Mental disorder and violence in the mental health and the correctional system:

different services with overlapping challenges?

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Table of contents

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Abbreviations

Nearly all the used abbreviations are explained in the text when they are introduced, and repetitions of them generally follow on the same or adjacent pages. Some few will however be listed alphabetically here:

AUC	Area Under the Curve
BVC	Brøset Violence Checklist
HCR-20	Historical, Clinical and Risk management, 20 items
NPV	Negative Predictive Value
PCL	Psychopathy Checklist
PPV	Positive Predictive Value
REFA	Report Form for Aggressive Episodes
ROC	Receiver Operating Characteristics
SOAS-R	Staff Observation Aggression Scale – Revised
WAS	Ward Atmosphere Scale

1 Overview

1.1 Summary

Even though the correctional and the mental health system have been separate entities throughout the last centuries, they both deal with the deposition of aberrant behaviour. The most serious type of such behaviour is interpersonal violence, which may lead to prison incarceration or to involuntary admission in mental institutions. The type and quantity of this violence has been incompletely charted and needs further exploration. Considerable occurrence of mental disorders in prisons has been estimated, but new studies are called for. The interface between populations from bed-based institutions in the two services has been studied in this thesis. However, this has been accomplished by conducting separate studies and not by using a direct comparative design at the same time in the two services. Violence risk assessment inventories have existed for some time in forensic psychiatry. These have typically been far too time-consuming for use in general psychiatric care with its large numbers of patients, and a new, user-friendly screening instrument has been developed and validated in some of the presented studies. The topics of this thesis are clustered in the following main questions:

Is there a significant correlation between crime rate and correctional and mental health beds in a modern welfare society?

In the late 1930s, the British psychiatrist Lionel Penrose published a classic study, covering most European countries, in which he demonstrated an inverse numerical relationship between prison and mental hospital beds. This cross-sectional study found that low numbers of mental hospital beds were paralleled by high numbers of prison beds and vice versa across all the countries. Penrose concluded that provision of more mental health beds would have a preventive effect on serious violent crime. However, a replicated study is needed to determine whether the results are valid in a modern welfare society. Since the late 1960s there has been a definite and well acknowledged mental deinstitutionalisation in Norway as in other Western countries. This has made possible a longitudinal study to evaluate whether this mental health deinstitutionalisation has been paralleled by changes in correctional institutions and violent crime rates. This issue is addressed in Paper I.

Paper I presents a study of the numerical relationship between mental health and prison beds, especially the changes of this relationship in Norway during the last forty years. The method was a register study that involved an extensive search in official statistics.

Results were: A longitudinal inverse relationship with a definite decrease (74%) in mental health beds and a parallel increase (52%) in prison beds was found. The study further showed a significant numerical relationship between mental health deinstitutionalisation and a rise in population-adjusted criminality. The strongest rise was found for violent crimes (900%).

Conclusion:
The results show an inverse relationship between prison and mental health inmate populations, longitudinally, through the last half century in Norway. Deinstitutionalisation in mental health services was a main feature in all Western societies in the same period. This was accompanied by a parallel increase in prison beds. The increase in crime rates could only partly be explained as simply being the result of transference of one type of inmates from the one system to the other; rather, the explanation lies mainly in complex sociological mechanisms. Still, relatedness and reciprocity between the correctional and mental health system were confirmed in this study.

What is the prevalence of mental symptom disorders among prison inmates in a welfare society like Norway?
Symptom disorders and especially some specific psychotic symptoms, both independently and coupled with co-existing risk factors, are acknowledged as risk factors for interpersonal violence. The prevalence of mental disorders in prisons around the world has been subjected to studies for many years. However, a great majority of the investigations were conducted in a single prison. A study from New Zealand is the only published research of a survey of symptom disorders that was nationwide. Because studies from one nation are not necessarily representative of another, a nationwide Norwegian prevalence investigation would be important to have. Such a study might illustrate one possible effect of mental deinstitutionalisation, that is, does keeping mentally disordered inmates in prisons hide a need for treatment capacity in the mental health system? It might also be relevant to assist a proper development of the prison mental health services and to obtain a better picture of the need of violence risk assessment in the correctional system. These issues are addressed in Paper II.

Paper II presents a study aimed at calculating both somatic and mental symptom disorder prevalence in the nationwide Norwegian prison population. The main method was an indirect cross-sectional design: Rates of symptom disorders were estimated by inference from

6

medical records of every inmate's prescribed medication. Only mental disorders are addressed in this thesis.

The following were the results regarding symptom disorders. Thirty-five percent of the inmates received psychotropic medication, in doses clearly indicating a manifest symptom disorder. Of these, close to 4% were assessed to suffer from a psychotic disorder, 11% from a major depression and 11%, from additional sleep disorders. The prevalence of psychotic disorders was 300% higher, and major depression was 50% higher than in the general population.

Conclusion:

Results indicate that a substantial number of persons with severe mental disorders are accommodated in prisons. It is hypothesized that the volume of this morbidity may be partly related to the general process of mental health deinstitutionalisation. Comparison with international studies suggests that our findings probably show a representative national prevalence estimate of symptom disorders in Norwegian prisons.

3. Is it possible to develop a brief, reliable and valid instrument for screening of violence risk?

Violence is an offence with severe consequences for victims, and it has been documented to be a prevalent pre-sentence crime committed by inmates in Norwegian prisons. Interpersonal violence is a serious concern to both inpatient and outpatient general psychiatric care, too. This makes risk assessment and management of violence important issues in the two systems and in the interface between them.

The number of actuarial and structured clinical violence risk assessment methods has increased substantially in research and practice during the last two decades, primarily in forensic psychiatry. Most of the instruments and checklists in use up to now have been too time-consuming for routine use in acute psychiatric care. Hence there has been a need for a brief screening checklist with good psychometric properties, both for in- and outpatient use in the psychiatric system and probably also in the correctional system.

The development of such an instrument will require a multi-step process. The first four steps have been accomplished and are described below.

Step 1:

To test the predictive validity of a 33-item screen and to select the lowest optimal number of items to construct a brief screen with good psychometric properties (Paper III).

Paper III presents a study with one main aim: to begin the development of a screening instrument for violence risk assessment among acute psychiatric patients. Methods were: A preliminary validation of a 33-item assessment instrument (Ps33) was conducted. Ps33 risk assessments at discharge from an acute psychiatric department were compared to recorded violence during a one-year follow-up. Data were analysed by uni- and multivariate logistic regression with the aim of possible item reduction. Results showed a base rate of violence of 26% and indicated that the Ps33 had good predictive validity; AUC (Area Under the Curve) = 0.71. After item reduction, briefer versions of the Ps33 showed even better predictive validity: ROC (Receiver Operating Characteristics; AUC up to 0.77.

Conclusion:

The base rate of violent acting out within one year after discharge was 26%, with a slight overweight of men involved. The Ps33 had a satisfactory predictive validity, but shorter versions seemed to function even better. These findings were used to construct a 10-item checklist for screening purposes, the V-RISK-10.

Step 2:

To test the predictive validity of the V-RISK-10 for patients in an inpatient setting (Paper IV).

Paper IV reports on a study with the main aim being related to the one in Paper III: to test the predictive validity of the V-RISK-10, and now in the inpatient context.

Methods: The recorded violent incidents during the hospital stay and the V-RISK-10 assessments at admission in two acute psychiatric departments for 1.017 patients were compared.

Results showed an inpatient violence base rate of 9%, and predictive validity estimates for the V-RISK-10: ROC- AUC values above 0.80 and Negative Predictive Value (NPV) 98%.

Conclusion:

The finding of a base rate of 9% for inpatient violence concurs with earlier results from studies in other Norwegian units. The predictive validity of the screen seemed very good.

8

Step 3:

To test the predictive validity of the V-RISK-10 concerning patients after discharge from an inpatient setting (Paper V).

Paper V describes findings from an investigation of risk assessment accuracy and rates of violence after discharge from acute psychiatry. Apart from different follow-up contexts, the methods were closely related to that reported in Paper IV: to compare the recorded violent incidents with the risk assessments made at discharge by the V-RISK-10. This was performed for 381 discharged patients followed up on for one year.

Results showed the same rate of total violence for discharged patients as in Paper III, 26%, with type of violence this time specified: non-physical 12%, moderate physical 9%, and severe physical 5%. The V-RISK-10 showed ROC- AUC values above 0.80.

Conclusion:

The violence base rate was 26%. This is identical to the base rate reported in Paper III. The predictive validity of V-RISK-10 in the outpatient context seemed very good; nearly identical to the one found in the inpatient study.

Step 4:

A naturalistic testing of the interrater reliability of the V-RISK-10 in acute psychiatry (Paper VI).

Paper VI reports findings from a naturalistic study of the interrater reliability of the V-RISK-10. The investigation involved a comparison of 25 raters' assessments of 73 randomly selected patients. This was conducted as a part of the everyday admission routine in two acute psychiatric departments. Scoring was done by pairs of raters who were blinded to each other's ratings.

Results showed an average measures ICC of 0.77 for the whole screen.

Conclusion:

The interrater reliability was found to be good even though the study was conducted in the very stressful and busy context of the acute units.

In summary, the thesis consists of two main parts, both focused on interpersonal violence associated with mental disorder. The first part deals with the interface between the mental

health and the correctional system. This was addressed by scrutinizing (1) the possible effect of a significant mental health deinstitutionalisation on the prison system *per se,* (2) the correlation between this process and a considerable increase of violent crime in society during the same period, and (3) a considerable rate of mental symptom disorders in prisons

The second, and most extensive part, studies violence by patients in general acute psychiatry and the development and validation of a brief screening checklist for assessing violence risk. The relevance of implementing such a screen on a wider scale (e.g., the prison and probation system) and, possibly also in a police version is discussed.

1.2 List of papers

I. Hartvig P, Kjelsberg E. Penrose's Law revisited: the relationship between mental institution beds, prison population and crime rate. Nord J Psychiatry 2009; 63: 51-56.

II. Kjelsberg E, Hartvig P. Can morbidity be inferred from prescription drug use? Results from a nation-wide prison population study. Eur J Epidemiol 2005; 20: 587-92.

III. Hartvig P, Alfarnes SA, Skjønberg M, Moger TA, Østberg B. Brief checklists for assessing violence risk among patients discharged from acute psychiatric facilities: A preliminary study. Nord J Psychiatry 2006; 60: 243-8.

IV. Hartvig P, Roaldset JO, Moger TA, Østberg B, Bjørkly S. The first step in the validation of a new screen for violence risk in acute psychiatry: The inpatient context. Eur Psychiatry 2010; 25: e-pub ahead of print.

V. Roaldset JO, Hartvig P, Bjørkly S. V-RISK-10: Validation of a screen for risk of violence after discharge from acute psychiatry. Submitted, and in second review Br J Psychiatry.

VI. Bjørkly S, Hartvig P, Heggen FA, Brauer H, Moger TA. Development of a brief screen for violence risk (V-RISK-10) in acute and general psychiatry: an introduction with emphasis on findings from a naturalistic test of interrater reliability. Eur Psychiatry 2009; 24: 388-94.

2 General introduction, background for the thesis' studies

This section discusses earlier and contemporary research constituting a background for the studies in the thesis, which, in their turn, seek both new and confirming findings.

2.1 Historical and numerical associations between the mental health and correctional system

Determining the deposition of persons with aberrant behaviour has always been a challenge to society, whether these behaviours were of criminal, psychiatric or mixed types. Most developed societies have performed this task by confining people in restrictive institutions. Earlier on, these determinations have had varying levels of differentiation, often mixing felons and psychiatric patients. The mechanisms of aberrant behaviour disposition through later centuries have been described, especially by Foucault in several works (e.g.[1, 2]). In the 19th century, many nations, including Norway, addressed the need for more differentiation in the handling of persons with aberrant behaviour. The fact that the first national insanity asylum, Gaustad, and the modern national prison, Bodsfengselet, both were opened in the1850s reflects this differentiation.

In 20th century Europe separate institutions for the mentally diseased and felons were well established, but still considerable overlaps existed between the populations of the two kinds of institutions. In 1939 Lionel Penrose published his classical work[3], indicating a negative correlation between the proportion of people within a nation placed in mental hospitals and the proportion held in prisons. In addition, using sentence statistics and official returns on homicide, he reported that the amount of crime in a community (particularly crime involving violence) was positively related to the proportion of the community sentenced to prison, and hence negatively to the rate of mental institution beds. Juxtaposing his findings, he claimed that provision of facilities for the mentally ill lessened the incidence of crime and, consequently, the numbers of people in prisons.

2.1.1 Cross-sectional numerical studies

Penrose's[3] main focus was on 18 European countries in the 1930s, where, in a comparative study, he found a main correlation of – 0.62 between the proportion of prisoners and mental hospital patients

The same pattern was found in a study 35 years later comparing the six states in Australia[4] regarding the same factors, which now also included size of the police force. In this study

"Penrose's Law" -- the proposition that a high mental hospital population was accompanied by a low prison population -- was supported. However, the study did not demonstrate a similar inverse relationship between the amount of crime and the extent of the mental health services[4].

2.1.2 Longitudinal studies

The deinstitutionalisation of mental health facilities as such in Western countries from the 1960s has been thoroughly described and discussed in papers later referred to, but studies covering longitudinal numerical correlations to the correctional institution capacities have almost been absent. However, a comparison of the development of the prison and the mental institution capacities in England and Wales from 1982 to 1997[5] showed an adjusted 35% rise of prison and a 54% decline in mental health populations. This study hence supported Penrose's 50-year-old, cross-sectional findings regarding these numerical relationships.

A remarkable development, regarding mental institution and prison beds, in the United States[3, 6] over 70 years is reflected in the following figures: In 1934, per 1, 000, there were 3.75 mental health to 1.58 prison beds; in 2004, 0.2 mental health to 7.14 prison beds. This American development has led to the description of prisons as the nation's "new mental hospitals"[7].

2.2 Further implications of mental health deinstitutionalisation

2.2.1 Relations to overall and violent crime

Mental health deinstitutionalisation has raised questions like the ones Penrose did. Can the rise in crime -- all, violent and homicidal -- be explained by this process? In Norway a considerable population-adjusted increase in overall and violent crime from 1960 until today, and, at the same time, a strong reduction of mental institution beds has been assumed. No comparison study of figures in this field has been made up to now. Through the last 30 years of this process in Norway, there has been a strong compensatory increase in personnel working in ambulatory psychiatry, and inflation-controlled budgets in the mental health sector are much higher now than ever[8]. In the correctional sector there has also been an increase in probation activities[9]. However, national statistics of reliable rates of extramural relapse into violence by patients/felons do not exist. Official statistics from the bed-based service in both systems are more reliable and therefore seem to be the most adequate numerical basis for comparison.

12

Homicide rate has been a topic of special interest in different scientific disciplines. Popular interest has suggested mental health deinstitutionalisation as a major causal factor for a rising homicide figure, but several studies in developed nations[5, 10] have rejected this as being a major cause. This conclusion relies mainly on findings that the rate of homicide from insane perpetrators has not increased more than in the general population.

2.3   Definitions of violence and aggression

Violence is the main topic of this thesis, but the co-existing concept of aggression also needs consideration. The two terms have, to a considerable degree, been used interchangeably. Bjørkly[11] refers to numerous publications by renowned researchers giving varying and complementary views on definitions of violence and aggression. He also[12] offers what he describes as a preliminary and pragmatic definition, describing *aggression* as being intentional and having the potential of causing milder physical injury and *violence* as referring to more severe consequences. The main component in violence and aggression is to intentionally cause physical pain or injury[13-17]. The component of *threat* of such physical injury is also central, and several authors (e.g., Buss[14]) also include the elements of causing feelings of dislike or being uncomfortable in the definition of violence. Harm to property and other inanimate objects have also been included by some authors [16, 17], but this inclusion is controversial[18].

There exists disagreement upon how broadly aggression should be defined, but the present thesis will be restricted to aggression and violence pertaining to actual or threatened physical acts. Self-harm, including suicidal behaviour, will not be addressed here, even if a correlation with interpersonal violence has been found in some studies[19, 20]. Furthermore, sexualized and spousal violence will not be treated as separate categories in this thesis.

The interchangeable use of the terms *aggression* and *violence* is demonstrated in the names of recording and risk assessment tools. In papers describing such instruments[18, 26] about half use the one term, and the other half, the other. The use of the term *violence* seems to be dominant in current *prediction* instruments. Monahan and co-workers[27] in their analyses divide violent acts into two categories of seriousness: "**a) Violence** (battery that resulted in physical injury; sexual assaults; assaultive acts that involved the use of weapons; or threats made with a weapon in hand), and **b) Other aggressive acts** (battery that did not result in physical injury)". Hence, both terms are still in contemporary use, but partly to make a discrimination regarding the seriousness of the outcome. If otherwise not specified, the term **violence** with the broader definition of Webster and co-workers[28] is chosen to be used in this

thesis: **"The actual, attempted, or threatened physical harm of another person that is deliberate and non-consensual".**

2.4   Mental disorder and violence

Historically, through the ages and across cultures, discussions have existed on the possible relationship between mental disorders and violent behaviour[29, 30]. This has pertained both to the "insanity" portion of mental disorder and the portion consisting of non-psychotic aberrant behaviour. In many cultures there has, in *legal* terms, been a sharp distinction between the two portions; violent acts as an aspect of psychotic behaviour have been "excused" and not sentenced; acts by persons without a psychotic condition have been sentenced and given much less excuse. In everyday life this distinction has not been sharp, and today many people have strong images of the "violent mental patient"[31], representing violence in both psychotic and non-psychotic aberrant behaviour. In this chapter, mental disorders will pragmatically be divided into two main categories: (A) *Major mental illness,* meaning active psychosis, including the whole ICD-10 chapter F 20-29 and the psychotic disorder types of the chapters F 0-19 and F 30-39, and (B) *Non- psychotic mental disorder* in the ICD-10 chapters 10-19, 40-59 and predominantly in F 60-69, i.e. the personality disorders.

2.4.1   Major mental illness

Since the beginning of the twentieth century violence by persons suffering from major mental illness has been increasingly studied. In the context of this thesis the historical comments will be restricted to the last half century and to some main stages of the actual prevailing research conclusions.

The first stage started in North America in the 1960s. This was closely related to the start of mental health deinstitutionalisation, imposed by a combination of a growing civil rights movement and the economic problems faced in maintaining large numbers of state mental hospitals. The prevailing attitude in this period, led by Monahan and co-workers, was that major mental illness in itself had an almost zero impact on violence risk when statistical controls were applied for, for example, age, gender, race, social class and previous institutionalisation[32].

The second stage, with its "post-deinstitutionalisation" research from the mid-1980s through the 1990s, brought a notion that the connection was far more complex than previously acknowledged. Monahan revised his categorical view from the early 1980s, and ten years later he claimed: "Those actively experiencing serious psychotic symptoms are involved in

violent behaviours at rates several times higher than those of the non-disordered members of the general population, and this difference persists even when a wide array of demographic and social factors are taken into consideration"[33] (page 295). Still, factors other than the psychotic state *per se*, (e.g., co-morbid substance abuse, certain types of personality disorder traits, and living in disorganized communities) have been considered as contributing strongly to the character and frequency of violence[33, 34]. A recent meta-analysis[35] comprising 204 international studies, concluded that the effect sizes indicated that *on average* "psychosis was highly statistically significantly associated with an approximately 50-70 % increase in the odds of violence. However, a substantial dispersion among effect sizes was found, depending on definition and measurement of psychosis (e.g. diagnostic vs. symptom-level measurement; type of symptom), and comparison group". The main conclusion from this analysis[35] is that unspecified psychosis *per se* bears a very moderate violence risk, but certain diagnostic psychosis types (e.g., schizophrenia) show much higher odds ratios. Furthermore, the time-presence of the active psychotic process, and the type and severity of its symptoms, strongly influence the odds of violence[35]. An important symptom cluster in this connection is the persecutory delusional, of which the so-called "perceived threat and control override, TCO" has been advanced and studied[36]. This involves the belief that (1) others are controlling one's thoughts by either stealing thoughts or inserting them directly into one's mind; and (2) others are plotting against one, following one and wanting to hurt one physically. It is also suggested[36] that high levels of delusional distress may increase risk of violence. The findings in these two studies[35, 36] concur with contemporary Norwegian research, showing links between psychosis and serious violence[37], described below in 2.4.4, where paranoid schizophrenia and non-schizophrenic delusional disorder dominate very strongly over other principal diagnoses in psychotic violent offenders.

2.4.2 Non-psychotic mental disorder

Persons in this category, diagnostically belonging to the ICD-10 chapters of F 40-59, seem to have the same violence prevalence as the normal population. However, those with substance abuse (F 10-19) and/or with an extroverted and antisocial personality disorder in the F 60-69 are responsible for far more violent acts/crimes than people with "pure" major mental illness (e.g., [32-37]). This is also reflected in the effect sizes shown in the comparison between psychosis and non-psychotic groups made in the meta-analysis referred to above[35]. It will be further elaborated below and in 2.5, 2.6 and 2.7.

2.4.3 "Dangerous" persons, situations or both?

Dangerousness as a term has been used extensively as a reason for involuntary civil psychiatric commitment of the major mentally ill and for prolonged detention of non-psychotic persons with aberrant behaviour. The use of this term has declined considerably over the last decades[29], parallel with the development of instruments for violence risk assessment, which will be described later. This period also saw a change in emphasis from static intra-psychological personality traits to situational and individual dynamic risk factors. The actual clinical state and trait and the impact of external situational factors are now acknowledged to count equally in risk assessment[29].

2.4.4 Contemporary serious violence in Norway by psychiatric patients with and without major mental disorder

In Norway, successfully investigated serious violent crime (putting life and health in danger, specified in the Penal Code) always leads to court sentences. Perpetrators not guilty by reason of psychotic illness at the time of the act, until recently judicially named "insanity" in the Norwegian legal system, will be sentenced to involuntary psychiatric treatment. The use of the term *insanity* in some parts of this thesis reflects the reality that having a psychotic condition in itself still is not enough for acquittal; the psychotic condition must be of sufficient strength to qualify the defendant for this. In the five-year period 2002 to 2007, 84 persons were sentenced to treatment in this mode in Norway[37]. As a contributor to an official report about these persons I made a study on the sentences and the psychiatric expert witnesses' assessments for these 84[37a]. In 30% of the cases homicide was the primary felony; the rest were different other serious violent acts. The diagnostic distribution of the psychotic conditions leading to an insanity conclusion was; paranoid schizophrenia, 59%; other schizophrenia and schizoaffective psychosis, 13 %; non-schizophrenia delusional psychosis, 18 %; others, 11 %[37a]. These figures show paranoid psychosis in any form to be the primary diagnosis in over three out of four such patients/felons. Only 2% had a primary diagnosis of substance-related psychosis, but, for example, among the schizophrenic perpetrators, 35% were given a co-morbid substance abuse disorder, and 35 % were deemed intoxicated by alcohol or drugs at the time of the act. Co-morbid personality disorder with schizophrenia was explicitly diagnosed in 11% of the cases.

Non-insane perpetrators of serious (defined above) violence acts can be sentenced to preventive detention in prisons[37] provided they have serious personality disorders with a danger of recidivism. In the 2002-2007 period, 125 persons with such non-psychotic disorders were sentenced[37] for this serious type of violence. Without a psychosis or a severe

personality disorder, the perpetrators, both of serious and less serious violence, will be sentenced to ordinary prison.

2.4.5 Contemporary less serious violence in persons not guilty for reasons of insanity

Violent crimes (less serious than the ones defined above) perpetrated by a person with major mental disorder do not result in a prison sentence because the person will be found not guilty by reason of insanity. At the same time he or she is not "dangerous enough" to be sentenced to involuntary psychiatric treatment. This category amounted to several hundred persons in the 2002-2007 period in Norway. They had sporadic short stays in psychiatric institutions, but could not be held for longer periods due to the Mental Health Act. This category of people therefore constitutes a continuous challenge to police and society.

I have studied a representative sample of 80 persons from this group[37b]. About half of the violence was of a less severe character, but the more serious index offences comprised the other half: serious violent threats, 23%; grievous or moderate bodily harm, 24%; aggravated robbery, 9%. The main diagnoses were; 45% paranoid schizophrenia; 25% other schizophrenia and schizoaffective psychosis; 18% paranoid psychosis. Diagnostically this group was almost similar to the spectrum of those sentenced to involuntary psychiatric treatment. As a whole, they constitute a very unstable group, carrying a definite risk of moderate to severe violence, indicating that they represent a considerable challenge to society and, hence, to efficient risk assessment and management.

2.4.6 Responsibility in the mental health system for preventing violence by patients with major mental illness and personality disorders

Around 20% of all homicides and 5% of all violent crimes in Sweden are committed by individuals with a major mental illness[38, 39]. Norwegian studies on homicides have pointed to the same levels[40, 41] of occurrence, with a decrease to about 15% during the last 5 years. Although most psychiatric patients in general are not more violent than persons without mental illness, there are, as mentioned above, robust findings that subgroups of persons with major mental illness pose a higher risk of violent acts[33, 35-37, 42, 43]. In an Australian cohort study[44], the odds ratio for violent criminality among men with schizophrenia *without* a known substance abuse problem was estimated to 2.7, and 14.1 *with* such co-morbidity. A Finnish study [45] showed a risk of committing homicide among men with schizophrenia *without* and *with* alcohol abuse, increasing from 7 to 17. Most researchers acknowledge in varying degrees the importance of confounding factors such as living in disorganised communities,

victimisation, substance use and/or antisocial personality disorder[34, 42]. The high prevalence of co-morbidity between schizophrenia and substance use disorder complicates the picture even more (see, e.g., [44, 45, 46]). Given the contemporary elevated prevalence of substance use among psychotic patients, this cluster constitutes a challenge to the mental health system. Regarding the co-morbidity with antisocial personality disorder, Hodgins[47], for example, has demonstrated a high prevalence among the schizophrenic offenders of "a pervasive and stable pattern of antisocial behaviour evident from at least mid adolescence" (i.e., before the onset of manifest psychosis). With the current downsized hospital system and a rising demand for all sorts of psychiatric help, there is a greater likelihood that the needs of patients with high risks of violence will be overlooked. This possibility increases the need for an improved risk awareness in the whole mental health system, especially for patients with paranoid schizophrenia and other paranoid psychoses[42, 45-48].

Psychiatric outpatient treatment involves far more patients without than with psychotic conditions. Most of these patients show no higher violence risk than the general population. However, persons with impulsive and antisocial personality disorders and/or substance abuse, in particular, do carry a greater risk of violence than both average non-psychotic patients and psychotic patients without co-morbidity[34].

2.4.7 Conclusion and some research implications

This section provides a brief introduction to some links between mental disorder and violence. The reciprocal relationship between the correctional and mental health systems as shown, for example, in a contemporary Australian study[44], has also been discussed. Violence risk and/or violent acts constitute a considerable characteristic of persons entering one or both of the systems. Even if mentally ill patients in general have a low violence risk, there is a need for research geared to generate efficient assessment of subgroups with high risk in both service systems. There is a need for valid and easy-to-use assessment instruments developed for both psychiatric patients and prison inmates.

2.5 Mental disorders in prisons

The occurrence of mental disorders in prisons has been the subject of many studies in the last couple of decades. Some of these are smaller, original studies from single prisons. Others are meta-analyses or surveys, combining single-prison studies for analysis in cross-national studies.

2.5.1 Larger population studies

2.5.1.1 Studies of symptom disorders and personality disorders

The most comprehensive recent study of this topic is a systematic review of 23, 000 prisoners based on 62 surveys[49]. Findings showed a common "previous 6 months prevalence" of psychotic illness for 3.7 % of men (4.0% of women). Ten and 12% of men and women, respectively, suffered from major depression. Personality disorder was attributed to 65% of the men (antisocial type, 47%); corresponding prevalence for women was 42% (21%). The results found for symptom or non-symptom disorders in this review concur well with findings from other studies[49-58]. Only the study by Brinded and co-workers[50] and one study by a colleague and me, not included in this thesis[59], have been of the nationwide type. The other studies, many of which were also collected in the meta-analyses, were conducted in single prisons. A substantial number of studies have found prevalence rates up to 80 to 90 % for at least one disorder, and, in addition, multiple co-morbidities exist[49, 55]. Especially high prevalence of symptom disorders have been found in studies of remand prisoners[60, 61]. As only two studies have a nationwide scope[50, 59], additional research of this kind is needed.

2.5.1.2 Studies of substance use disorders

Most of the above-mentioned epidemiological studies did not include assessment of substance abuse disorders. Generally, this has been explained by methodological difficulties, since the prevalence of substance use in prisons is likely to be affected by reporting and ascertainment biases (e.g.[49]). Still, the use of valid self-report instruments has revealed a high prevalence of substance use disorder in the three Scandinavian countries. Results showed prevalence rates of around 60% and very often as a co-morbid disorder[62-64].

2.5.2 Smaller population studies

2.5.2.1 Studies of mental disorders in general

One Norwegian study[65] screened symptom disorders with the Symptom Checklist -90 through one year in a regional prison, and combined with the ICD-10 diagnosis by the prison psychiatrist, a psychosis prevalence of 3.2% and major depression of 10% was reported. Another[66] study of 40 inmates in a regional prison showed 17% having psychotic symptoms, but mostly precipitated by substance abstinence. Furthermore 5% had major depression and 20% moderate, but definite, depression. Substance use disorder with co-morbid personality disorder was described in 80 to 90% of the sample.

2.5.2.2 Studies of specific disorders and dysfunctions

Personality disorders and psychopathy

A Norwegian study[67] monitored both personality disorders and psychopathy in a study of 41 inmates in a regional prison. No present major mental illness was found, but a lifetime diagnosis of major depression or bipolar disorder was found in 52%. All inmates had different personality disorders, and 49% scored over a cut-off of 26 for psychopathy on the PCL-R.

Psychopathy, a severe form of antisocial personality disorder, has been extensively studied and described during the last decades[67-72]. It is estimated to be found in 1% of the general population, and its close connection to violent behaviour is strongly stated[69]. Reports of the rate of prevalence in prisons have varied, but are mostly around 20%[68].

Attention Deficit/Hyperactivity Disorder, (AD/HD)

In prison populations these disorders are described in a highly increasing number of studies. These studies seem to have had definite methodological problems pertaining to diagnostic criteria and cut-off values. A meta-analysis of 25 surveys[73] by Fazel and co-workers in 2008 showed an AD/HD prevalence of 11.7% (4.1% -19.2%) among young imprisoned men; among young women, 18.5% (9.3% - 27.7%). In the context of this thesis only two subsidiary papers, presumably typical, will be referred to. From a Norwegian regional prison[74] a definite occurrence of persistent AD/HD in the inmate population was reported, without giving exact numerical prevalence. Of interest in that study is a strong co-morbidity with personality disorders and learning disability. A German study[75] showed an overall prevalence of AD/HD of 45% and a very high occurrence of co-morbidity with other mental disorders in young male prison inmates.

Intellectual disability

This disability constitutes a mental disorder in the official diagnostic systems. In a cross-sectional sample from a regional Norwegian prison, 10.8% of the inmates were registered as having an IQ < 70[76]. Persons scoring under this cut-off were estimated as being intellectually disabled (ID). The prevalence was demonstrated to be significantly higher than in the general population, and two out of three prisoners with ID were medicated for mental disorders[76].

2.5.3 Conclusion and some research implications

According to a considerable number of studies, mental disorders are highly prevalent in prison populations. Eight to nine out of ten prisoners have or have had at least one disorder, and co-morbidity is frequent. The high prevalence both of symptom and personality disorders

indicates frequent exchanges between residing in either the main society, correctional or mental health facilities. The high occurrence of antisocial personality disorder and psychopathy in prisons makes risk of recidivism into violence a central issue [34, 49, 68, 69]. For Norway, there has been a lack of agreement regarding the national prevalence of psychoses in the prison system, because single-prison studies [65-67] have shown a strong variation in prevalence rates. Studies based on the entire prison system need to be made.

2.6   Occurrence of violence/aggression by patients in the mental health system

2.6.1   Violence rates

2.6.1.1   Recording of interpersonal violence

This section describes specific types of assessment tools used in inpatient settings. Two instruments often used in Norway are the Staff Observation Aggression Scale (SOAS)[77] and the Report Form for Aggressive Episodes (REFA)[18]. Other internationally used instruments will not be mentioned specifically here, but the reader is referred to a comprehensive overview[78]. Both the SOAS and REFA measure specific features of aggression, as precipitating situational variables, harm outcome, and options for limiting/preventing measures. This is shown in somewhat different ways in the two instruments, but both have well recognized qualities.

2.6.1.2   Prevalence in different groups and contexts

Many studies on this topic have been published over the last decades[77, 80]. They have shown a wide variety of prevalence or base rates, depending on patient categories, facilities, observation time and origin of study. Two patient types seem to have the highest base rates: the psycho-geriatric (e.g.[80-82]) and the forensic[18, 77, 81]. In general higher rates have been found in Finland and the Netherlands[77], but to my knowledge no comprehensive, nationwide statistic exists. For acute general psychiatry, base rates of 6 to 11% have been found[26, 83-86], and rates have been found to be higher for outpatients (25-30 %)[27, 28, 87].

2.6.2   A brief presentation of some psychosocial factors related to violence

There are two main categories of psychosocial factors related to violence reported in the literature: individual and social/contextual.

The individual factors include biological and psychological elements, which act in a reciprocal matter. In this thesis the presentation will be limited to psychosocial factors. These can be

clustered in three main groups: psychoanalytic theories, drive theory and social learning theory, all referred to in a thorough literature study[88]. Of single items, age is a factor that has been widely studied. Most violence tends to be found among young persons (e.g., [89]) and geriatric weakened patients (e.g., [80]), whereas middle age seems to be protective[81]. Gender factors have also been variably assessed[81, 86, 90], showing, for example, that in inpatient populations women may have as high a violence prevalence as men. Still, women's violence generally is less physically serious. More severe acts like homicide and other violence leading to imprisonment are ten times more often perpetrated by men[37]. Personality traits, especially related to high impulsivity, low affect control and lack of empathy are strongly related to violence[69].

Social/environmental factors are reported to be crucial precipitants of violence. Changes in factors of this kind have been claimed to be the main cause of the increase in violent crimes in Norway through the last half century[91].

Inpatient violence and aggression has been the subject of many studies. A recent paper has divided variables in this field into the following subgroups[92]: Patient–related, staff-related, unit-related and interactional-related factors. The three latter factors, grouped together, can be named "clinical setting" or "ward milieu". These are partly influenced by economical and material factors, like staffing ratios and the internal architecture of the wards, including a proper space factor. The importance of these factors has been confirmed in a recent thesis[93]. The psychosocial dimensions of staff, unit, and interactional factors form a complex and challenging area. Friis, in two publications[94, 95], has investigated this with data collected by means of the Ward Atmosphere Scale (WAS)[96]. The main message of his analysis is that stable, experienced staff, clear leadership and predictable, clearly structured staff roles and events reduce the likelihood of violent incidents. In contrast, milieus with a high level of anger and aggression, low levels of order and staff control result in a higher likelihood of violence.

2.6.2.1 Consequences of violence by psychiatric patients

Violence by psychiatric patients has a wide range of outcomes, from mild to catastrophic, depending primarily on the gravity of the violent act, but also in some cases on the victims' vulnerability. In outpatient situations, the victims naturally are rarely health workers; most often they are family or others in the nearby environment.

Inpatient violence has an important impact on workplace milieu and security. More than 90% of doctors and nurses in mental health care in Denmark have been exposed to violence during their careers[85] and similar results exist from other nations[97, 98]. The risk has been

demonstrated to be particularly higher for nurses than other professions[85, 97]. Several publications deal with the probability of victims developing post-traumatic stress disorders[94, 99]. Furthermore, workplace absence resulting from this violence may strain the system's economy[100].

2.6.3 Conclusion and some research implications

About 10% of acute psychiatric inpatients have committed at least one violent act during their stays. Base rates of violence in discharged patients have been estimated to be from 25 to 30 %. This difference in base rates is mostly attributable to a longer observation time for discharged patients. Especially regarding rates of post-discharge violence, few studies exist, and this field needs further investigation.

2.7 Occurrence of violence/aggression by sentenced persons, during and before imprisonment

2.7.1 International studies

Exact base rate estimates of violent acts during imprisonment are hard to find in the literature. It has been claimed that this is due to lack of standardised definitions and methodology[101]. However, in a Swiss sample of imprisoned sex and violence offenders, a base rate of 27% for physical and/or verbal aggression was found[102], and an investigation of a probability sample from Iowa, in the U.S., suggested a similar rate[103]. No study has been found covering a nationwide general sample of prisoners.

2.7.2 Norwegian studies

Physical and/or verbal violence from inmate against inmate have only been studied qualitatively in Norway. In prisons recorded violent acts from victimized employees amounted to a base rate of 9%, with some uncertainty about the possibility of the same inmate having performed more than one act[104]. In the probation system a base rate of less than 1% has been recorded[105].

Prevalence of violence as the main *pre-trial* crime among the imprisoned population has been estimated to 21% in a 2004 study[62].

2.7.3 Conclusion and some research implications

The current understanding about different types of violence rates in the above two sub-chapters would profit substantially from further research. In the context of this thesis, only further national studies seem relevant to mention. There is reason to believe that further

research on topics mentioned in 2.7.2[104, 105] will produce even more specific base rates. The prevalence of violence as the main pre-trial crime[62] should be re-studied.

2.8 Assessment of violence risk, with special focus on structured clinical instruments

2.8.1 Risk definitions

The Oxford English Dictionary defines the term *risk* as "the probability of a bad consequence"[106]. In the field of violence research, *risk* has been defined as "a hazard that is incompletely understood, and thus whose occurrence can be forecasted only with uncertainty. The concept is multi-faceted and refers to: the nature of the hazard; the likelihood that the hazard will occur; the frequency of duration of the hazard; the seriousness of its consequences; and the imminence of the hazard"[107].

2.8.2 Risk assessments through the last five decades

2.8.2.1 Self-rating procedures

From the 1950s self-rating questionnaires were commonly used to measure anger and hostility[108], but without convincing results[79]. Later new instruments were developed (e.g.[109]), but they have not been widely implemented and hence will not be discussed further.

2.8.2.2 Observer-rating procedures

The "modern" era of observer-rating procedures started in the United States in the 1960s with two renowned court decisions, the Baxtrom and Dixon cases[110]. In these cases the judgments found that there was no evidence that psychiatrists or psychologists have any special expertise in predicting violent acts among patients dismissed after being involuntarily hospitalised on the grounds of presumed dangerousness to others. These precedence-giving sentences led to the release of many hundreds of involuntarily admitted patients, and a follow-up study some years later showed that only one third of patients originally predicted to become violent turned out to be violent[111]. This finding fired a critical debate about clinicians' risk assessment ability and led to an allegation that "flipping coins in the courtroom" could provide as good an assessment[111]. Monahan referred to this phrase in his 1984 paper[112] and announced "second generation research and development" in the field, giving rise to the introduction of instrument-based prediction and assessment. The new doctrine discarded clinical "intuitive, impressionistic" risk assessment. This "second generation research and development" led to the validation and use of *actuarial* assessments. The term *actuarial*, best known from the predictive methods of insurance companies, builds upon an explicit model of

empirical data in the correlates of violence risk. The model defines a number of well validated risk factors to be assessed following certain rules and expressed numerically.

While the actuarial, purely statistical method can be described as the antithesis of unstructured clinical assessments, a combined approach ("third generation") has emerged from the early 1990s. This approach has been termed *structured clinical assessment*. In addition to measuring historical/static factors, this method also contains items that measure characteristics amenable to change.

2.8.3 Risk assessment in forensic and general psychiatry

Unstructured clinical assessment has always been used in psychiatry. The second, actuarial generation originated in the forensic field. This field includes both the forensic clinical departments in hospitals and their associated activities; also pre-trial observations by psychiatrists and psychologists.

In forensic psychiatry two actuarial instruments, the Violence Risk Appraisal Guide (VRAG)[113] and the Violence Risk Assessment System-Iterative Classification Tree(VRAS-ICT)[19] have been used, mainly to assess violence risk after discharge and also to monitor inpatient violence risk. Quite recently the latter of these two instruments has been developed into an interactive software version and is now named Classification of Violence Risk (COVR)[114]. Of structured clinical instruments originally developed for forensic psychiatry, three will be mentioned: The Violence Risk Scale, 2nd Edition (VRS-2)[115], the scale for the prediction of aggression and dangerousness in psychotic patients (PAD/VAFA)[116] and the Historical, Clinical and Risk Management Assessment Scheme (HCR-20)[28] . These are also currently used for the same forensic purposes, especially the HCR-20, which in this connection is the internationally leading instrument. Another instrument, the Hare Psychopathy Checklist-Revised (PCL-R)[117], is also used extensively. Originally this was not a risk assessment checklist, but an instrument to measure psychopathic traits. Based on positive findings in validation studies, it has gradually come to be used independently to assess violence recidivism. An abbreviated version (PCL-SV) is an integrated part of HCR-20.

Since about the year 2000 increasing efforts have been made to introduce structured methods - both actuarial and structured clinical instruments - into general psychiatry. An example of this is a risk checklist originally developed for use in forensic psychiatry, the Brøset Violence Checklist, (BVC)[26], which has been increasingly implemented in acute and general psychiatric wards. The HCR-20 has also been validated in general, outpatient

psychiatry[118]. Nonetheless, all the above-mentioned tools, except the BVC, are too time-consuming to be implemented in regular use for all inpatient or outpatient violence risk assessment. In general psychiatry they are only used in special situations, to weaken or strengthen definite clinical risk suspicion. Instruments for everyday or screening purposes will be described in the following section.

2.8.4 Literature review of violence risk checklists for use in general psychiatry

Violence risk instruments, or checklists, are important helping agents in the clinician's total assessment, but can never be pathognomonic laboratory tests, which, in cases of somatic medicine, can be the *sole* diagnostic agent. State of the art contemporary violence risk assessments should always be based on instrument use combined with a clinical and common sense evaluation in the final analysis. In a screening context the instruments' role may be compared to the necessary use of checklists in other alert-based services, for example, aviation or fire control. In psychiatry they will help the therapist/evaluator to avoid overlooking important components in a situation or to be misled by counter-transference.

It has been claimed that actuarial instruments are sufficient for making a valid risk assessment[119], that is, can be used without individual-specific assessment. However, it is likely that most clinicians using contemporary versions of actuarial tools use them, in the end, as the basis for their total, individual-specific assessments[120, 121]. Still, it seems obvious that structured clinical checklists, with their dynamic contents, would be of more assistance in making the total assessment, or a "structured professional judgment"[122].

2.8.4.1 Outpatient use

The structured clinical HCR-20 and PCL-SV have been studied, mostly retrospectively, regarding the assessment of post-discharge violence[118]. For the predictive validity of HCR-20, ROC-AUC was estimated to 0.76; for PCL-SV, the corresponding value was 0.68, both statistically significant. The actuarial VRAS-ICT was prospectively studied in a one-year post-discharge follow-up[19, 123], also showing good validity estimated by other methods.

These three instruments have not been used in standard clinical practise for discharged patients or in primary ambulatory treatment in acute and general psychiatry. I have also not found any other instrument used for this purpose described in the literature. As mentioned earlier, the extent to which they are used depends on their length and the amount of time they take to administer, further underlining a considerable need of valid screening checklists.

2.8.4.2 Inpatient use

The VRAG, the HCR-20, and the VRS-2 have been tested in the inpatient setting. These scales were originally developed for risk assessment of forensic patients at the time of discharge or release into the community, and most of the validation studies have taken place in long-term treatment settings.

In the mid 1990s Bjørkly[79] reviewed the literature, finding only seven prospective prediction studies of intra-institutional violence in general psychiatric settings for short-term treatment. No study used instruments that were more specifically developed to predict aggression, and the average rate of false positives was 64%. An update that included the years up to 2009 was conducted by the same author. The review identified two main groups of approaches: **(1) scales** for continuous monitoring of fluctuating or dynamic risk factors, and **(2) screens** for identifying patients at risk for aggressive and violent behaviour.

The first group consisted of the BVC, the Dynamic Appraisal of Situational Aggression: Inpatient Version (DASA:IV)[124] and the Short-Term Assessment of Risk and Treatability (START)[125] . The BVC[26] is composed of the following items: confusion, irritability, boisterousness, verbal threats, physical threats, and attacks on objects. Research findings support that an individual displaying two or more of these behaviours is likely to be violent in the next 24-hour period[26]. Like the BVC, the DASA:IV was developed for continuous monitoring of risk for aggression and to assess the risk of imminent aggression pertaining to dynamic factors in the inpatient setting. They were both initially constructed for use in acute forensic settings. However, the items and the principles that underlie the scales are also applicable to general psychiatric patients. The DASA:IV has seven items: two from the HCR-20, two from the BVC, and three items based on the authors' own research[124]. The START [125] defines 20 dynamic variables cast both as risk markers and as possible protective factors. The relevance of this scale is hampered in the short-term context because it presumes rating of the 10 historical items of the HCR-20.

In the second group we find the Violence Screening Checklist (VSC) [24], the Clinical Assessment of Risk Decision Support (CARDS)[126] and the Alert assessment form (M55)[127]. The VSC is an actuarial instrument which evaluates risk for aggression at admission. The present version has four items: (1) history of physical attacks and/or fear-inducing behaviour during the 2 weeks before hospital admission, (2) absence of recent suicidal behaviour, (3) diagnosis of schizophrenia or mania, and (4) male gender. The CARDS is a two-stage assessment, with a screen and a full risk assessment phase. Only the screen is presented here, containing five items: (1) current thoughts, plans or symptoms indicating a risk of

violence, (2) current behaviour suggesting the risk of violence, (3) current problems with alcohol or substance misuse, (4) significant past history of violence, and (5) an expression of concern from others about risk of violence. The M55 form is part of the Alert system which is used to identify potentially violent inpatients. The form has two levels for the screening of risk for violence. The risk is rated as high if the patient (1) has a history of violence or physical aggression, (2) is physically aggressive or threatening, or (3) is verbally hostile or threatening. The next level contains eight items where a positive identification of three or more risk factors leads to a high-risk evaluation.

The two main groups of scales presented above have some limitations to their use. Since this thesis deals with the screening of patients with risk of violence, the caveats of the second main group of scales are discussed here. First, no validation studies of the CARDS have been found in the literature. Second, the base rates in the validation studies of the two other scales were very high, and this calls for caution concerning generalization to patient samples with base rates of violence lower than 40%. Finally, the nature of items included in the VSC and their relationship with violence has a substantial impact on this instrument's accuracy. It may not discriminate as well in settings where most patients are male, schizophrenic or manic, and admitted following recent aggressive behaviour and absence of suicidal behaviour. It must also be noted that the VSC is compromised by its sole reliance on static risk factors.

2.8.5 Risk assessment and risk management

Improved risk management has always been the goal of proper risk assessment. In recent years risk management has become more emphasized in practice and research[48, 115]. In the present thesis risk management will not be dealt with explicitly, in spite of its importance. However, it is to be mentioned that the two contemporary prevailing risk assessment "schools", the MacArthur (Monahan and co-workers) and the Vancouver (Webster and co-workers), have different views regarding the role of risk management items in the assessment process. The MacArthur group has argued that the two phases should be separate and distinct; first an actuarial assessment and then a dynamically based management process[123]. The Vancouver group has advocated a combined approach from the start, using structured clinical instruments[107]. The latter view has been advocated in later publications[122, 128].

2.8.6 Conclusion and some research implications

A wide variety of instruments for assessing violence risk in forensic and, to some extent, general psychiatry has been described. This review shows that instruments for screening of both in- and outpatients in acute and general psychiatry are scarce. In particular, instruments for combined use in both settings need further development and research.

3 Aims, materials, methods and results of the thesis

In an attempt to fill in some of the above-mentioned gaps in our knowledge, I have written a thesis with the following aims.

3.1 Aims

A) To focus on the interface between prison and mental health populations.

1. To make an accurate evaluation of the correlations between the size of the correctional and psychiatric inmate populations and their relationship to violent crime in Norway through the last half century (Paper I).

2. To chart the nationwide contemporary prevalence of mental symptom disorders in the prison system (Paper II).

B) To improve risk assessment methods for violence, and contribute to better understanding of its prevalence in general acute psychiatry.

1. To introduce and validate a new screening checklist in this field for use both in the in- and outpatient contexts (Paper III, IV, V and VI).

2. To estimate the rate of inpatient violence in Norwegian acute psychiatry in a prospective study (Paper IV).

3. To estimate the post-discharge rate of violence (Paper III and V).

3.2 Materials, subjects and methods

For each paper respectively:

1) Official statistics for the Norwegian prison and health systems for 1930-2004 (Paper I).

All relevant reports were searched for, gathered and studied together with literature in this field. The main points searched for were the numerical size of the imprisoned national population, the population residing in bed-based mental institutions, and, finally, the nature and volume of reported total and violent crime through the studied period. Numerical differences and fluctuations were recorded and analysed statistically.

2) Exact medication records covering 2, 617 prison inmates (90% of a cross-sectional national inmate population, 2004) (Paper II).

The material was gathered by contacting the health service in all Norwegian prisons, asking for anonymous medication sheets for every prisoner receiving any medication of a somatic or psychotropic nature on a given date. Participation was high, without any need for reminders. For this thesis, only psychotropic medication is referenced. Mental symptom disorders were estimated by inference from the medication sheets. Based on a clinical judgement, each individual was assigned the diagnosis considered to be most important. Prevalence rates of different disorders were calculated after that.

3) One hundred and ten outpatients discharged from an acute psychiatric department 2003-2004 (Paper III).

These patients were all in after-care situations within one year after a stay in a broad-spectered, acute psychiatric department. At discharge they had been scored with a 33-item violence risk assessment scheme, constructed for this study. During after-care consultations violent incidents were recorded, mainly by questioning the patient, but also by getting parallel information from family or officials. The recordings were then compared to the assessments and statistically treated with univariate logistic regression and ROC analysis, with the aim of item reduction.

4) One thousand and seventeen inpatients in two acute psychiatric departments in 2006 (Paper IV).

In this study the inpatient predictive validity of a brief screening instrument, the V-RISK-10, was tested. This screen was the result of item reduction of the 33-item scheme used in the former study (Paper III). All patients, in two acute psychiatric departments, were assessed with the screen at *admission* and all violent incidents were recorded during their stay. Assessments and recordings were compared and treated statistically with uni- and multivariate logistic regression and ROC analysis.

5) Three hundred and eighty-one outpatients discharged from the same two departments 2006 - 2008 (Paper V).

In this study the outpatient predictive validity of V-RISK-10 was tested. Discharged patients from the two departments mentioned above, belonging to their after-care system, were monitored in the same way as in the Paper III-study, that is, violent incidents were recorded throughout the first year after discharge. The comparison of these incidents with the risk

32

assessment by V-RISK-10 at *discharge* was treated with uni- and multivariate logistic regression and ROC analysis.

6) Seventy-three inpatients in two acute psychiatric departments 2008 (Paper VI).

In this naturalistic study the interrater reliability of V-RISK-10 was estimated. Seventy-three randomly selected patients from two acute departments were assessed with V-RISK-10 by different pairs formed from 25 medical doctors who were unaware of each others' ratings and performed on the same day. This was conducted in the everyday admission routine of the departments. ICC was used to estimate the interrater reliability for the scores, with a one-way random model. Both average and single measures agreement were estimated. A one-way ANOVA, *t*-tests and Chi-square tests were used for further statistical analysis of the entire material.

In the studies behind Paper IV, V and VI, the Violence Risk Screening-10 (V-RISK-10) was a central part of the methods. A full version of this is displayed in the Appendix. A short description is given here:

A 10-item screen developed to assess patients both at admittance and discharge from acute psychiatric settings.
Item numbers and labels:

1. Previous and/or current physical violence
2. Previous and/or current threats (verbal/physical)
3. Previous and/or current substance abuse
4. Previous and/or current major mental illness
5. Personality disorder
6. Shows lack of insight into illness and/or behaviour
7. Expresses suspicion
8. Shows lack of empathy
9. Shows unrealistic planning
10. Exposure to future stress-situations

Scoring instruction: No = 0, Maybe/moderate = 1, Yes = 2.

There is a brief scoring instruction guide that accompanies each item in the scoring form. Including the instructions was a deliberate step taken in order to make the screen easy to use.

3.3 Results, presented studies

Paper I:

Hartvig P, Kjelsberg E. Penrose's Law revisited: the relationship between mental institution beds, prison population and crime rate. *Nord J Psychiatry* 2009; 63: 51-56.

The basis for this paper was an extensive search of the official Norwegian statistics on the prison and mental health systems. From these data, the changes in both through the last 75 years, and especially for the period 1960-2004, were recorded. "Penrose's Law", the inverse relationship between the two inmate populations (concerning number of persons allocated to the two services), was confirmed in our naturalistic and longitudinal study for the years 1960 to 2004. When cross-sectional populations were compared, the mental institution beds decreased 74% and prison beds increased 52%, after having been adjusted for the total Norwegian population figures. Significant population-adjusted increases in total (500%) and violent (900%) crimes through this period were found.

Conclusion:

The results demonstrate the inverse relationship between prison and mental health inmate populations, longitudinally through the last half century in Norway. Deinstitutionalisation in mental health services was a main feature in all Western societies during the same period. This phenomenon was accompanied by a parallel increase in prison beds. The increase in crime rates could only partly be explained by a simple transference of one type of inmates from the one system to the other, but mainly is attributed to complex sociological mechanisms. Still, relatedness and reciprocity between the correctional and mental health system were confirmed in this study.

Paper II:

Kjelsberg E, Hartvig P. Can morbidity be inferred from prescription drug use? Results from a nation-wide prison population study. *Eur J Epidemiol* 2005; 20: 587-92.

The basis for this paper was a cross-sectional study of data covering nearly 100% of the 3.000 (5% women) Norwegian prison inmate population. The aim of this research was to estimate the prevalence of mental symptom disorders inferred from exact information of every inmate's prescribed medication. Except for a study from New Zealand, no other estimation of nationwide psychiatric epidemiology in prisons had been published.

This study also included somatic morbidity, but results are restricted to psychiatric symptom disorders in this context. Among all Norwegian inmates, 35% received medication indicating a psychiatric disorder. From medication type and dosage we inferred that 1% had affective psychosis and 3%, other psychotic disorders. Major depressive disorders (11%) and sleep disorders (11%) were the most prevalent non-psychotic disorders. The highest morbidity was found among prisoners on preventive detention, followed by remanded prisoners, and the lowest morbidity was among sentenced prisoners. Compared to a 12-month general population prevalence study, the occurrence of major mental illness was 300% and major depression 50% higher in prisons.

Conclusion:

Results indicate that a substantial number of persons with severe mental disorders are accommodated in prisons. It is hypothesized that the volume of this morbidity may be partly related to the general process of mental deinstitutionalisation. Comparison with international studies suggests that our findings probably show a representative national prevalence estimate of symptom disorders in Norwegian prisons.

Paper III:

Hartvig P, Alfarnes SA, Skjønberg M, Moger TA, Østberg B. Brief checklists for assessing violence risk among patients discharged from acute psychiatric facilities: A preliminary study. *Nord J Psychiatry* 2006; 60: 243-8.

Based on the scarcity of brief and easy-to-use screens for the assessment of violence risk in acute psychiatry, a preliminary 33-item instrument (Ps33) was developed to undergo logistic regression analysis and possible item reduction. One hundred and ten patients, scored with the instrument at discharge, were monitored for violent episodes throughout the following year. Recorded acts were compared to assessments at discharge within a prospective design. Base rate of recorded interpersonal violence throughout the post-discharge observation year was 26%, evenly distributed on physical and non-physical (physical or verbal threats) violence. Gender distribution of all violence showed a slight overweight of men (59%, controlled for real numbers). Predictive validity of the Ps33 was estimated. Receiver Operating Characteristics (ROC) analysis yielded an area under the curve (AUC) of 0.71 ($p < 0.01$). Regression analysis indicated that a substantial number of items could be reduced without losing predictive validity.

Conclusion:

The base rate of violent acting out within one year after discharge was 26%, with a slight overweight of men. The Ps33 had a satisfactory predictive validity, but shorter versions seemed to function even better. These findings were used to construct a 10-item checklist for screening purposes, the V-RISK-10.

Paper IV:

Hartvig P, Roaldset JO, Moger TA, Østberg B, Bjørkly S. The first step in the validation of a new screen for violence risk in acute psychiatry: The inpatient context. *Eur Psychiatry* 2010; 25: e-pub ahead of print.

The main objectives were to monitor violence prevalence and to test the predictive validity of the Violence Risk Screening-10 (V-RISK-10) by comparing admission assessment to recorded inpatient violence in a one-year prospective study. The subjects for calculating the violence base rate were 1.017 patients from two acute psychiatric departments. The two departments represent different parts of Norway, covering urban, semi-urban and rural populations.

The screen had an inter-item consistency, measured by Chronbach's alpha, of 0.79, and a vignette-based interrater reliability, measured by ICC, of 0.87. Base rate of interpersonal violence during the hospital stay of 8 days *(median)* and 15 days (*mean)* was 9% (7% physical *and* non-physical, 2% only non-physical). The inpatient base rate of violence was similar in both departments. Gender distribution of any violence showed an equality of 50% controlled for real numbers. Predictive validity for the screen regarding all violence, by ROC, yielded an AUC of 0.83 with sensitivity/specificity of 0.81/0.73, (AUC of 0.80 for physical violence). Positive Predictive Validity (PPV) was 0.24. There were only 2% false negative predictions. At the single-item level, all univariate odds ratios were significant, except for two items, "substance abuse" and "personality disorder". The screen was found to have a short completion time, 5 minutes (*Range:* 2-10 minutes) after the necessary information for a standard admission record for the individual patient was gathered.

Conclusion:

The finding of a base rate of 9% for inpatient violence concurs with earlier results from studies in other Norwegian units. The predictive validity of the screen, measured by ROC analysis, was very good. The NPV was very high, but due to a low base rate of violence, the PPV was low.

Paper V:

Roaldset JO, Hartvig P, Bjørkly S. Validation of a screen for risk of violence after discharge from acute psychiatry. Submitted; in second review *Br J Psychiatry.*

This study investigated the predictive validity of the V-RISK-10 in the outpatient context. Here 381 of the 1, 017 patients, discharged from the same two acute departments as in Paper IV, were followed prospectively through one year, comparing recorded violence with the discharge assessment with V-RISK-10. Base rate of overall violence was 26% (with "most serious act": non-physical 12%, moderate physical 9%, severe physical 5%). Gender distribution of all violence showed a slight overweight of men (53% controlled for real numbers). Predictive validity obtained by ROC analysis for one-year follow-up yielded the following AUC values: All violence 0.76 (non-physical 0.71, moderate physical 0.77, severe physical 0.90). For three months follow-up after discharge, the AUCs were somewhat higher 0.81 (0.77, 0.83 and 0.92, respectively). At the single-item level, univariate analysis showed odds ratios with a slightly different pattern from the inpatient context: "substance abuse" had become significant, "personality disorder" was still not significant, and the other 8 items were still significant. PPV after one-year follow up was 0.50. The screen yielded significant (p = 0.002) predictive validity for later violence even for patients *without a history* of such behaviour prior to the screen assessment.

Conclusion:

The violence base rate was 26%. This is identical to the base rate reported in Paper III. The predictive validity of V-RISK-10 in the outpatient context was nearly identical to the one found in the inpatient study, i.e. very good.

Paper VI:

Bjørkly S, Hartvig P, Heggen FA, Brauer H, Moger TA. Development of a brief screen for violence risk (V-RISK-10) in acute and general psychiatry: an introduction with emphasis on findings from a naturalistic test of interrater reliability. *Eur Psychiatry* 2009; 24: 388-394.

Before the two studies reported in Papers IV and V*,* the interrater reliability of the V-RISK-10 had only been tested by a method using clinical vignettes from real case stories. We therefore made a naturalistic study of the interrater reliability of the screen in two acute psychiatric units. Seventy-three patients were randomly chosen and scored on the V-RISK-10 by 25 physicians forming reciprocally blind pairs, that is, two raters per patient.

Average measures ICC for the whole 10-item screen yielded a value of 0.77, single measures ICC 0.62. There was no significant relationship between rater characteristics and interrater reliability results regarding psychiatric work experience. For the rated patients, no significant differences in ICC were found for age, gender or ethnicity.

Conclusion:

The interrater reliability was found to be good even when the study was conducted in the very stressful and busy context of the acute units.

4 Discussion

The thesis has been organized around the research aims listed in 3.1. The discussion follows these.

4.1 Aim A

4.1.1 The numerical relation between correctional and mental health inmates, and the importance of this for the prevalence of violence in society

The main hypothesis was to test if changes in the two systems could explain the recorded high increase in violent crimes in Norwegian society during the last half century. In our longitudinal study covering 1960 to 2004, a definite inverse relationship was demonstrated, with a considerable decrease in mental health beds and a parallel increase in prison beds. This inverse relationship was also displayed in the cross-sectional Penrose study[3], where low numbers of mental health beds in societies were accompanied by high numbers of violent crimes and high numbers of prison beds, in contrast to societies with a higher provision of mental health beds. An easy explanation could be that the Norwegian mental health deinstitutionalisation was the main cause for the recorded high increase in crime rates in general and specifically in rates of violent crimes and the increase in prison beds. This has been a widespread popular belief. We found that some association of this kind definitely seems to exist, but that overall, sociological changes probably are more important causes for the increased violence.

4.1.2 Contemporary nationwide prevalence of mental symptom disorders in Norwegian prison inmates

The prevalence of mental symptom disorders was estimated indirectly from prescribed medication use. A direct method using standardised diagnostic interviews with a representative sample of Norwegian inmates could have given more exact symptom disorder figures. However, it may be seen as a support for the validity of our results that the only other nationwide prevalence study, from New Zealand[50], gave symptom disorder prevalence rates close to the ones we found, as did a comprehensive international meta-analysis, gathered mostly from single prisons[49]. Even if we need a replicatory study with better methodology to get more exact numbers, our study clearly indicates that mental disorders are so prevalent in the prison population that they represent a major challenge.

4.2 Aim B

4.2.1 The development and validation of a new screen for interpersonal violence risk in acute psychiatry, the V-RISK-10

4.2.1.1 Main validation results

The screen has a short completion time and is user friendly. It can therefore be implemented as a standard tool for screening of whole in- and outpatient populations in acute psychiatry, provided its validity justifies this. The forerunner of the V-RISK-10, the Preliminary Scheme, Ps33[III] was inspired by the HCR-20, but our present 10-item version is substantially different from the Ps33 and also from the HCR-20. For instance, four of the items are of a composite type, signifying that both past and present identification of the individual risk factor may be the basis for a complete score. Validity testing for the whole screen has shown good results in materials of high numbers of subjects. Of further interest is that the screen showed an independently good predictive validity even if "previous/current violence" had not been recorded.

4.2.1.2 Single-item findings

1: Previous and/or current physical violence and

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

No research contradicts the notion that previous violence is, by far, the dominating item in violence risk assessment[19, 27, 33, 129, 130]. This is also confirmed in our research[III, IV, V]. However, it is interesting that we found that the closely related, but not identical, item 2 (threats), gave an even higher odds ratio in predictive validity, though both were highly significant. This regards both in- and outpatient violence, underlining the relatedness between the two items. The finding that threats within psychiatric facilities should be taken seriously is to our knowledge new evidence in the violence risk field.

3: Previous and/or current substance abuse

At first glance, the inpatient validation of this item gave a surprising result of being non-significant[IV]. Drug abuse has empirically been demonstrated as a strong violence risk factor[34]. We believed, however, that our finding was influenced by the control measures taken to prevent abuse and its negative consequences in the inpatient setting. The outpatient validation[V] yielded significant results that were in line with our earlier findings[III].

4: Previous and/or current major mental illness

This item showed a high significance in the inpatient setting; in the outpatient still significant, but less strong. The outpatient findings are in line with what we found in the preliminary study[III], and may have something to do with the relatively high number of patients with psychotic illnesses in the acute facilities, weakening the discriminatory effect of this item here[III]. Furthermore, these findings may support critical opinions[33, 34] about overrating major mental illness per se as a dominant cause of violence.

5: Personality disorder

This item, without further specification, has shown itself to have a very low significance in all our studies[III, IV, V], and therefore not to be a significant risk factor for violence. We believe that this finding has been caused by the broad spectrum of different personality disorders covered in the DSM-IV and ICD-10. In our opinion there are no theoretical or empirical reasons to expect that persons characterized by inhibition or avoidance traits should bear the same risk of violence as those with antisocial traits. In fact, this finding seemed to show that many personality disorders reduce the risk of physical violence[IV]. Consequently, from 2008, we have changed the scoring instruction of the item to imply only eccentric, impulsive and uninhibited types of personality disorder. In future studies we will test to see if this results in an expected better validity of the item.

6: Shows lack of insight into illness and/or behaviour, and

7: Expresses suspicion

There is some empirical support for these factors being valid risk indicators [III, 131]. Good predictive validity was found both in the in- and outpatient phase, except for a borderline value for item 7, after one-year follow-up.

8: Shows lack of empathy

This item is expected to reflect only one of the two original components of psychopathy[68]. In spite of this, the item was highly predictive in both the in- and outpatient settings[III, IV, V].

9: Unrealistic planning

High significance in both in- and outpatients was found [III, IV, V]. Relatedness between this item and item 6, Lack of insight, was demonstrated through multivariate design[IV].

10: Future stress-situations

This item is used to assess violence risk as a function of the effect of stressful conditions and the individual's ability to cope with such situations without violent acting out. It also showed good predictive validity.

Since 2008 the screen has been listed as the first instrument for violence risk screening in clinical psychiatry from the Norwegian Directorate of Health. It is also in use in central parts of Sweden, and in Wales and China.

It is important to repeat and call attention to the fact that another Norwegian screen for inpatient violence risk assessment, the Brøset Violence Checklist (BVC)[26], has existed since the late 1990s, and has been well validated and widely implemented in and outside our country. This is a screen consisting of purely present-state dynamic items, and it is ordinarily administered within 24 hours after assessment. The V-RISK-10 also predicts for the whole inpatient context and is validated for use in both brief and longer inpatient periods, in addition to the period after discharge. Another asset of the V-RISK-10 is that it comprises historical, clinical and risk management items.

4.2.2 General methodological considerations regarding our validation studies

4.2.2.1 Specificity in assessment and outcome recordings

Assessments of risk of violent acts can be all-or-nothing assessments or can include both threats and physical acts in differentiated intensities and frequencies[79]. Methods of recording violent acts can be similarly diverse[18, 77]. Cut-off scores have been associated with provision of dichotomous predictions of aggressive potential (e.g. [117, 132]), but the use of such methods has to a large extent been replaced by new approaches, especially the Receiver Operating Characteristics (ROC- analysis)[133]. This method was introduced as a statistical approach to risk assessment in the early 1990s. The results are given by curves where each plot is based on the balance between the true positive rate (Sensitivity) and the false positive rate (1-Specificity) in all threshold values. The greater the area yielded between the curve and the straight diagonal line that marks "chance" -- the area under the curve (AUC) -- the better the result will be deemed. In the past few years ROC analysis has become increasingly used in the validation of violence risk assessment. The method is often referred to as a gold standard in this field. It has lately been critically analysed, but not at all discarded, even though the criteria for high precision have been sharpened[120].

4.2.2.2 Outcome measurement methods

Several studies (e.g.[118, 134]) rely on retrieving outcome information from criminal records alone. This approach has been assessed to have definite limitations[135, 136], because much of the important, though less serious, aggression/violence will almost solely be traced in patient records and in patient/next-of-kin interviews. One of the best methods for risk assessment research was used in the McArthur Violence Risk Assessment Study[19], which collected data from multiple sources, such as self-reports, collaterals and official records.

4.2.2.3 Prospective, pseudo-prospective or retrospective study design

In the mid 90s a review of risk assessment with prospective designs was conducted using the following definition criteria: Separate predictions of aggression for each individual made from a set of predictor variables and recordings of aggressive outcomes in a subsequent follow-up period[79]. Retrospective designs do not contain a sequence with assessment followed by prospective follow-up measurement. The same goes for pseudo-prospective designs where assessment is made retrospectively based on existing medical/psychological patient records . The assessment is then compared with the actual rate of violence that the patient was involved in after that time. Retrospective designs are often used in case-control studies, but it seems likely that the prospective studies in general carry even higher relevance than the others, because data in retrospective studies were not originally collected for research purposes[137]. A very large proportion of research on risk assessment instruments has been performed with retrospective designs[24, 118, 134]. Some prospective studies also exist, however, such as the earlier mentioned McArthur Study[19] where 939 patients were assessed for risk factors in the hospital and then monitored for aggressive incidents for 20 weeks after discharge. This is probably the best known prospective study conducted so far.

4.2.2.4 Prediction; assessment; judgment; types of instruments

These terms also present definition challenges. The word *prediction* has been used frequently, as, for example, in phrases like "predictive ability" and "prediction of dangerousness". The recent use of this concept pertains mainly to a statistical/psychometric interpretation of the term. Historically, the concept *prediction* was replaced by *risk assessment* when the structured clinical tools emerged in the mid 1990s. Anyhow, it is important to remember that violence risk assessment must be a dimensional, and not a categorical, task[138].

Regarding the two main approaches to risk assessment, the actuarial and the structured clinical, the former has been subject to strong critique in recent years[128]. This sparked

counter-arguments and illustrative discussions in the field of violence risk assessment in 2007[139, 140]. At the heart of the critique has been the group-based approach in actuarial instruments, which lack risk management and contextual factors and arrive at an unconditional conclusion in the form of a risk estimate. This approach is in contrast to the basis for assessments by structured clinical instruments. The so-called Vancouver group seems to have gone even a step further from their original structured clinical instrument (HCR-20), discussing replacing "Risk prediction/assessment" with "Structured Professional Judgement (SPJ)" and leaving out all use of numerical figures in clinical assessments[122]. This approach indicates future options and developments in the field

4.2.2.5 Outcome validation: "true" and "false" predictions

The outcome validation can be simply illustrated by a figure comparing instrument-based predictions and outcomes.

Prediction	Outcome	
	Violent	**Not violent**
Violent	*"True Positive- TP"*	*"False Positive-FP"*
Not violent	*"False Negative-FN"*	*"True Negative-TN"*

The numbers which can be inserted in the figure, allow for calculations of so-called Positive (PPV) and Negative Predictive Value (NPV). Through formulas, PPV = TP/(TP + FP) and NPV = TN/(TN + FN), these are estimated in percentages. As discussed earlier, it is important to remember that the predictions in the figure do not constitute categorical prophecies, but probabilities linked to cut-offs in the instrument scores. Here, base rates of violent acts are of special importance, and a primary rule is that the lower the base rate, the lower the PPV[79]. Normally, base rates are clearly dependent on the observation time for recording, which is very short in, for example, acute hospital wards, leading to low PPVs even for effective risk assessment methods. A high NPV, meaning few false negatives, is probably a more important goal in instrument validation. Another value apt to be used in validation of risk assessment is "Number Needed to Treat" (NNT), an epidemiological measure used in assessing the effectiveness of a health care intervention, typically for patients treated with medication compared to untreated control subjects. NNT is the number of patients needed to be treated to avoid a bad consequence, defined as the inverse of absolute risk reduction, with the ideal number being 1. Violence risk assessment may be compared to the treatment intervention; effective assessments should have a low NNT. The related phrase "Number Needed to Detain" (NND) is also used, meaning how many patients need to be kept in hospital to avoid discharge of one violent patient.

4.2.2.6   Validation by ROC analysis

This statistical method[133] is described in 4.2.2.1, and it is today the most frequently used statistic in validation studies of risk assessment tools (e.g.[25, 113, 118, 134]).

4.2.2.7   Ethical issues

Ethics in medical and psychological research and practice cover a variety of issues. In research, the foremost objective is to avoid doing harm, in particular, by violating in various ways the autonomy of the individual participant. In the case of medication, this could mean physical harm caused by medication and other types of treatment trials. In all types of investigations, it could refer to psychological harm and violation of patient confidentiality. It also could involve harm to future patients and surroundings if the research methods are inferior and thereby result in poor evaluation and treatment.

In studies of treatment effect, randomised control trials (RCT)[141] are usually viewed as the best method for achieving evidence-based results. In studies of violence risk the assessment procedure *per se* is not directly producing comprehensive change measures for the patient, as opposed to what is the case in treatment studies. When an empathetic interview style is practiced, the mere fact that violence is mentioned should not be inducing noticeable changes in the risk for such acts. It is important in the design of such studies that assessors of risk and recorders of violent acts are not the same persons and that the recorders are unaware of the assessment results. Ideally, the assessment results will remain completely hidden from the in- or outpatient setting in the follow-up of the assessed patient, so that the assessments *per se* could not give rise to preventive measures, which in their turn could mask the validity of the risk instrument. This would however be a violation of clinicians' duty to warn, because destructive acting out by a patient with high risk could have been prevented with proper risk communication from the assessors. In such studies a randomised controlled trial is very difficult to design, and a naturalistic cohort study will be the pragmatic choice. The ethical consideration must always lead to open communication of an assessed higher risk, irrespective of what scientifically might be desirable.

Compared to experimental studies involving treatment interventions, the validation of violence risk assessment instruments seem to carry less ethical hazards than treatment trials, provided the above-mentioned considerations are practiced.

4.2.2.8 Numerical scores or not?

During a validation research process, it is central and necessary to use numerical scoring of each item and also the sum score of the screen. For ordinary clinical use, a method for structured clinical instruments, the earlier mentioned "Structured Professional Judgement-SPJ"[122] is emerging. Here, it is not recommended to use numerical scores for risk determination. This concurs, even though partly, with the use of the HCR-20. The latter indeed employs numerical scores in clinical use, but does not give cut-off scores to differentiate between low, medium and high risk, which has to be determined by the evaluator's judgment.

Regarding the V-RISK-10, at present we advise clinical use without numerical scoring, practicing the ideals of the SPJ.

4.3 Limitations

4.3.1 Relationship between prison and mental health bed capacity (Paper I)

Exact numerical calculations of therapeutic and control activities outside the bed-based institutions do not exist in official statistics, and the restriction to intramural activities was a limitation. Furthermore, the length of stays in both systems was not registered in this study, which was based on statistical information only, as was the case in the original Penrose paper[3].

4.3.2 Base rates and diagnostic prevalence (Paper II)

A direct method using standardised diagnostic interviews with a representative sample of Norwegian inmates could have given more exact estimates for mental disorders, including personality disorders. The benefit of repeated studies regarding rates of personality disorders in prisons with structured clinical tools has been somewhat questioned[5], but the total lack of personality disorder assessments still constitutes a limitation in the thesis.

4.3.3 Validation of the V-RISK-10 (Paper III, IV, V, VI)

4.3.3.1 Underreporting of less serious violent outcomes, in- and outpatient studies

Even in thorough clinical follow-up interviews with recordings of violent acts from patients and staff, from family or other collaterals, there will be some underreporting. This happens for a number of reasons such as people having different attitudes about what is grave enough for reporting, eventual irrational positive counter-transference in recorders, and other

confounding factors like intense time-pressure in the workplace. The base rates in our studies therefore generally must be considered as minimal estimates. Regarding outpatients, criminal charts of different kinds can give important additional information. However, earlier international studies[135, 136] indicate that the gain is small. We collected such data in patients discharged from one of the acute departments in the study described in our Paper V. These carefully collected data only provided a quite small supplement to what was recorded from the clinical follow-up. Therefore we have reason to believe that the lack of such data from the other wards does not substantially influence our results.

4.3.3.2 Limitations pertaining to the naturalistic design, ethical issues

This topic has been more extensively discussed in 4.2.2.7. Ethical considerations led to our choice of design which included open communication of an assessed *high* risk from the raters to the ward personnel and the outpatient follow-up systems. This may possibly have instigated special preventive measures towards high-risk patients and hence may have caused an increase in false positive predictions. A design in which risk assessments systematically were hidden from the nursing staff might have decreased rates of the false positives and correspondingly increased ROC-AUC values – that is, had better results scientifically. Even if we do not have empirical evidence from our study about this possibility, our choice of an open, naturalistic design was a limitation. The alternative would, however, have been an unethical violation of clinicians' duty to warn of imminent risk. The balance between the demands of scientific rigour and clinical reality is not always easy to keep.

5 Future research

5.1 Similarities and differences between correctional and mental health populations

The rates and severity of violence in both correctional and mental health populations are not yet comprehensively investigated. Direct comparative studies regarding pre-admission and pre-trial violence in general psychiatric and prison populations are needed to improve our understanding of the relatedness and reciprocity between the populations in intra-institutional contexts. Violent recidivism post-discharge and post-release seems also apt for comparative studies.

Renewed and refined studies of symptom and personality disorders in prisons will improve the understanding and treatment of psychiatric ailments and disorders in prison and probation settings. There is also a need of strengthened research efforts in therapeutic and supportive activities in this field. One area where this is especially needed seems to be identification and treatment of adult AD/HD in prisons and probation. A main subject in this will be the challenges of central stimulant medication regarding the high co-morbidity with personality disorders and substance abuse.

5.2 Future research on the V-RISK-10

New studies that focus on the predictive validity of single items of the V-RISK-10[142] are recommended. In this respect item 5, Personality disorder, is of special relevance. In the validation research described in this thesis, scores on this item had very low validity. The item has now been revised to only cover Cluster A and B personality disorders. Further development of the screen requires validity tests of the revised item. Another probably relevant revision would be to restrict the content of item 4, Major mental illness, so that it comprises mainly the paranoid psychotic conditions. This would be in line with modern research findings, referred to earlier in this thesis, but would also need further validity testing. The same also pertains to a planned version of the screen for assessment of youth under the age of 18.

Future research should also test the instrument in other psychiatric settings, such as primarily outpatient facilities. This kind of validation has already been instigated in Norway and, as mentioned, Sweden and Wales. There is also a need for research on the validity of the V-RISK-10 in still other countries and cultures. The screen has also been translated to Russian and Chinese. Validation studies are contemporarily performed in the latter country.

It would also be of interest to develop and validate a version of the screen for use by the police and in correctional facilities. A single blind study comparing the psychometric properties of V-RISK-10 and HCR-20 in the prison service has recently been conducted[143]. High correlations between the instruments were obtained in this small-scale study. However, as expected, it took considerably less time to accomplish the V-RISK-10. This may be an introduction to further research on the screen in police, prison and probation settings.

6 Concluding remarks on the thesis' findings

The main focus of the thesis is the interface between the mental health and the correctional system, particularly the association between mental disorder and interpersonal violence. The presented studies fall in two related parts.

The first part is represented by two papers/studies. Even if this part is less extensive than the second one, I deem it to be an important part of the thesis. The aim of the two studies was to identify links between mental disorders and violence outside the mental health system per se. This is important for understanding the entirety of the complex of mental disorder/violence. Paper I outlines a longitudinal study of the sizes of the prison and the mental health systems in Norway, both bed-based. The study demonstrated that over the last 40 years the deinstitutionalisation process in mental health was paralleled by an increase in prison beds. The same period showed an almost ten-fold increase in violent crimes. Paper II, which is the first nationwide study of mental symptom disorders in Norwegian prisons, demonstrates much higher prevalence rates than in the general population. This was interpreted to partly be a result of the mental health deinstitutionalisation. The findings are further important for a proper size and quality of the prison health services. Regarding the increased violence in society, we have also concluded with a certain association with the deinstitutionalisation, even if general sociological factors seem to play a more important role in this increase.

The second part of the thesis comprises the four papers, III through VI. These present findings of violence rates among patients in acute general psychiatric care, both during hospital stay and in after-care. Results for the inpatient phase confirmed earlier Norwegian findings; for the after-care period a prevalence of violence was determined for the first time in Norway. The results of the studies seem strengthened by the large number of subjects studied and the variety of settings included. International studies using methods related to ours suggest a level almost identical to our findings. These findings are important for the attention to, and further the assessment and management of, interpersonal violence in general psychiatry. Our aim was to develop a brief, reliable and valid instrument for screening of violence risk. This process is depicted in the four papers, where, in a stepwise process, a constructed preliminary scheme of 33 items was reduced to a 10-item screen, the V-RISK-10, through validity testing by ROC analysis and logistic regression. The screen showed very good predictive validity both for large numbers of in- and outpatients. It was further found to be easy to use with a short consumption of time. It is now used extensively in

Norway and Sweden and to a lesser extent elsewhere, and it appears to be a valuable supplement to violence risk assessment in general psychiatry.

The benefit of instrument-based compared to pure global clinical risk assessment only is a theme in an ongoing international discussion. Critics may say that a brief screen will provide nothing more than a careful clinical assessment would. The latter is however always the ultimate phase of every risk assessment; what a screening checklist offers is decisive additional help against overlooking important components of the assessment that might be caused by, for example, pressures of time, irrational counter-transference, or random lack of concentration. Some may claim that history of earlier violence is the only item necessary to record. To this we point to the fact that the V-RISK-10 showed predictive validity also where no earlier violence had been detected.

Is it possible to have a sufficient knowledge of the patient to complete the screen in 2-10 minutes during the admission phase?

Even if the screen is meant to be the last part of the admission medical record process, it must often be completed with limited knowledge of the patient. However, in Norwegian acute psychiatry, roughly half of the patients have been hospitalised in the department before, and for these, records with all the primary information exist at admission. In addition, Norwegian acute wards are not walk-in clinics, and a justifying application from an external doctor is required for every admission.

Can findings from two Norwegian acute psychiatric units be generalized to other units/systems?

The screen was validated among an extensive acute hospital population from two different parts of the country. Nonetheless there is a considerable need of testing in other settings such as other types of bed-based wards and in primarily ambulatory units. This need pertains also to versions for the police and correctional systems. Regarding use in other countries, validation research is necessary due to possible cultural and professional differences that might have an influence. As mentioned, this kind of research is presently being undertaken.

7 References

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8 Papers and appendix

PAPERS I - VI

Paper I
Hartvig P, Kjelsberg E. Penrose's Law revisited: the relationship between mental institution beds, prison population and crime rate. Nord J Psychiatry 2009; 63: 51-56.

Paper II
Kjelsberg E, Hartvig P. Can morbidity be inferred from prescription drug use? Results from a nation-wide prison population study. Eur J Epidemiol 2005; 20: 587-92.

Paper III
Hartvig P, Alfarnes SA, Skjønberg M, Moger TA, Østberg B. Brief checklists for assessing violence risk among patients discharged from acute psychiatric facilities: A preliminary study. Nord J Psychiatry 2006; 60: 243-8.

Paper IV
Hartvig P, Roaldset JO, Moger TA, Østberg B, Bjørkly S. The first step in the validation of a new screen for violence risk in acute psychiatry: The inpatient context. Eur Psychiatry 2010; 25: e-pub ahead of print.

Paper V
Roaldset JO, Hartvig P, Bjørkly S. V-RISK-10: Validation of a screen for risk of violence after discharge from acute psychiatry. Submitted, and in second review Br J Psychiatry.

Paper VI
Bjørkly S, Hartvig P, Heggen FA, Brauer H, Moger TA. Development of a brief screen for violence risk (V-RISK-10) in acute and general psychiatry: an introduction with emphasis on findings from a naturalistic test of interrater reliability. Eur Psychiatry 2009; 24: 388-94.

II

III

IV

V-RISK-10: Validation of a screen for risk of

violence after discharge from acute psychiatry.

John Olav Roaldset, Pål Hartvig, Stål Bjørkly.

Background

Current violence risk assessment instruments are time-consuming and mainly developed for forensic psychiatry. A paucity of violence screens for acute psychiatry instigated the development and validation of the V-RISK-10.

Aims

To test the predictive validity of the V-RISK-10 as a screen of violence risk after discharge from two acute psychiatric wards.

Method

A prospective naturalistic study with 381patients who were screened at discharge. Incidents of violence were recorded 3 and 12 months post-discharge.

Results

The ROC-AUC values for any violent behaviour were 0.80 and 0.75 ($P <$ 0.001) for the two measurement points. The most accurate risk estimates were obtained for severe violence. For persons without a known history of violence prior to the screening AUCs were 0.74 ($P =$ 0.004) and 0.68 ($P =$ 0.002).

Conclusions

Results indicate that the V-RISK-10 is a valid and clinically useful screen for violence risk in acute psychiatry.

Assessment and management of a patient's risk of violence toward others after discharge from psychiatric hospital is an important challenge to clinicians. However, there is a lack of standardised risk assessment tools suitable for use in acute psychiatry. This paucity has been met by two different approaches. The first implies the use of unstructured clinical risk judgments.[1,2] Results from validation studies, however, have not encouraged reliance on unaided judgment of violence risk.[3] The other approach involves attempts to adapt forensic risk assessment tools to civil psychiatric patients, and the forensic tools have proven to be valid in general psychiatry.[4-6] However, their use requires specially qualified professionals, and they are time-consuming. This may partly explain why evidence-based assessment instruments are not used routinely in contemporary mental health services.[7] Also, recent research has questioned the extent to which these instruments are able to take into account risk factors that differ between civil and forensic patients.[8] In spite of good results at the group level, high rates of false predictions have been cited as one of the main reasons for claiming that the predictive values of these instruments are limited on the individual level.[9,10]

In our first review of the literature the Classification of Violence Risk (COVR) turned out to be the only risk assessment instrument developed and validated for use in civil psychiatric facilities.[11,12] The COVR is a computerised actuarial regression tree procedure for comprehensive risk assessment before discharge. However, results from the validation study of the actuarial model have been criticized for exhibiting low positive predictive power, and further validation studies remain to establish its predictive validity.[12] When the literature review was

expanded to also include screening instruments for risk of violence, we found two screens. The Clinical Assessment of Risk Decision Support (CARDS) is a two-stage assessment, with a screening and a full risk-assessment phase.[13,14] According to the findings in our review this instrument is not validated.

Wotton et al. have recently developed a five-factor screen model for risk of violence based on age, gender, violence history, drug abuse and personality disorder.[15] A validation study of 2 years' post-discharge recorded violence yielded an area under the Receiver Operating Characteristics (ROC) curve (AUC) of 0.73. However, the screen was developed only for screening of psychotic patients, and patients with a primary diagnosis of substance misuse or a diagnosis of organic brain damage were excluded.

The paucity of validated "easy-to-use" screens for evaluation of acute psychiatric patients' violence risk justifies development and validation of new screening tools. The Violence Risk Screening-10 (V-RISK-10) was developed for this purpose.[16-18] In the present study our objectives were (a) to investigate the predictive validity and clinical usefulness of V-RISK-10 as a screen of violence risk 3 and 12 months after discharge from two acute psychiatric facilities and, specifically, (b) to test whether the instrument was able to detect risk in patients with no known history of violence.

Method

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.

Setting

The design was a naturalistic prospective follow-up study at two acute psychiatric units at Aker University Hospital (n = 43 beds) and Ålesund Hospital (n = 38 beds) in Norway. The units cover a catchment area of about 160,000 inhabitants of an urban setting and 130,000 inhabitants of a combined small-town and semirural population, respectively. Both units were differentiated into closed emergency, closed sub acute and open sub acute wards.

Subjects

All involuntary and voluntary admitted patients (N = 1,017 patients, 1,446 hospitalizations) were included in the investigation that lasted from January 2006 to July 2008. Aker received 528 patients with 730 hospitalisations, and Ålesund had 489 persons with 716 hospitalisations. Demographic and clinical data are shown in Table 1

Insert   Table 1 about here

Procedure

After the initial examination and information collection at admittance, the physician on duty scored the V-RISK-10 for the hospital stay period (Hartvig et al.,

submitted). Patients received written and verbal information about the project

shortly after admission. The ward staff recorded in-patient violent episodes

continuously.

As part of the discharge procedure, the physician, psychiatrist or

psychologist in charge did a second V-RISK-10 screening for the subsequent year

after discharge. In accordance with routine practise, the scores were based on

clinical and collateral information obtained during hospital stay. The V-RISK-10 at

admission was available when V-RISK-10 was scored at discharge, but scores

from prior hospital admissions were not available if the patient was admitted again.

No other risk assessment tools were used in the wards during the study.

At 3, 6, 9 and 12 months after discharge, the project assistant sent the

standard recording form to the patient's therapist at the outpatient psychiatric clinic

and at the district psychiatric wards, to record violent episodes for the 0-3, 4-6, 7-9

and 10-12 months periods. District psychiatric wards offer a broad range of low-

level psychiatric services to voluntarily admitted patients. For the patients

discharged into community, the project leader sent the recording form to the

patient's primary nurse at the acute ward at the four measurement points. The nurse

subsequently contacted the patients by phone and recorded community violence for

the individual follow-up period. The V-RISK-10 ratings were not available to the

recording staff. The local research coordinator systematically collected data

concerning the 3, 6, 9 and 12 months follow-up from hospital records. Information

concerning violent crimes was gathered from criminal records, but only for patients

discharged from the acute unit at Ålesund Hospital. Patients who were recorded at least at one of the four follow-ups were included.

If a patient was readmitted to the acute ward during the study period, his trial file was closed, after occurred violent episodes in that post-discharge period were recorded. The patient was then included with a new file number.

Measures

Information concerning gender, age, length of hospital stay, judicial status at admission and discharge, and ICD-10 diagnosis at discharge was obtained from hospital records and included as demographic variables.

V-RISK-10

The development of V-RISK-10 was based on a 33-item screen (Ps33),[16,19] inspired by the HCR-20 risk assessment scheme [20] and the Brøset Violence Check-list.[21] Two 1-year follow-up studies of in-patient violence ($n = 500$) and post-release community violence ($n = 110$) gave an overall AUC of the Ps33 total score of 0.71 ($P < 0.001$). Statistical tests disclosed that the predictive accuracy estimates were even better for a brief screen, and on this basis the V-RISK-10 was developed.

V-RISK-10 consists of 10 items: 1. previous or current violence, 2. previous or current violent threats (verbal or physical), 3. previous or current substance abuse, 4. previous or current severe mental illness, 5. personality disorders, 6. lack of insight into illness or behaviour, 7. suspiciousness, 8. lack of empathy, 9. unrealistic planning and 10.

exposure to future stress situations (www.forensic-psychiatry.no).[17] Only the

demarcation of the operational definition of item 1, the content of item 7, and the

composite definition of *stress* in item 10 make the V-RISK-10 somehow different from

other risk assessment tools.

The scheme contains a brief scoring instruction for each item. The

individual item is scored on a 4-point scale: (i) *No - not present,* (ii) *May be or*

moderately present, (iii) *Yes - definitely present*, or (iv) *Don't know, too little*

information.

Before the project started, all V-RISK-10 raters (psychiatrists, medical doctors,

psychologists) went through a brief introduction lesson. Then 15 short cases extracted

from medical records were rated independently by each participant. New raters followed

the same tutorial procedure before taking part in the project. Based on the 15 vignettes, a

preliminary interrater reliability test ($N = 30$) yielded an intraclass correlation coefficient

(ICC) of 0.87 for the whole instrument. Lately, a naturalistic interrater reliability test of

25 un-experienced medical doctors and 73 patients yielded an average measure of ICC of

0.77 and a single measure of 0.62.[19] Raters reported that it took between 2 and 10

minutes to score the screen after the initial examination at admission.[19]

Outcome measures

Definition of *violence to others after discharge* was based on definitions used in

other recent studies. [12 22] It included the following severity categories: violent acts,

less severe violent acts, and threats of violence. *Violent acts* were acts of battery

that resulted in physical injury, sexual assault, and any assaultive act that involved

the use of weapon. *Less severe violent acts* were defined to be kicks, blows, knocks and pushes that did not cause physical injury. *Threats of violence* was operationalised as verbal and non-verbal communication conveying a clear intention to inflict physical injury upon another person.

The violence record form was designed as a check-list and contained detailed scoring instructions for each violence category. The score was either *No, Yes,* or *Don't know.* Prior to the study, staff at all sites were trained in recording violent behaviour. Data from criminal and police records concerning violent threats and acts included convictions, charges, and withdrawal of charges for violent crime by reason of insanity were combined with hospital data in a common outcome variable.

Statistics

Data were analysed using SPSS version 16.0. Independent and dependent variables and the use of statistical methods were determined before the study started. Statistics were computed for discharged patients at the four measurement points (3, 6, 9 and 12 months after discharge). Results are only presented for violence during 0-3 and 0-12 months because including the second and third measurement points did not bring significant changes in the results.

For the statistics of V-RISK-10, the first three points (*no*, *may be*, and *yes*) were counted 0, 1 and 2, respectively. *Don't know* and missing items were handled in two ways: they were scored as a "no" (0), and they were "prorated" according to the following formula: (this omitted item's mean for non-missing cases)*(the

patient's total score on his non-missing items)/(mean score for all patients on this patient's non-missing items).

Don't know answers in the recording schemes were handled as missing and excluded. One person could belong only to one category, and if more than one category of violence against others was present, the most severe category was chosen.

For persons with more than one admission during the study, the discharge period with the most severe violent episode was chosen. If two or more episodes with similar severity had occurred, the first episode was chosen as positive identification of violence for the analysis. "Any violence", a composite outcome variable, was constructed to include all persons with recorded threats, less severe or severe acts.

Our primary concern was that one patient should only count once in the statistics. Due to the very low number of patients with more than one hospitalisation and additional ("new") violence after discharge, the statistical power in our material is too low to test if the V-RISK-10 scores at different discharges were differently associated with different types of aggression.

Statistics were also computed for all post-discharge periods to compare the effect of readmissions.

The chi-square test was used for categorical variables, and Student's *t*-test and the Mann-Whitney test were used for continuous variables. The area under the curve (AUC) of the Receiver Operating Characteristic (ROC) analysis was used to assess the predictive accuracy of V-RISK-10 total score. The ROC-AUC is less

dependent on the base rate of the criterion variable than other traditional measures of predictive accuracy. [6,23,24]

Uni- and multivariate logistic regression analyses were conducted to obtain effect size estimates. Exp (B) was used as odds ratio for occurred episodes, and the progression in chi-square values to test the relative contribution of each factor or category of factors to the model. Cox & Snell R^2 and Nagelkerke R^2 were used as lower and upper estimates of the explained variance or "model fit", that is, how much of the total variance of the outcome variable that can be explained by the actual model.[25,26]

The following predictive validity estimates of the V-RISK-10 were also computed: sensitivity (how many of the violent patients have a positive test), specificity (how many of the non-violent patients have a negative test), positive predictive value (PPV; how many patients with a positive test are violent), negative predictive value (NPV; how many patients with a negative test are not violent) and number needed to detain (NND; how many patients it would be necessary to detain in hospital to avoid the discharge of one violent patient). PPV, NPV and NND give important information about the applicability of screening tools and will change with the use of different cut-off values of V-RISK-10.

Results

Missing Data Analysis

One year post-discharge, 381 patients (55 at Aker; 326 at Ålesund) had been recorded at follow-up, and 609 (446 and 163) patients were missing. There was a low follow-up rate at Aker because the research assistant changed employer and was not replaced for financial reasons. Characteristics of the follow-up and the missing samples and comparison of the two samples are shown in Table 1. Complete screening forms with all items answered *no*, *maybe/moderate*, or *yes* were obtained for 270 patients (71%); 96 (25%) had 1 to 3 omitted items (missing or *don't know*), and 18 patients (5%) had 4 or more. The mean total score of V-RISK-10 (95% CI) was 6.4 (5.9 - 6.8). When prorated the score was 6.7 (6.2 - 7.2) and 7.5 (6.9 - 8.2) for men and 5.7 (5.0 - 6.3) for women. Some differences between the AUCs and odds ratios emerged when we compared data with up to 3 prorated items with data without prorating. In accordance with this, all statistical analyses were conducted with prorating for V-RISK-10 scores with 3 or less omitted items.

Prevalence of Violence

Follow-up 3 months post-discharge showed that 69 (21%) of the discharged patients had expressed violent behaviour (threats, less severe and severe violent acts), and for 1-year follow-up, 101 patients (28%). Thirty-two percent of the males and 20% of the females had been involved in any violence (see Table 3). Including readmissions, total violence rate decreased to 18% and 25%, respectively. The violence rates in the subgroup of patients without a known

history of violence (*No* or *Don't know* score on items 1 and 2, *n* = 211) were 7% at

3 months and 13% after 1 year.

From the criminal record, 12 patients (4%) and 21 patients (6%) were

identified 3 and 12 months after discharge, respectively. Five patients that dropped

out during the follow-up period were identified with violence in the criminal

records. The diagnoses were substance misuse (10 patients), personality disorder

(3), "observation of mental or conduct disorders" (Z03.2) (3), ADHD

(hyperactivity) (2), bipolar disorder (1), obsessive-compulsive disorder (1), and

mental retardation (1). The Z03.2 was used when the symptoms that had emerged

during the hospital stay were not sufficient to give a specific diagnosis. Patients

diagnosed with substance abuse disorders, personality disorders and Z03.2

accounted for 35% of the violence in the combined clinical and criminal records

and for 80% of the violence obtained from criminal records.

Predictive Validity and Characteristics

Table 3 shows the predictive validity of the V-RISK-10 for subsequent violent

threats and less severe and severe violent acts at 3 and 12 months after discharge,

when stratified for gender.

insert Table 3 about here

AUC's (95% CI) of any violence for completed V-RISK-10 schemes (*n* =

270) were 0.83 (0.77- 0.88, *P* < 0.001) at 3 months, and 0.78 (0.73- 0.84, *P* <

0.001) after 1 year. For the prorated schemes with 1 to 3 omitted items the AUC's

(95%CI) of any violence were 0.76 (0.64 - 0.89, *P* = 0.001) and 0.68 (0.57 - 0.80,

$P = 0.006$), respectively. Schemes without prorating had almost identical results for any violence, but differed when categorising for severity and across genders.

Results did not change when statistics were re-computed with all admissions included.

Controlling for other variables

Table 4 shows univariate and multivariate analysis of V-RISK-10 and the other variables that were significant risk factors of violence. The length of hospital

insert table 4 about here

stays did not have a normal distribution. A stay shorter than 4 days (the 25th percentile) showed an OR of violence at 3 months of 2.2 (95% CI 1.3- 3.9, $P = 0.005$). A stay shorter than median 8 days showed OR of violence at 3 months of 2.0 (95%CI 1.2 - 3.4, $P = 0.012$). The results after 1 year were about the same. For the mean hospital stay (18.8 days) and the 75th percentile (19 days), and for longer stays, no significant differences were found.

Incremental validity

V-RISK-10 items were grouped into four categories: 1. "Violent" (violent acts and threats), 2. "Diagnostic" (substance abuse, major mental illness, personality disorders), 3. "Present" (symptoms) (lack of insight, suspiciousness, lack of empathy) and 4. "Future" (unrealistic planning, stress exposure). All four categories were significant in the univariate analyses (Table 5A).

Insert Table 5 about here

The increase in variance when the four categories were entered in a stepwise procedure is shown in Table 5B. The chi-square increase by dynamic factors ("present" and "future") upon historic factors ("violent" and "diagnostic") was 11.5 (d.f.= 5, $P = 0.040$) at 3 months, and 5.0 (d.f.= 5, $P = 0.49$) after 1 year. [

A cut-off value of 4.5 gave estimates of sensitivity and specificity at 3- and 12-months follow-up of 0.96 / 0.48 and 0.89/ 0.49, respectively. This cut-off value turned out to be optimal for risk *screening* in this sample. Corresponding PPVs at 3 and 12 months were 0.33 and 0.40; NPV values were 0.98 and 0.92; and NNDs, 3.0 and 2.5 patients, giving 133 false positive patients (67%) and 3 false negative patients (2.3%) at 3 months, and 136 (66%) and 11 (7.8 %) after 1 year.

Persons without a known history of violence

Separate analyses were conducted for patients with *zero* and *don't know* scores (see Table 3B). Mean V-RISK-10 total score (95% CI) was 3.9 (3.4 - 4.3) for patients with two *zero* scores on the two items and 7.2 (5.4 - 9.0) for patients with two *don't know* scores. For patients with at least one item with a 1 score (moderate) the mean score was 8.4 (7.5 - 9.2), and 11.3 (10.6 - 12) for at least one 2 score (severe). Only seven patients had one *zero* and one *don't know* score.

For the patients with two *zero* scores on the violence items, major mental illness (OR = 2.5, 95% CI 1.1 - 5.8, $P = 0.036$) were the only significant individual items of violent behaviour at 3 months. After 12 months, substance abuse (OR = 2.2, 95%CI 1.7 - 13, $P = 0.002$) was the only significant item. For patients with either *zero* or *don't know* scores the significant factors at 3 months were suspicion

(OR = 2.1, 95%CI 1.0 - 4.3, P = 0.040), unrealistic planning (OR = 3.1, 95% CI

1.4 - 6.5, P = 0.004, stress exposure (OR = 2.6, 95%CI 1.2 - 5.6, P = 0.016).

Substance abuse was the only individual item that was significant after 1 year (OR

= 2.0, 95% CI 1.3 - 3.2, P = 0.002).

Discussion

The follow-up rate of 37% appears to be low, but it is still similar to other

prospective follow-up studies that compare drop-outs with all admissions, without

a selection procedure for inclusion.[27,28] The base rate of violence in our study was

comparable to findings from other recent research.[6, 27]

Main findings

The ROC analyses yielded predictive results with validity estimates that were

equal or better than other research that has used comprehensive risk assessment

instruments.[5,6,11,15,28] Accuracy was high across gender, and the screen identified

risk of severe violence with very high precision. The screen was even significant,

but with decreased accuracy, for patients without a known history of violence.

Since the V-RISK-10 contains no "new" risk items, or combinations of items, the

tool in itself cannot fully explain the good results. As with any study in this field

clinicians may have been more vigilant and monitored violent behaviour more

thoroughly for patients with higher V-RISK-10 scores. Naturally, the opposite

effect that occurred violence in patients with lower scores may have run undetected

is also plausible. Our sample was characterised by a large group of non-violent

persons with low V-RISK-10 scores and a smaller violent group with higher scores. This will give a very high specificity of the lower scores which could have affected the AUC-values.

As expected, assessment was more accurate for shorter than longer follow-up periods. The finding that most of the violent episodes occurred within the first 3 months after discharge concurs with results from other research.[27] The fact that the predictive validity of the V-RISK-10 was very high for severe violence may be a clinically important finding if substantiated by further research. It is also important to emphasize that even when stratified for gender, results remained highly significant. Recent research on persons with serious mental illness has questioned whether men are more prone to violence than women in this group of patients.[22] A screen that is sensitive to violence risk independent of patient gender would be of great clinical value.

The "future" and "present" categories were stronger predictors at 3 months than after 1 year and added significant incremental validity to the model after 3 months. Otherwise, the diagnostic category was a stronger predictor after 1 year than at 3 months, probably due to effects of the hospitalisation. These findings are consistent with the literature. [4][29]

Patients without a history of violence

A history of violence has been demonstrated to be one of the strongest predictors of future violence.[16,30,31] Patients with no previous violence are more difficult to assess, though they still may pose a potential risk to the surroundings. Further

development of instruments that may aid in identifying patients that should be referred for comprehensive risk assessment is a substantial concern in acute psychiatry. Our study indicates that the V-RISK-10 may have good predictive validity as a screen of violence risk in patients without a known history of violence. Despite the fact that AUC values were lower than for patients with an identified history of violence prior to assessment, the significant predictive validity of V-RISK-10 for this group offers some promise for future use of the screen. The V-RISK-10 mean scores and the recorded violence rates indicated that patients in the *Don't know* subgroup were closer to those with a known history of violence than to those with no history of violence.

Another interesting finding pertains to the fact that item 10 (stress exposure), item 9 (unrealistic plans) and item 7 (suspiciousness) were significant predictors of violence at 3 months, and item 3 (substance misuse) after 1 year for this group. Since these items comprise dynamic risk factors that are liable to change, they may successfully be integrated into planning and implementing intensive risk management strategies. Still, it is crucial to emphasize that results from a group study cannot be generalized to be automatically relevant at the individual level.

Clinical and ethical consideration

A challenge in using risk assessment tools is the almost inevitable inverse relationship between false negatives and false positives. In screening procedures it is important to keep rates of false negatives as low as possible without having too

many false positives, and ethical, judicial and cost-benefit issues about high proportions of false predictions have been addressed in previous research. [24,32] A V-RISK-10 cut-off value of 4.5 would imply that all patients with a total score of 5 or more should be detained in hospital or referred to an outpatient clinic for further risk assessment and management. With this cut-off value, the NND at 3 months was 3.0 patients and, after 1 year, 2.5 patients. The theoretical "cost" of this procedure would be to detain 2 patients for unnecessary risk assessments and management at 3 months and 1.5 patients after 1 year, for every correctly detained patient. With successful risk management after discharge, violence could ideally be limited to the rate of false negatives that we found (2.5% at 3 months and 7.5% after 1 year). No *severe* violent episodes were recorded among the false negatives. The lowest V-RISK-10 total score for severe violence was 7.

Information is often limited in an acute psychiatric setting, and a 100% hit rate for all items is not feasible due to the complexity of assessing an individual's risk for violence. One aim of this study was validation of risk screening in a naturalistic setting. The finding that the prorating of up to three omitted items did not improve the predictive validity of V-RISK-10 of any violence is positive in relation to the feasibility issue. However, there were differences across genders and for severe violence. Moreover, the accuracy was higher for completed forms than for forms with omitted items.

The predictive validity of the substance abuse and personality disorders items was low compared to most other studies. There is a risk that personality disorders due to the brief observation time may have run undetected in our

prospective study. A great majority of previous studies have investigated criminal records retrospectively. Persons with a diagnosis of substance abuse, personality disorders and "observation of mental and conduct disorders" accounted for 35% of recorded violence in our total sample and for 80% of the recorded violence in the criminal records. In our catchment area persons with substance abuse and acute violent behaviour are often taken care of by the police before they are examined by a community physician. Admittance to a psychiatric or somatic hospital depends on the conclusion of this examination. Most of the patients will clear up or calm down after a short time in police custody, and it is more likely that they will be released than that they will be hospitalized. If they are hospitalized, a large proportion of alcohol- and drug-intoxicated patients are initially treated in a somatic emergency unit. Only a few are transferred to acute psychiatric wards. Violent persons with personality disorders are usually not admitted to acute psychiatric wards unless they suffer from concurrent severe psychiatric symptoms. If they are suicidal or self-mutilating, however, psychiatric admittance is more common for this group, even without concurrent psychiatric symptoms. In our sample, F60-62 personality disorders were a significant predictive factor for inpatient and post-discharge suicidal and self-mutilation behaviour, but not for violence.

Limitations

Findings cannot be generalised directly to other (acute) psychiatric units without further studies. Episodes of violence may have been underreported, because

reliable judgment of violent behaviour, especially threats, is not always easy to obtain. A high number of staff was involved in ratings of predictor variables and outcome variables. V-RISK-10 raters and post-discharge violence recorders were working at different locations, but in departments within the same psychiatric organisation. This may have biased the results, but the close follow-up by clinicians and patient may also have secured valid recordings of violence.

      The mean and median values of hospital stay indicate that short- and long-term patients were overrepresented in the missing sample. Short hospital stay was predictive of post-discharge violence. Mandatory aftercare and psychotic disorders that were overrepresented in the follow-up sample were also predictive of post-discharge violence. The difference between the follow-up and missing samples concerning demographic and diagnostic risk factors may limit the validity of the results. Still, there were no score differences between drop-outs and follow-ups concerning having a history of violence (item 1 and item 2). The other predictor variables -- involuntary admittance, inpatient violence rate, substance abuse, depressive disorders (protective) -- and other demographic variables were not significant. Legal status at discharge and the quality of the subsequent treatment and aftercare may have had an impact on violence rates after discharge.

      Due to the follow-up procedures, violence from patients discharged into the community may have gone undetected more often than in patients followed up by psychiatric services. There are reasons to assume that patients discharged directly into community had lower V-RISK-10 scores than patients that were given closer supervision. This may have caused a pooling effect of the sample with

patients discharged into society with low V-RISK-10 scores and not so intensive follow-up monitoring, and the opposite effect for patients discharged to district psychiatry services. However, we argue that some aspects of the procedure may have moderated this possible bias. First, the fact that we collected outcome data from multiple sources such as self-report, collaterals, clinicians, and hospital and criminal records was an asset to this study. Second, ordinary length of stay in district psychiatric wards was 2 to 4 weeks, and rarely over 8 weeks before discharges into the community. Only a few patients stayed for a longer time period. Since the patients were followed-up for 12 months, the brief stay diminished the possible outcome measure difference between the community and institutional sample. Third, it is plausible that persons with a prior psychiatric hospital stay that behaved violently in the community were re-admitted to the hospital. Finally, since the follow-up procedure covered all community-based and institutional psychiatric services in the region, the likelihood of losing participants due to their use of other psychiatric services was very low. Still, the effect of a possible bias has to be taken into consideration when interpreting the findings. The fact that validation studies have a tendency to produce better results than follow-up studies is another caution to be taken.

Sample characteristics might have affected the AUC-values. The current study population seem compatible with a large low-scoring non-violent population being combined with a smaller high-scoring violent population, which enables high AUCs.

Due to the low number of patients with more than one hospitalisation and additional "new" violence after discharge, the statistical power in our material is too low to test whether the scores at different discharges were differently associated with different types of aggression.

Implications

This study indicates that the V-RISK-10 is an easy-to use, valid and feasible tool for screening risk of violence in acute psychiatric patients. If confirmed by further research this findings applies across diagnoses, age, gender, length of stay, and with somehow lower accuracy even for patients without a known history of violence. However, future research should involve larger samples to secure sufficient statistical power to examine the value of V-RISK-10 for this subgroup of patients. Notwithstanding, the results from our study have to be confirmed by other research before the tool may be recommended for routine clinical practise. Further prospective research should optimize designs to keep underreporting and drop-outs to a minimum.

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Table 1 Demographic data on all patients: follow-up sample and missing sample

	All admitted N = 1,017	Follow-up n = 381	Missing n = 636	P value
Male/female %	52.7 / 47.3	55.3 / 44.7	51.5 / 48.5	0.262
Mean age, years, men/women	41.8 / 43.8	42.0 / 43.3	41.6 / 44.1	0.845
Hospital stay days, mean/median	19.3 / 8	18.8 / 10	19.8 / 7	0.030[a]
Violent inpatients	7.6%	7.8%	7.4%	0.796
Involuntary admitted patients[c]	20%	21%	19%	0.625
Mandatory aftercare[c]	6.8%	8.8%	2.1%	0.008
F10-19 substance misuse[c]	16%	16%	17%	0.842
F20-29 psychotic disorders[c]	16%	19%	11%	0.036
F30-31 bipolar disorders[c]	12%	14%	7.1%	0.027
F32-39[b] depressive disorders[c]	25%	24%	29%	0.271
F40-49 Anxiety disorders[c]	18%	17%	22%	0.244
F60-62 Personality dis[c]	5.6%	7.0%	1.4%	0.013

a. Mann-Whitney U = 95138.00
b. F34.0 and F38.0 not included
c. From the Ålesund sample, the Aker sample had the same diagnostic distribution, but could not
   be differentiated in follow-up/drop-out samples

Table 2 Patients' V-RISK-10 scores and recorded violence 3 and 12 months after discharge[a]

V-RISK-10 scores:	0-4.9	5-9.9	10-14.9	15-20	Total
3 months: No violence	122	87	34	8	253
Violent threats	3	13	15	3	35
Less severe acts	0	11	11	5	27
Severe acts	0	1	5	1	7
Total patients	125	112	65	20	322
One year: No violence	126	91	35	11	263
Violent threats	7	23	11	4	45
Less severe acts	4	15	14	5	38
Severe acts	0	5	9	3	17
Total patients	137	134	69	23	363

a. patients with more than 3 missing items were excluded

Table 3 V-RISK-10: Predictive validity when stratified for gender and for past history of violence

	3 months			12 months		
	Patients	AUC (95% CI)	P	Patients	AUC (95% C)	P
A. Male / female	180 / 147			205 / 162		
Violent threats	35	0.77 (0.69-.084)	<0.001	46	0.71(0.63-0.78)	<0.001
Male	21	0.73 (0.62-0.85)	0.001	24	0.68 (0.57-0.78)	0.006
Female	14	0.81 (0.69-0.92)	<0.001	22	0.74 (0.64-0.84)	<0.001
Less severe acts	27	0.83 (0.78-0.89)	<0.001	38	0.76 (0.69-0.84)	<0.001
Male	21	0.79 (0.71-0.87)	0.001	28	0.74 (0.66-0.83)	<0.001
Female	6	0.89 (0.77-0.99)	<0.001	10	0.73 (0.57-0.89)	0.016
Severe acts	7	0.87 (0.78-0.85)	0.001	17	0.86 (0.80-0.91)	<0.001
Male	6	0.83 (0.71-0.95)	0.006	14	0.82 (0.74-0.90)	<0.001
Female	1	0.91 (0.85-0.96)	0.164	3	0.90 (0.84-0.97)	0.017
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. Past history of violence (outcome variable: any violence)						
No violence[b] (n =166,186)[a]	9	0.66 (0.52-0.80)	0.106	22	0.66 (0.56-0.76)	0.014
Don't know[c] (n = 21, 25)[a]	4	0.93 (0.80-1.0)	0.009	6	0.72 (0.44-0.99)	0.119
No+Don't know (n =187,211)[a]	13	0.75 (0.61-0.88)	0.003	28	0.68 (0.59-0.80)	0.002
Moderate[d] (n = 57, 65)[a]	15	0.68 (0.53-0.83)	0.040	22	0.63 (0.49-0.76)	0.100
Severe violence[e] (n = 83, 91)[a]	42	0.56 (0.44-0.83)	0.312	51	0.53 (0.41-0.65)	0.157

a. n = numbers at 3 mo, 12 mo,
b. No previous violence history; zero score on item 1 and item 2.
c. Don't know scores on item 1 or item 2.
d. At least one score of "moderate" threats or acts.
e. At least one score of "severe" threats or acts

Table 4 Significant factors of post-discharge violence in uni- and multivariate analyses

	Univariate analyses			Multivariat analyses		
	OR (95% CI).	P	Model fit[a]	OR (95% CI).	P	Model fit[a]
At 3 months:						
V-RISK-10	1.30 (1.2-1.4)	<0.001	15- 25%	1.25 (1.1-1.4)	<0.001	
Inpatient violence	3.6 (1.6-8.2)	0.002	3 - 4%	2.0 (0.57-7.3)	0.276	
Involuntary admittance	5.6 (3.1-10)	<0.001	10- 15%	2.1 (0.72-6.4)	0.174	
Mandatory aftercare	3.5 (1.6-7.6)	0.002	3 - 4%	1.8 (0.38-8.2)	0.470	19-33%
Gender (male)	2.3 (1.3-4.1)	0.005	3 - 4%	1.5 (0.66-3.5)	0.328	
Subst. abuse F10-19	2.7 (1.3-5.2)	0.005	3 - 4%	2.4 (0.82-7.2)	0.109	
Depression F32-39	0.26 (0.11-0.63)	0.003	4 - 6%	1.6 (0.50-5.0)	0.439	
Anxiety F40-49	0.37 (0.14-0.97)	0.043	2 - 3%	1.3 (0.27-5.8)	0.767	
Hospital stay pr day[b]	0.99 (0.97-1.0)	0.129		0.97 (0.95-0.99)	0.016	
After one year:						
V-RISK-10	1.25 (1.2-1.4)	<0.001	14- 21%	1.20 (1.1-1.3)	<0.001	
Inpatient violence	2.7(1.2-6.1)	0.020	2%	1.5 (0.44-5.0)	0.531	
Involuntary admittance	3.9(2.2-6.7)	<0.001	7 -10%	2.1 (0.83-5.2)	0.121	
Mandatory aftercare	2.7(1.3-5.9)	0.011	2 - 3%	0.8 (0.17-2.9)	0.633	18-27%
Gender (male)	2.1(1.3-3.5)	0.004	3 - 4%	1.6 (0.82-3.2)	0.164	
Subst. abuse F10-19	2.1(1.1-3.9)	0.019	2%	1.3 (0.52-3.3)	0.567	
Psychosis F20-29	2.0 (1.1-3.6)	0.017	2%	1.2 (0.44-3.1)	0.761	
Depression F32-39	0.19(0.08-0.43)	<0.001	7 – 9%	0.7 (0.27-1.7)	0.406	
Hospital stay pr day[c]	0.99 (0.98-1.0)	0.130		0.98 (0.96-0.99)	0.034	

a. Cox & Snell R^2 - Nagelkerke R^2 (value 0 – 100%).
b. Mann-Whitney U = 7869.00, P = 0.011, c. Mann-Whitney U = 12187.00, P = 0.012.

Table 5. Incremental validity of historical factors (violent and diagnostic categories) and dynamic factors (present and future categories) of V-RISK-10.

	3 months			One year			
	χ^2 (d.f.)	P	Model fit[a]	χ^2 (d.f.)	)	P	Model fit[a]
A. Univariate analyses of categories[b]:							
Violent	71.8 (2)	<0.001	20-31%	64.3 (2)		<0.001	16-23%
Diagnostic	16.8 (3)	0.001	5 - 8%	26.4 (3)		<0.001	7-10%
Present	28.7 (3)	<0.001	8-13%	20.9 (3)		<0.001	6- 8%
Future	50.1 (2)	<0.001	14-22%	37.8 (2)		<0.001	10-14%
B. Multivariate Block-Enter procedure:							
Gender, hosp stay	10.8 (2)	0.005	3- 5%	8.5 (2)		0.014	2- 3%
+ Violent	67.5 (2)	<0.001	21-33%	62.5 (2)		<0.001	18-26%
+ Diagnostic	1.6 (3)	0.660	0	4.2 (3)		0.239	2- 3%
+ Future	11.6 (2)	0.003	3- 4%	5.2 (2)		0.076	2- 3%
+ Present	1.7 (3)	0.644	1- 2%	0.4 (3)		0.938	0%
Total model	103.1(24)	<0.001	25-39%	87.9 (24)		<0.001	20-29%

a. Cox & Snell R^2 – Nagelkerke R^2 .
b. *Violent*: violent acts and violent threats. *Diagnostic*: substance abuse, severe mental disorder, personality disorders. *Present* (symptoms): lack of insight, suspiciousness, lack of empathy. *Future*: unrealistic plans, stress exposure.

VI

Appendix I

Violence risk screening-10 - V-RISK-10

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

At admission ☐
At discharge ☐
In policlinic ☐

Patient's name:		**Date of birth:**
Female ☐ **Male** ☐		**Patient number:**
Date of admittance:	**Date of discharge:**	**Registration number:**
Signed in 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
- **Maybe/moderate:**   Maybe applies/present to a moderately severe degree
- **Yes:**   Definitely applies to a severe degree
- **Do not know:**   Too little information to answer

	No	Maybe/ moderate	Yes	Do not know
1. Previous and/or current violence *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 shoving that does not cause severe harm to the victim is rated* ***Maybe/moderate.***	☐	☐	☐	☐
2. Previous and /or current threats (verbal/physical) ***Verbal:*** *Statements, yelling and the like, that involve threat of inflicting other individuals physical harm.* ***Physical:*** *Movements and gestures that warn physical attack.*	☐	☐	☐	☐
3. Previous and/or current substance abuse *The patient has a history of abusing alcohol, medication and/or other substances (e.g. amphetamine, heroin, cannabis). Abuse of solvents or glue should be included. To rate* ***Yes****, the patient must have and/or have had extensive abuse/dependence, with reduced occupational or educational functioning, reduced health and/or reduced participation in leisure activities.*	☐	☐	☐	☐
4. Previous and/or current major mental illness ***NB:*** *Whether the patient has or has had a psychotic disorder (e.g. schizophrenia, delusional disorder, psychotic affective disorder).* <u>*See item 5*</u> *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/or 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. Expresses suspicion	No	Maybe/ moderate	Yes	Do not know
The patient expresses suspicion towards other individuals either verbally or nonverbally. The person in question appears to be "on guard" towards the environment.	☐	☐	☐	☐

8. Shows lack of empathy	No	Maybe/ moderate	Yes	Do not know
The patient appears emotionally cold and without sensitivity towards others' thoughts or emotional situation.	☐	☐	☐	☐

9. Unrealistic planning	No	Maybe/ moderate	Yes	Do not know
This assesses to which degree the patient him/herself has unrealistic plans for the future (inside or outside the inpatient unit). Is for instance the patient him/herself realistic with regard to what he/she can expect of support from family and of professional and social network? It is important to assess whether the patient is cooperative and motivated with regard to following plans.	☐	☐	☐	☐

10. Future stress-situations	No	Maybe/ moderate	Yes	Do not know
This evaluates the possibility that the patient may be exposed to stress and stressful situations in the future 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, substance use, homelessness, spending time in violent environment/association with violent environment, easy access to weapons etc.	☐	☐	☐	☐

Overall clinical evaluation

· **Based on clinical judgement, other available information and the checklist:**
· **How great do you think the violence risk is for this patient?**   *(Put a check in one of the boxes)*

LOW	**MODERATE**	**HIGH**

· **Suggestion following overall clinical evaluation:**   *(Put a check in one of the boxes)*

NO MORE DETAILED VIOLENCE RISK ASSESSMENT	**MORE DETAILED VIOLENCE RISK ASSESSMENT**

IMPLEMENTATION OF PREVENTIVE MEASURES

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