAKT 1. Umiddelbar nærhet av farlige gjenstander (glass, kniv, våpen) 2. Trafikkerte områder (bil, buss, tog o.l.)				
G. STOFF 1. Rus av et eller annet slag 2. Uten røyk 3. Annen stoff-abstinens				
H. TILLEGGSOMRÅDER				

SKALA FOR ALVORLIGHETSGRAD:

Sett en ring rundt tallet som angir hvor alvorlig du opplevde den aggressive hendelsen:

IKKE ALVORLIG 0 1 2 3 4 5 6 7 8 9 10 SVÆRT ALVORLIG

Retningslinjer for utfylling av REFA

Generelt:
Bruk ett skjema per pasient per aggresjonshendelse. Men om flere hendelser innen 30 minutter settes kun flere streker på samme skjemaet (se forklaring nedenfor).
Det personalet som har observert eller opplevd aggresjonsepisoden fyller ut skjemaet, helst så tidlig som mulig etter episoden.
Diskuter med annet personal, be om råd eller veiledning ved utfyllingen.
Ta kontakt med avdelingssjukepleier/prosjektkoordinator om du har spørsmål om utfylling av skjemaet.

Framgangsmåte ved utfylling av skjemaet:

Fyll inn pasientens navn, fødselsdato, kjønn, pasientnummer. og løpenummer.
Fyll inn datoen for aggresjonsepisoden, samt klokkeslettet

Finn først ut hva slags aggresjonstype dette dreier seg om (verbal trussel, fysisk trussel, fysisk angrep eller angrep som medførte alvorlig skade). Dette finner du ved å se på den øverste horisontale raden.

Finn deretter ut hva slags situasjon som utløste eller gikk forut for den aggressive episoden (fysisk kontakt, grensesetting, kommunikasjonsproblemer, etc). Dette finner du ved å se på kolonnen lengst til venstre på skjemaet.

I den kolonnen (boksen) du har valgt fyller du inn hvem som ble offer i den aktuelle aggresjonsepisoden, med bruk av kodene; **M** = Medpasient. **PM** = Mannlig personale. **PK** = Kvinnelig personale. **F** = Familie/pårørende. **V** = Venner. **X** = Ukjent
Fyll gjerne inn situasjonskode også, for eksempel B3 (Grensesetting/korrigering).

Om det er flere aktuelle foranledninger kan man registrere i flere bokser, for eksempel både for ”kommunikasjonsproblem” og ”personer”.

Hvis pasienten utagerer flere ganger etter hverandre innen kort tid (innen 30 minutter) kan en markere antall episoder ved å sette inn en strek for hver (for eksempel: M I I I). Bruk nytt skjema om pasienten fortsetter utover 30 minutter.

Aggresjonstyper:

Verbal trussel	Et angrepsforberedende muntlig signal om å ville påføre et potensielt offer i nærheten fysisk smerte, skade eller død. Eks: ”Jeg skal slå inn tennene på deg”.
Fysisk trussel	Et angrepsforberedende motorisk signal om å ville påføre et potensielt offer i nærheten fysisk smerte, skade eller død. Eks: Knytter nevene mot en person.
Fysisk angrep	Et angrep rettet mot et annet individ med hensikt om å påføre fysisk smerte, skade eller død. Eks: Slag, spark, kvelertak, bruk av slagredskap, våpenbruk (kniv, skytevåpen, stikkvåpen) etc., inkludert kloring og lugging. Registrer her selv om pasienten ikke treffer aggresjonsmålet sitt (offeret hopper unna, flykter, får hjelp fra andre, etc).
Angrep som medførte alvorlig fysisk skade	Et fysisk angrep som førte til alvorlig fysisk skade. Eks: Førte til smerte mer enn 10 minutter og synlig kroppslig skade i form av dypt sår, stor hevelse eller beinbrudd.

NAVN: **FØDT:**

REGISTRERINGSSKJEMA FOR SUICIDALATFERD / SELVSKADE (RESUS)

KJØNN: PASIENTNR: LØPENR DATO KL

SITUASJON SOM GIKK FORUT FOR DEN AGGRESSIVE ATFERDEN	TRUSSEL OM SUICID	LETTERE/ MODERAT SUICIDAL FORSØK	ALVORLIG SUICIDAL FORSØK	TRUSSEL OM SELVSKADE	LETTERE/ MODERAT SELVSKADE	ALVORLIG SELVSKADE
A. FYSISK KONTAKT 5. Fra pasient til kjente personer 6. Fra pasient til ukjente personer 7. Til pasient fra kjente personer 8. Til pasient fra ukjente personer						
B. GRENSESETTING 7. Avslag på ønsker / forespørsler 8. Avvisning / fikk ikke oppmerksomhet nok 9. Grensesetting / korrigering 10.Press på pasient om å utføre praktiske handlinger 11.Manglende struktur / grenser 12.Omgivelsene viste usikkerhet / redsel						
C. KOMMUNIKASJONSPROBLEM 4. Pasienten forsto ikke det som ble formidlet 5. Pasienten ble ikke forstått 6. Pasienten virket styrt av befalende stemmer o.l.						
D. OMSTILLINGER 7. Fast personal sluttet / ble permittert / dro på ferie o.s.v. 8. Andre nære personer «trakk seg unna» pasienten 9. Pasienten kom fra perm, tur e.l. 10.Skremmende ytre begivenheter (formidlet via massemedia, eller selvopplevde ulykker) 11.Uro i avdelingen 12.Komplikasjoner i forhold til familie						
E. PERSONER 7. Ukjent betjening / vikarer 8. Kontakt med visse personer (medpasienter, venner, slektninger) 9. Kontakt med barn 10.Kontakt med eldre / uføre / fysisk «hjelpeløse» 11.Enekontakt med kvinner 12.Enekontakt med menn						
F. RISIKO - KONTAKT 3. Umiddelbar nærhet av farlige gjenstander (glass, kniv, våpen) 4. Trafikkerte områder (bil, buss, tog o.l.)						
G. STOFF 4. Rus av et eller annet slag 5. Uten røyk 6. Annen stoff-abstinens						
H. TILLEGGSOMRÅDER						

SKALA FOR ALVORLIGHETSGRAD:

Sett en ring rundt tallet som angir hvor alvorlig du opplevde hendelsen:

IKKE ALVORLIG 0 1 2 3 4 5 6 7 8 9 10 SVÆRT ALVORLIG

Utfylt av: **Dato:**

Retningslinjer for utfylling av SUICIDALATFERD / SELVSKADE - RESU

Generelt:
Bruk ett skjema per pasient per hendelse. Men om flere hendelser innen 30 minutter settes kun flere streker på samme skjemaet (se forklaring nedenfor).
Det personalet som har observert eller opplevd aggresjonsepisoden fyller ut skjemaet, helst så tidlig som mulig etter episoden.
Diskuter med annet personal, be om råd eller veiledning ved utfyllingen.
Ta kontakt med avdelingssjukepleier/prosjektkoordinator om du har spørsmål om utfylling av skjemaet.

Framgangsmåte ved utfylling av skjemaet:

Fyll inn pasientens navn, fødselsdato, kjønn, pasientnummer. og løpenummer.
Fyll inn datoen for suicidal/selvskadingsepisoden, samt klokkeslettet

Finn først ut hva slags suicidal /selvskadetypetype dette dreier seg om (Dette finner du ved å se på den øverste horisontale raden).

Finn deretter ut hva slags situasjon som utløste eller gikk forut for suicidal/selvskadingsepisoden (fysisk kontakt, grensesetting, kommunikasjonsproblemer, etc). Dette finner du ved å se på kolonnen lengst til venstre på skjemaet.

I den kolonnen (boksen) du har valgt fyller du inn hvem som ble vitne til den aktuelle episoden, med bruk av kodene; **M** = Medpasient. **PM** = Mannlig personale. **PK** = Kvinnelig personale. **F** = Familie/pårørende. **V** = Venner. **X** = Ukjent
Fyll gjerne inn situasjonskode også, for eksempel B3 (Grensesetting/korrigering).

Om det er flere aktuelle foranledninger kan man registrere i flere bokser, for eksempel både for ”kommunikasjonsproblem” og ”personer”.

Hvis pasienten utagerer flere ganger etter hverandre innen kort tid (innen 30 minutter) kan en markere antall episoder ved å sette inn en strek for hver (for eksempel: M I I I). Bruk nytt skjema om pasienten fortsetter utover 30 minutter.

Definisjoner:

SUICIDAL- eller SELVSKADE TRUSSEL:
Den verbale eller fysiske trusselen er fremsatt overfor en / flere personer som fysisk sett er tilgjengelig i situasjonen.
Innebærer verbale utsagn om å ta sitt eget liv eller skade seg selv, eller fysiske bevegelser og truende kroppsholdning som gir et klart bilde av et nært forestående suicidalforsøk eller selvskading.

LETTERE / MODERAT SUICIDALFORSØK:
Innebærer forsøk hvor intensjonen om å ta eget liv var usikker, eller forsøket var ”et rop om hjelp”, *og* hvor forsøket viste seg å være relativt ufarlig.

LETTERE / MODERAT SELVSKADE:
Innebærer mindre alvorlige former for selvskade som f.eks. risping og mindre kutt som ikke trenger å sys, samt andre former for selvskade (f.eks. mindre alvorlig brenning) som ikke er potensielt livstruende eller kan gjøre større fysisk skade.

ALVORLIG SUICIDALFORSØK:
Klar intensjon om å ta eget liv, eller forsøk hvor risikoen for å dø var stor, eller gjennomført suicid.

ALVORLIG SELVSKADE:
Innebærer alvorlige former for selvskade, som f.eks. dype kutt som må sys, svelging av gjenstander med påfølgende operative inngrep for behandling, alvorlige brenne og etseskader, samt alvorlige kvelningsforsøk

Dissertations at the Faculty of Medicine, NTNU

1977

1. Knut Joachim Berg: EFFECT OF ACETYLSALICYLIC ACID ON RENAL FUNCTION
2. Karl Erik Viken and Arne Ødegaard: STUDIES ON HUMAN MONOCYTES CULTURED *IN VITRO*

1978

3. Karel Bjørn Cyvin: CONGENITAL DISLOCATION OF THE HIP JOINT.
4. Alf O. Brubakk: METHODS FOR STUDYING FLOW DYNAMICS IN THE LEFT VENTRICLE AND THE AORTA IN MAN.

1979

5. Geirmund Unsgaard: CYTOSTATIC AND IMMUNOREGULATORY ABILITIES OF HUMAN BLOOD MONOCYTES CULTURED IN VITRO

1980

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1981

8. Jens Hammerstrøm: CYTOSTATIC AND CYTOLYTIC ACTIVITY OF HUMAN MONOCYTES AND EFFUSION MACROPHAGES AGAINST TUMOR CELLS *IN VITRO*

1983

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1984

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1985

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73. Svein Anda: EVALUATION OF THE HIP JOINT BY COMPUTED TOMOGRAMPHY AND ULTRASONOGRAPHY.

1992

74. Martin Svartberg: AN INVESTIGATION OF PROCESS AND OUTCOME OF SHORT-TERM PSYCHODYNAMIC PSYCHOTHERAPY.
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84. Bjørn Naume: IMMUNOREGULATORY EFFECTS OF CYTOKINES ON NK CELLS.
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87. Piotr Kruszewski: SUNCT SYNDROME WITH SPECIAL REFERENCE TO THE AUTONOMIC NERVOUS SYSTEM.
88. Mette Haase Moen: ENDOMETRIOSIS.
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90. Lars Jacob Stovner: THE CHIARI TYPE I MALFORMATION.
91. Kjell Å. Salvesen: ROUTINE ULTRASONOGRAPHY IN UTERO AND DEVELOPMENT IN CHILDHOOD.

1994

92. Nina-Beate Liabakk: DEVELOPMENT OF IMMUNOASSAYS FOR TNF AND ITS SOLUBLE RECEPTORS.
93. Sverre Helge Torp: *erb*B ONCOGENES IN HUMAN GLIOMAS AND MENINGIOMAS.
94. Olav M. Linaker: MENTAL RETARDATION AND PSYCHIATRY. Past and present.
95. Per Oscar Feet: INCREASED ANTIDEPRESSANT AND ANTIPANIC EFFECT IN COMBINED TREATMENT WITH DIXYRAZINE AND TRICYCLIC ANTIDEPRESSANTS.
96. Stein Olav Samstad: CROSS SECTIONAL FLOW VELOCITY PROFILES FROM TWO-DIMENSIONAL DOPPLER ULTRASOUND: Studies on early mitral blood flow.
97. Bjørn Backe: STUDIES IN ANTENATAL CARE.
98. Gerd Inger Ringdal: QUALITY OF LIFE IN CANCER PATIENTS.
99. Torvid Kiserud: THE DUCTUS VENOSUS IN THE HUMAN FETUS.
100. Hans E. Fjøsne: HORMONAL REGULATION OF PROSTATIC METABOLISM.
101. Eylert Brodtkorb: CLINICAL ASPECTS OF EPILEPSY IN THE MENTALLY RETARDED.

102. Roar Juul: PEPTIDERGIC MECHANISMS IN HUMAN SUBARACHNOID HEMORRHAGE.
103. Unni Syversen: CHROMOGRANIN A. Phsysiological and Clinical Role.

1995

104. Odd Gunnar Brakstad: THERMOSTABLE NUCLEASE AND THE *nuc* GENE IN THE DIAGNOSIS OF *Staphylococcus aureus* INFECTIONS.
105. Terje Engan: NUCLEAR MAGNETIC RESONANCE (NMR) SPECTROSCOPY OF PLASMA IN MALIGNANT DISEASE.
106. Kirsten Rasmussen: VIOLENCE IN THE MENTALLY DISORDERED.
107. Finn Egil Skjeldestad: INDUCED ABORTION: Timetrends and Determinants.
108. Roar Stenseth: THORACIC EPIDURAL ANALGESIA IN AORTOCORONARY BYPASS SURGERY.
109. Arild Faxvaag: STUDIES OF IMMUNE CELL FUNCTION *in mice infected with* MURINE RETROVIRUS.

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110. Svend Aakhus: NONINVASIVE COMPUTERIZED ASSESSMENT OF LEFT VENTRICULAR FUNCTION AND SYSTEMIC ARTERIAL PROPERTIES. Methodology and some clinical applications.
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112. Petter Aadahl: CARDIOVASCULAR EFFECTS OF THORACIC AORTIC CROSS-CLAMPING.
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116. Torbjørn Grøntvedt: TREATMENT OF ACUTE AND CHRONIC ANTERIOR CRUCIATE LIGAMENT INJURIES. A clinical and biomechanical study.
117. Sigrid Hørven Wigers: CLINICAL STUDIES OF FIBROMYALGIA WITH FOCUS ON ETIOLOGY, TREATMENT AND OUTCOME.
118. Jan Schjøtt: MYOCARDIAL PROTECTION: Functional and Metabolic Characteristics of Two Endogenous Protective Principles.
119. Marit Martinussen: STUDIES OF INTESTINAL BLOOD FLOW AND ITS RELATION TO TRANSITIONAL CIRCULATORY ADAPATION IN NEWBORN INFANTS.
120. Tomm B. Müller: MAGNETIC RESONANCE IMAGING IN FOCAL CEREBRAL ISCHEMIA.
121. Rune Haaverstad: OEDEMA FORMATION OF THE LOWER EXTREMITIES.
122. Magne Børset: THE ROLE OF CYTOKINES IN MULTIPLE MYELOMA, WITH SPECIAL REFERENCE TO HEPATOCYTE GROWTH FACTOR.
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124. Torstein Vik: GROWTH, MORBIDITY, AND PSYCHOMOTOR DEVELOPMENT IN INFANTS WHO WERE GROWTH RETARDED *IN UTERO*.
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126. Jon S. Skranes: CEREBRAL MRI AND NEURODEVELOPMENTAL OUTCOME IN VERY LOW BIRTH WEIGHT (VLBW) CHILDREN. A follow-up study of a geographically based year cohort of VLBW children at ages one and six years.
127. Knut Bjørnstad: COMPUTERIZED ECHOCARDIOGRAPHY FOR EVALUTION OF CORONARY ARTERY DISEASE.
128. Grethe Elisabeth Borchgrevink: DIAGNOSIS AND TREATMENT OF WHIPLASH/NECK SPRAIN INJURIES CAUSED BY CAR ACCIDENTS.
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130. Rolf W. Gråwe: EPIDEMIOLOGICAL AND NEUROPSYCHOLOGICAL PERSPECTIVES ON SCHIZOPHRENIA.
131. Tonje Strømholm: CEREBRAL HAEMODYNAMICS DURING THORACIC AORTIC CROSSCLAMPING. An experimental study in pigs.

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132. Martinus Bråten: STUDIES ON SOME PROBLEMS REALTED TO INTRAMEDULLARY NAILING OF FEMORAL FRACTURES.
133. Ståle Nordgård: PROLIFERATIVE ACTIVITY AND DNA CONTENT AS PROGNOSTIC INDICATORS IN ADENOID CYSTIC CARCINOMA OF THE HEAD AND NECK.
134. Egil Lien: SOLUBLE RECEPTORS FOR **TNF** AND **LPS**: RELEASE PATTERN AND POSSIBLE SIGNIFICANCE IN DISEASE.
135. Marit Bjørgaas: HYPOGLYCAEMIA IN CHILDREN WITH DIABETES MELLITUS
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137. Juan A. Pareja: SUNCT SYNDROME. ON THE CLINICAL PICTURE. ITS DISTINCTION FROM OTHER, SIMILAR HEADACHES.
138. Anders Angelsen: NEUROENDOCRINE CELLS IN HUMAN PROSTATIC CARCINOMAS AND THE PROSTATIC COMPLEX OF RAT, GUINEA PIG, CAT AND DOG.
139. Fabio Antonaci: CHRONIC PAROXYSMAL HEMICRANIA AND HEMICRANIA CONTINUA: TWO DIFFERENT ENTITIES?
140. Sven M. Carlsen: ENDOCRINE AND METABOLIC EFFECTS OF METFORMIN WITH SPECIAL EMPHASIS ON CARDIOVASCULAR RISK FACTORES.

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141. Terje A. Murberg: DEPRESSIVE SYMPTOMS AND COPING AMONG PATIENTS WITH CONGESTIVE HEART FAILURE.
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143. Noèmi Becser Andersen:THE CEPHALIC SENSORY NERVES IN UNILATERAL HEADACHES. Anatomical background and neurophysiological evaluation.
144. Eli-Janne Fiskerstrand: LASER TREATMENT OF PORT WINE STAINS. A study of the efficacy and limitations of the pulsed dye laser. Clinical and morfological analyses aimed at improving the therapeutic outcome.
145. Bård Kulseng: A STUDY OF ALGINATE CAPSULE PROPERTIES AND CYTOKINES IN RELATION TO INSULIN DEPENDENT DIABETES MELLITUS.
146. Terje Haug: STRUCTURE AND REGULATION OF THE HUMAN UNG GENE ENCODING URACIL-DNA GLYCOSYLASE.
147. Heidi Brurok: MANGANESE AND THE HEART. A Magic Metal with Diagnostic and Therapeutic Possibilites.
148. Agnes Kathrine Lie: DIAGNOSIS AND PREVALENCE OF HUMAN PAPILLOMAVIRUS INFECTION IN CERVICAL INTRAEPITELIAL NEOPLASIA. Relationship to Cell Cycle Regulatory Proteins and HLA DQBI Genes.
149. Ronald Mårvik: PHARMACOLOGICAL, PHYSIOLOGICAL AND PATHOPHYSIOLOGICAL STUDIES ON ISOLATED STOMACS.
150. Ketil Jarl Holen: THE ROLE OF ULTRASONOGRAPHY IN THE DIAGNOSIS AND TREATMENT OF HIP DYSPLASIA IN NEWBORNS.
151. Irene Hetlevik: THE ROLE OF CLINICAL GUIDELINES IN CARDIOVASCULAR RISK INTERVENTION IN GENERAL PRACTICE.
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154. Arild Aamodt: DEVELOPMENT AND PRE-CLINICAL EVALUATION OF A CUSTOM-MADE FEMORAL STEM.
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157. Jolanta Vanagaite Vingen: PHOTOPHOBIA AND PHONOPHOBIA IN PRIMARY HEADACHES

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158. Ola Dalsegg Sæther: PATHOPHYSIOLOGY DURING PROXIMAL AORTIC CROSS-CLAMPING CLINICAL AND EXPERIMENTAL STUDIES
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160. Christina Vogt Isaksen: PRENATAL ULTRASOUND AND POSTMORTEM FINDINGS – A TEN YEAR CORRELATIVE STUDY OF FETUSES AND INFANTS WITH DEVELOPMENTAL ANOMALIES.

161. Holger Seidel: HIGH-DOSE METHOTREXATE THERAPY IN CHILDREN WITH ACUTE LYMPHOCYTIC LEUKEMIA: DOSE, CONCENTRATION, AND EFFECT CONSIDERATIONS.
162. Stein Hallan: IMPLEMENTATION OF MODERN MEDICAL DECISION ANALYSIS INTO CLINICAL DIAGNOSIS AND TREATMENT.
163. Malcolm Sue-Chu: INVASIVE AND NON-INVASIVE STUDIES IN CROSS-COUNTRY SKIERS WITH ASTHMA-LIKE SYMPTOMS.
164. Ole-Lars Brekke: EFFECTS OF ANTIOXIDANTS AND FATTY ACIDS ON TUMOR NECROSIS FACTOR-INDUCED CYTOTOXICITY.
165. Jan Lundbom: AORTOCORONARY BYPASS SURGERY: CLINICAL ASPECTS, COST CONSIDERATIONS AND WORKING ABILITY.
166. John-Anker Zwart: LUMBAR NERVE ROOT COMPRESSION, BIOCHEMICAL AND NEUROPHYSIOLOGICAL ASPECTS.
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169. Dalius Bansevicius: SHOULDER-NECK REGION IN CERTAIN HEADACHES AND CHRONIC PAIN SYNDROMES.
170. Bettina Kinge: REFRACTIVE ERRORS AND BIOMETRIC CHANGES AMONG UNIVERSITY STUDENTS IN NORWAY.
171. Gunnar Qvigstad: CONSEQUENCES OF HYPERGASTRINEMIA IN MAN
172. Hanne Ellekjær: EPIDEMIOLOGICAL STUDIES OF STROKE IN A NORWEGIAN POPULATION. INCIDENCE, RISK FACTORS AND PROGNOSIS
173. Hilde Grimstad: VIOLENCE AGAINST WOMEN AND PREGNANCY OUTCOME.
174. Astrid Hjelde: SURFACE TENSION AND COMPLEMENT ACTIVATION: Factors influencing bubble formation and bubble effects after decompression.
175. Kjell A. Kvistad: MR IN BREAST CANCER – A CLINICAL STUDY.
176. Ivar Rossvoll: ELECTIVE ORTHOPAEDIC SURGERY IN A DEFINED POPULATION. Studies on demand, waiting time for treatment and incapacity for work.
177. Carina Seidel: PROGNOSTIC VALUE AND BIOLOGICAL EFFECTS OF HEPATOCYTE GROWTH FACTOR AND SYNDECAN-1 IN MULTIPLE MYELOMA.

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178. Alexander Wahba: THE INFLUENCE OF CARDIOPULMONARY BYPASS ON PLATELET FUNCTION AND BLOOD COAGULATION – DETERMINANTS AND CLINICAL CONSEQUENSES
179. Marcus Schmitt-Egenolf: THE RELEVANCE OF THE MAJOR hISTOCOMPATIBILITY COMPLEX FOR THE GENETICS OF PSORIASIS
180. Odrun Arna Gederaas: BIOLOGICAL MECHANISMS INVOLVED IN 5-AMINOLEVULINIC ACID BASED PHOTODYNAMIC THERAPY
181. Pål Richard Romundstad: CANCER INCIDENCE AMONG NORWEGIAN ALUMINIUM WORKERS
182. Henrik Hjorth-Hansen: NOVEL CYTOKINES IN GROWTH CONTROL AND BONE DISEASE OF MULTIPLE MYELOMA
183. Gunnar Morken: SEASONAL VARIATION OF HUMAN MOOD AND BEHAVIOUR
184. Bjørn Olav Haugen: MEASUREMENT OF CARDIAC OUTPUT AND STUDIES OF VELOCITY PROFILES IN AORTIC AND MITRAL FLOW USING TWO- AND THREE-DIMENSIONAL COLOUR FLOW IMAGING
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186. Knut Ivar Aasarød: RENAL INVOLVEMENT IN INFLAMMATORY RHEUMATIC DISEASE. A Study of Renal Disease in Wegener's Granulomatosis and in Primary Sjögren's Syndrome
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188. Bodil Kavli: HUMAN URACIL-DNA GLYCOSYLASES FROM THE UNG GENE: STRUCTRUAL BASIS FOR SUBSTRATE SPECIFICITY AND REPAIR
189. Liv Thommesen: MOLECULAR MECHANISMS INVOLVED IN TNF- AND GASTRIN-MEDIATED GENE REGULATION
190. Turid Lingaas Holmen: SMOKING AND HEALTH IN ADOLESCENCE; THE NORD-TRØNDELAG HEALTH STUDY, 1995-97

191. Øyvind Hjertner: MULTIPLE MYELOMA: INTERACTIONS BETWEEN MALIGNANT PLASMA CELLS AND THE BONE MICROENVIRONMENT
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193. Kristian Midthjell: DIABETES IN ADULTS IN NORD-TRØNDELAG. PUBLIC HEALTH ASPECTS OF DIABETES MELLITUS IN A LARGE, NON-SELECTED NORWEGIAN POPULATION.
194. Guanglin Cui: FUNCTIONAL ASPECTS OF THE ECL CELL IN RODENTS
195. Ulrik Wisløff: CARDIAC EFFECTS OF AEROBIC ENDURANCE TRAINING: HYPERTROPHY, CONTRACTILITY AND CALCUIM HANDLING IN NORMAL AND FAILING HEART
196. Øyvind Halaas: MECHANISMS OF IMMUNOMODULATION AND CELL-MEDIATED CYTOTOXICITY INDUCED BY BACTERIAL PRODUCTS
197. Tore Amundsen: PERFUSION MR IMAGING IN THE DIAGNOSIS OF PULMONARY EMBOLISM
198. Nanna Kurtze: THE SIGNIFICANCE OF ANXIETY AND DEPRESSION IN FATIQUE AND PATTERNS OF PAIN AMONG INDIVIDUALS DIAGNOSED WITH FIBROMYALGIA: RELATIONS WITH QUALITY OF LIFE, FUNCTIONAL DISABILITY, LIFESTYLE, EMPLOYMENT STATUS, CO-MORBIDITY AND GENDER
199. Tom Ivar Lund Nilsen: PROSPECTIVE STUDIES OF CANCER RISK IN NORD-TRØNDELAG: THE HUNT STUDY. Associations with anthropometric, socioeconomic, and lifestyle risk factors
200. Asta Kristine Håberg: A NEW APPROACH TO THE STUDY OF MIDDLE CEREBRAL ARTERY OCCLUSION IN THE RAT USING MAGNETIC RESONANCE TECHNIQUES

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202. Henrik Døllner: INFLAMMATORY MEDIATORS IN PERINATAL INFECTIONS
203. Asta Bye: LOW FAT, LOW LACTOSE DIET USED AS PROPHYLACTIC TREATMENT OF ACUTE INTESTINAL REACTIONS DURING PELVIC RADIOTHERAPY. A PROSPECTIVE RANDOMISED STUDY.
204. Sylvester Moyo: STUDIES ON STREPTOCOCCUS AGALACTIAE (GROUP B STREPTOCOCCUS) SURFACE-ANCHORED MARKERS WITH EMPHASIS ON STRAINS AND HUMAN SERA FROM ZIMBABWE.
205. Knut Hagen: HEAD-HUNT: THE EPIDEMIOLOGY OF HEADACHE IN NORD-TRØNDELAG
206. Li Lixin: ON THE REGULATION AND ROLE OF UNCOUPLING PROTEIN-2 IN INSULIN PRODUCING ß-CELLS
207. Anne Hildur Henriksen: SYMPTOMS OF ALLERGY AND ASTHMA VERSUS MARKERS OF LOWER AIRWAY INFLAMMATION AMONG ADOLESCENTS
208. Egil Andreas Fors: NON-MALIGNANT PAIN IN RELATION TO PSYCHOLOGICAL AND ENVIRONTENTAL FACTORS. EXPERIENTAL AND CLINICAL STUDES OF PAIN WITH FOCUS ON FIBROMYALGIA
209. Pål Klepstad: MORPHINE FOR CANCER PAIN
210. Ingunn Bakke: MECHANISMS AND CONSEQUENCES OF PEROXISOME PROLIFERATOR-INDUCED HYPERFUNCTION OF THE RAT GASTRIN PRODUCING CELL
211. Ingrid Susann Gribbestad: MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY OF BREAST CANCER
212. Rønnaug Astri Ødegård: PREECLAMPSIA – MATERNAL RISK FACTORS AND FETAL GROWTH
213. Johan Haux: STUDIES ON CYTOTOXICITY INDUCED BY HUMAN NATURAL KILLER CELLS AND DIGITOXIN
214. Turid Suzanne Berg-Nielsen: PARENTING PRACTICES AND MENTALLY DISORDERED ADOLESCENTS
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216. Jan Pål Loennechen: HEART FAILURE AFTER MYOCARDIAL INFARCTION. Regional Differences, Myocyte Function, Gene Expression, and Response to Cariporide, Losartan, and Exercise Training.
217. Elisabeth Qvigstad: EFFECTS OF FATTY ACIDS AND OVER-STIMULATION ON INSULIN SECRETION IN MAN
218. Arne Åsberg: EPIDEMIOLOGICAL STUDIES IN HEREDITARY HEMOCHROMATOSIS: PREVALENCE, MORBIDITY AND BENEFIT OF SCREENING.
219. Johan Fredrik Skomsvoll: REPRODUCTIVE OUTCOME IN WOMEN WITH RHEUMATIC DISEASE. A population registry based study of the effects of inflammatory rheumatic disease and connective tissue disease on reproductive outcome in Norwegian women in 1967-1995.
220. Siv Mørkved: URINARY INCONTINENCE DURING PREGNANCY AND AFTER DELIVERY: EFFECT OF PELVIC FLOOR MUSCLE TRAINING IN PREVENTION AND TREATMENT
221. Marit S. Jordhøy: THE IMPACT OF COMPREHENSIVE PALLIATIVE CARE
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225. Torunn Bruland: STUDIES OF EARLY RETROVIRUS-HOST INTERACTIONS – VIRAL DETERMINANTS FOR PATHOGENESIS AND THE INFLUENCE OF SEX ON THE SUSCEPTIBILITY TO FRIEND MURINE LEUKAEMIA VIRUS INFECTION
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229. Solfrid Romundstad: EPIDEMIOLOGICAL STUDIES OF MICROALBUMINURIA. THE NORD-TRØNDELAG HEALTH STUDY 1995-97 (HUNT 2)
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239. Steinar Krokstad: SOCIOECONOMIC INEQUALITIES IN HEALTH AND DISABILITY. SOCIAL EPIDEMIOLOGY IN THE NORD-TRØNDELAG HEALTH STUDY (HUNT), NORWAY
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243. Per Arne Aas: MACROMOLECULAR MAINTENANCE IN HUMAN CELLS – REPAIR OF URACIL IN DNA AND METHYLATIONS IN DNA AND RNA
244. Anna Bofin: FINE NEEDLE ASPIRATION CYTOLOGY IN THE PRIMARY INVESTIGATION OF BREAST TUMOURS AND IN THE DETERMINATION OF TREATMENT STRATEGIES
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246. Reidar Fossmark: GASTRIC CANCER IN JAPANESE COTTON RATS
247. Wibeke Nordhøy: MANGANESE AND THE HEART, INTRACELLULAR MR RELAXATION AND WATER EXCHANGE ACROSS THE CARDIAC CELL MEMBRANE

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250. Ragnhild Støen: ENDOTHELIUM-DEPENDENT VASODILATION IN THE FEMORAL ARTERY OF DEVELOPING PIGLETS
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254. Viggo Pettersen: FROM MUSCLES TO SINGING: THE ACTIVITY OF ACCESSORY BREATHING MUSCLES AND THORAX MOVEMENT IN CLASSICAL SINGING
255. Marianne Fyhn: SPATIAL MAPS IN THE HIPPOCAMPUS AND ENTORHINAL CORTEX
256. Robert Valderhaug: OBSESSIVE-COMPULSIVE DISORDER AMONG CHILDREN AND ADOLESCENTS: CHARACTERISTICS AND PSYCHOLOGICAL MANAGEMENT OF PATIENTS IN OUTPATIENT PSYCHIATRIC CLINICS
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267. Kirsti Berg: OXIDATIVE STRESS AND THE ISCHEMIC HEART: A STUDY IN PATIENTS UNDERGOING CORONARY REVASCULARIZATION
268. Björn Inge Gustafsson: THE SEROTONIN PRODUCING ENTEROCHROMAFFIN CELL, AND EFFECTS OF HYPERSEROTONINEMIA ON HEART AND BONE

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269. Torstein Baade Rø: EFFECTS OF BONE MORPHOGENETIC PROTEINS, HEPATOCYTE GROWTH FACTOR AND INTERLEUKIN-21 IN MULTIPLE MYELOMA
270. May-Britt Tessem: METABOLIC EFFECTS OF ULTRAVIOLET RADIATION ON THE ANTERIOR PART OF THE EYE

271. Anne-Sofie Helvik: COPING AND EVERYDAY LIFE IN A POPULATION OF ADULTS WITH HEARING IMPAIRMENT
272. Therese Standal: MULTIPLE MYELOMA: THE INTERPLAY BETWEEN MALIGNANT PLASMA CELLS AND THE BONE MARROW MICROENVIRONMENT
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274. Birger Henning Endreseth: STRATEGIES IN RECTAL CANCER TREATMENT – FOCUS ON EARLY RECTAL CANCER AND THE INFLUENCE OF AGE ON PROGNOSIS
275. Anne Mari Aukan Rokstad: ALGINATE CAPSULES AS BIOREACTORS FOR CELL THERAPY
276. Mansour Akbari: HUMAN BASE EXCISION REPAIR FOR PRESERVATION OF GENOMIC STABILITY
277. Stein Sundstrøm: IMPROVING TREATMENT IN PATIENTS WITH LUNG CANCER – RESULTS FROM TWO MULITCENTRE RANDOMISED STUDIES
278. Hilde Pleym: BLEEDING AFTER CORONARY ARTERY BYPASS SURGERY - STUDIES ON HEMOSTATIC MECHANISMS, PROPHYLACTIC DRUG TREATMENT AND EFFECTS OF AUTOTRANSFUSION
279. Line Merethe Oldervoll: PHYSICAL ACTIVITY AND EXERCISE INTERVENTIONS IN CANCER PATIENTS
280. Boye Welde: THE SIGNIFICANCE OF ENDURANCE TRAINING, RESISTANCE TRAINING AND MOTIVATIONAL STYLES IN ATHLETIC PERFORMANCE AMONG ELITE JUNIOR CROSS-COUNTRY SKIERS
281. Per Olav Vandvik: IRRITABLE BOWEL SYNDROME IN NORWAY, STUDIES OF PREVALENCE, DIAGNOSIS AND CHARACTERISTICS IN GENERAL PRACTICE AND IN THE POPULATION
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284. Eva Tegnander: DETECTION OF CONGENITAL HEART DEFECTS IN A NON-SELECTED POPULATION OF 42,381 FETUSES
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286. Per Magnus Haram: GENETIC VS. AQUIRED FITNESS: METABOLIC, VASCULAR AND CARDIOMYOCYTE ADAPTATIONS
287. Agneta Johansson: GENERAL RISK FACTORS FOR GAMBLING PROBLEMS AND THE PREVALENCE OF PATHOLOGICAL GAMBLING IN NORWAY
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289. Charlotte Björk Ingul: QUANITIFICATION OF REGIONAL MYOCARDIAL FUNCTION BY STRAIN RATE AND STRAIN FOR EVALUATION OF CORONARY ARTERY DISEASE. AUTOMATED VERSUS MANUAL ANALYSIS DURING ACUTE MYOCARDIAL INFARCTION AND DOBUTAMINE STRESS ECHOCARDIOGRAPHY
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