

# Prevention of suicide and attempted suicide in Denmark

Epidemiological studies of suicide and intervention studies in selected risk groups

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## INTRODUCTION

Striving to live is fundamental for all living creatures, also among human beings. Suicidal impulses and suicidal behaviour must be considered as disturbances of this fundamental condition. When suicidal behaviour occurs, it must be considered as a sign of strain on the individual that exceeds his or her capability to cope with the situation.

The purpose of a model is to provide us with a theoretical construct upon which we can place our theories about ethiology, pathogenesis and expression [Silverman, 1996]. The diathesis-stress model can be used as a framework for understanding suicidal impulses and suicidal behaviour. The threshold model for suicidal behaviour has been suggested by Blumenthal and Kupfer [Blumenthal and Kupfer, 1988]. This model subdivides factors into predisposing factors, risk factors, protective factors and precipitating factors. The model can be seen as an elaboration of the diathesis-stress model. To develop preventive interventions requires theoretical considerations and empirical knowledge about ethiology and pathogenesis and empirical data concerning risk factors, predisposing factors, protective and precipitating factors, and effectiveness of preventive measures.

The stressors can be manifold and diverse, and modified by protective factors hosted by the individual. Different individuals react differently to the same condition and would not agree about what should be considered stressful; they might very well differ in their perception of different situations. Also the perception of possibilities for help is likely to be subjected to individual and cultural variation.

Durkheim's theory about social integration must be seen as an attempt to explain differences between countries and cultures in the amount and character of stressors and their effect on the individual [Durkheim, 1897].

It is widespread public opinion that so-called rational suicides exist, and it is subject to much debate [Hendin, 1998; Herrestad and Mehlum, 2005]. The term rational can be used to indicate that the suicidal person is not mentally disturbed and has considered suicide very carefully for a long period. It is tempting to conclude that the term also implies that doctors or others agree with the suicidal person in his or her pessimistic evaluation of future possibilities. The term rational is loaded with the illusion that there is nothing to gain from further exploration. However, the clinical world is full of examples of how the determined suicidal person can change his or her mind after finding relief from physical or psychological pain, after coming to terms with sadly changed perspectives, and after having

received treatment of depressive symptoms expressed as long lasting hopelessness. The diathesis-stress model can be used as a framework for also understanding so-called rational suicides, and it opens the possibility for reconsidering the stressful situation and the person's ability to cope with this situation.

In suicide prevention, much more than the impulse is important. In many cases, the impulse can be prevented from resulting in a suicidal act, because the individual stops after reconsidering or if somebody, professional or private, can intervene and persuade or otherwise hinder the individual in committing a suicidal act. If a person proceeds to commit a suicidal act, it can be of vital importance that not too dangerous means are available. If a suicidal act is committed, it is crucial that medical care of sufficiently high quality is always available in order to prevent further complications as a consequence of self-damage. After that, it is important that effective treatment for the underlying condition is available and provided with flexibility.

Suicidal acts can be considered as a complication (that can be fatal) common to a range of diseases and conditions. As such, it can be paralleled with wound infections, and the chain of preventive efforts can be compared. The primary goal is to avoid stress that is likely to produce wounds. If that fails, the next step is to treat wounds optimally and monitor closely so that infection does not develop. Finally, it is important to treat and control wound infections and to prevent systemic infections and dissemination.

In the case of suicide, the ultimate goal is to prevent persons from coming into the very desperate situations where suicide seems to be the only alternative. The next step is to ensure that persons who feel that their situation is desperate can receive sufficient support and treatment. If this fails, it is important at least to make sure that it is not too easy and accessible to commit fatal suicidal acts. If a suicide attempt cannot be avoided, it is important to secure high quality medical intervention to remedy any physical consequences and to secure psychological and psychiatric treatment for the psychiatric mental condition.

## RELIABILITY OF SUICIDE MORTALITY DATA

Official suicide mortality data should be approached with a degree of caution [DeLeo and Evans, 2004]. Death certification practices differ considerably in the different European countries. In the United Kingdom, a coroner's request is mandatory in all cases of suspected suicide. In Germany, general practitioners can issue death certification of suicide without any police examination [Cantor, 2000]. In Denmark, the legal regulation of death certification states that any case of sudden and unexpected death shall be reported to the police, and the death certificate may only be issued after a medico-legal examination. Individual differences exist in the interpretation of the manner of death – that is, whether the physician classifies the death as caused by natural causes, an accident, or suicide. One study based on a blinded review of 40 uncertain cases of sudden death compares the differences in the classification by English coroners and their Danish counterparts and finds that the Danes consistently classified more cases as suicides than the English coroners [Atkinson et al., 1975]. Other studies report a similar discrepancy in death certification by different medico-legal examiners [Fingerhut et al., 1998; Goodin and Hanzlick, 1997]. Hence, the registered differences in suicide rates between two countries may be based in part on differences in classification of manner of death.

Studies of migrants indicate that differences between countries are not merely a product of different certification processes between countries [DeLeo & Evans 2004]. Several studies have consistently demonstrated a correlation between suicide rates among immigrants from different countries and the suicide rate for the migrants' country of origin [Sainsbury and Barraclough, 1968; Burvill et al., 1982; Kliewer, 1991; Kliewer and Ward, 1988; Whitlock, 1971; Hjern and Allebeck, 2002]. Certification processes are likely to be different in migrants' countries of origin, while the certification process in

the country the migrants have immigrated to are supposed to be equal for all inhabitants. Thus, studies of migrants indicate that differences between countries are not merely a product of different certification processes between countries.

Even after considering the differences in procedures mentioned above and the possible influence of religion, legislation and culture, it seems reasonable to conclude that it is possible to make international comparisons of suicide rates that have sufficient validity to examine trends, although any interpretations must be made with caution. World Health Organization has considered the official suicide mortality data to be sufficiently reliable and has consequently published suicide mortality figures in World Health Statistics and in the Health-for-All database.

However, the officially reported suicide rates most likely underestimate the true extent of suicide mortality [Sainsbury and Jenkins, 1982; O'Donnell and Farmer, 1995]. This can be due to difficulties in ascertaining suicides by methods that are frequently associated with accidents, such as single car accidents [Ahlm et al., 2001], drowning [Kringsholm et al., 1991; O'Donnell and Farmer, 1995] and drug overdoses [Jonasson et al., 1999; Cantor et al., 2001] thus, it is most likely that suicide rates are a conservative calculation of the true suicide mortality in any given country [DeLeo and Evans, 2004]. Allebeck proposed that scrutinizing medical records should be used to improve classification of deaths among psychiatric patients and for obtaining data on hospital care [Allebeck et al., 1986]

The Danish Cause-of-Death Register is used as a basis for several papers in this thesis; therefore, special attention needs to be paid to the validity of this register.

The classification of manner of death is based on death certificates, which include post-mortem examination reports, information on social and psychiatric history provided by family members and associates, and other corroborating information such as suicide notes. There has been no change in the legislation concerning the duties of the police with regard to investigation of place and circum-

stances of death, and no changes in the official procedure for coding death certificates. The number of deaths classified with undetermined manner of death was stable for both men and women from 1981 until 1996, when an increase in these figures occurred. The number of deaths classified with undetermined manner of death rose from six percent in 1995 to nine percent in 1996, because the Danish National Board of Health chose a more conservative approach in cases where the doctor who filled in the death certificate had classified the manner of death as undetermined. Previously, if the doctor, supplementary to the undetermined manner of death, stated another cause of death as reasonably certain, this cause of death was used for classification. From 1996 and onwards, the classification of undeterminant manner of death could only be changed if the doctor stated that there was a substantial probability of a specific cause of death [Sundhedsstyrelsen (Danish National Board of Health), 1998b] The Danish National Board of Health is investigating the increased number of undetermined manner of deaths, and this is partly due to an increasing number of missing deaths certificates (Morten Hjulsager, Danish National Board of Health, personal communication). However, if unnatural death is suspected, the procedure proscribed in the legislation ensures that death certificates are in most cases filled in and sent to the National Board of Health.

The increasing mortality figures for substance abusers during the last two decades introduce a risk that suicide in this group is underestimated [Steentoft et al., 2000]. All deaths related to drug abuse should according to Danish legislation be subjected to medico-legal examination and toxicological investigation, but in a small proportion of cases this procedure was not followed [Helweg-Larsen et al., 2006]. In some cases, even the most thorough examination of a death caused by overdose cannot reveal whether the person intended suicide or not, if no suicide note was left.

The number of autopsies has declined in Denmark, which introduces the risk that registration of suicide in the Cause-of-Death Register is less valid. However, the decline in autopsies occurred al-

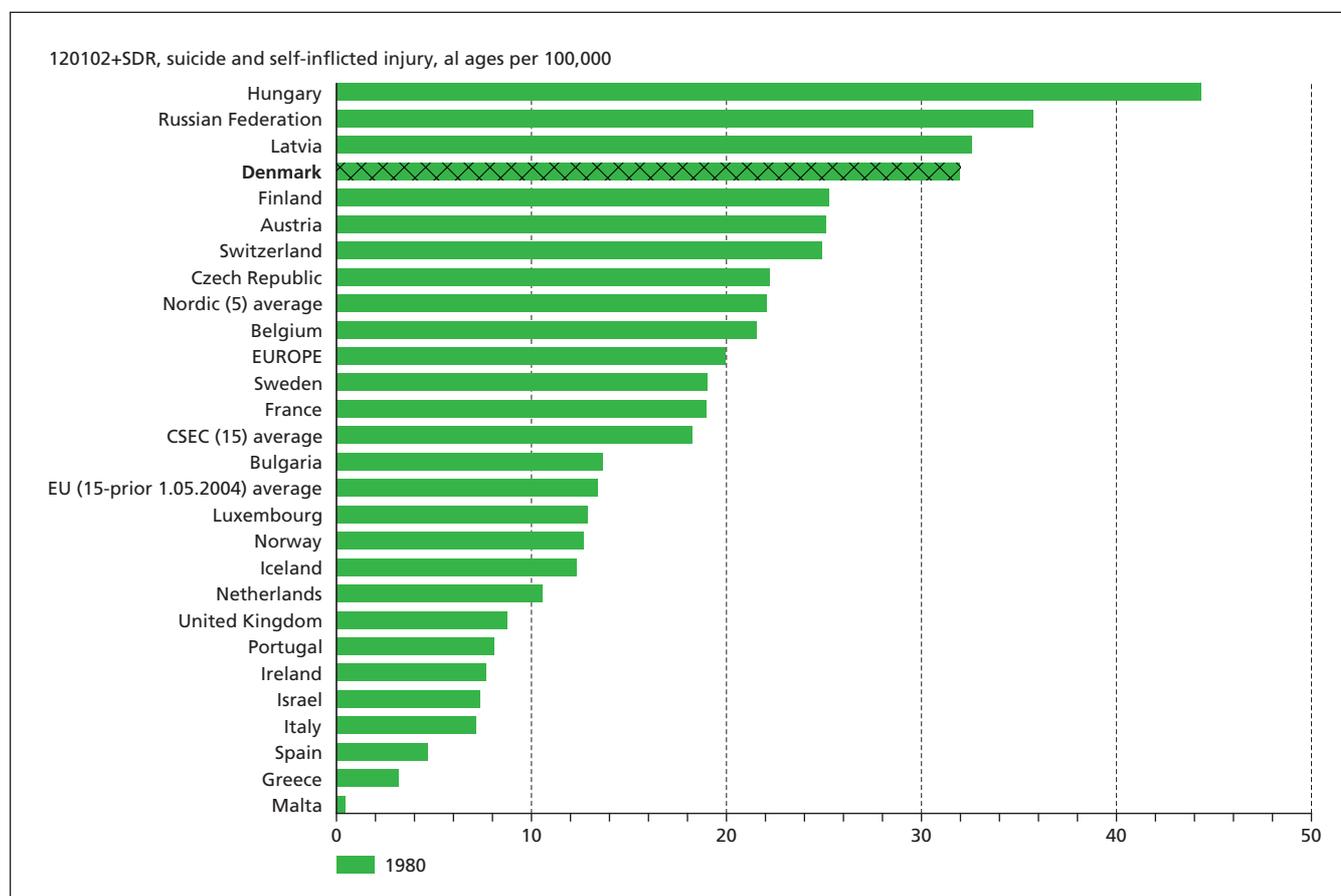


Figure 1. Suicide and self-inflicted injury, all ages per 100,000, 1980. WHO: European Health for All database.

most exclusively among patients who were classified as dead by accident or natural causes in hospital, which is not likely to contribute to a large number of suicides being misclassified as natural deaths or accidents [Sundhedsstyrelsen (Danish National Board of Health), 1998a; Sundhedsstyrelsen (Danish National Board of Health), 2004]. There are no national statistics reporting number of deaths investigated with forensic chemical analyses. Even though some uncertainty remains about the validity of the Cause-of-Death Register, it is not likely that this can explain the large changes over time in Danish suicide rates for both men and women.

### EPIDEMIOLOGY OF SUICIDE IN DENMARK

Suicide is one of the leading health problems in the world. Each year almost one million people (849,000 in 2001, The World Health Report 2002, [www.who.int/whr/2002/en/annex\\_table](http://www.who.int/whr/2002/en/annex_table)) die from sui-

cide. Thus, suicide is among the top ten causes of death worldwide and the second most common cause of non-illness death worldwide.

The suicide rate in Denmark was among the highest in Europe in 1980 (see Figure 1), and even though suicide rates have declined steadily in Denmark since then, Denmark still has higher suicide rates than other countries in Scandinavia and most countries in Western Europe (see Figure 2A and Figure 2B).

In almost all age groups for both men and women, Denmark was the country in Europe that experienced the largest decline in suicide rate from 1980 to 2000 [DeLeo and Evans, 2004]. However, also Austria and Portugal had a strong positive development in the age groups 15-24 years and 25-44 years.

Very little is known about the mechanisms behind high or low suicide rates, and no theory can embrace all elements. However, there is some stability over time in the ranking of countries with re-

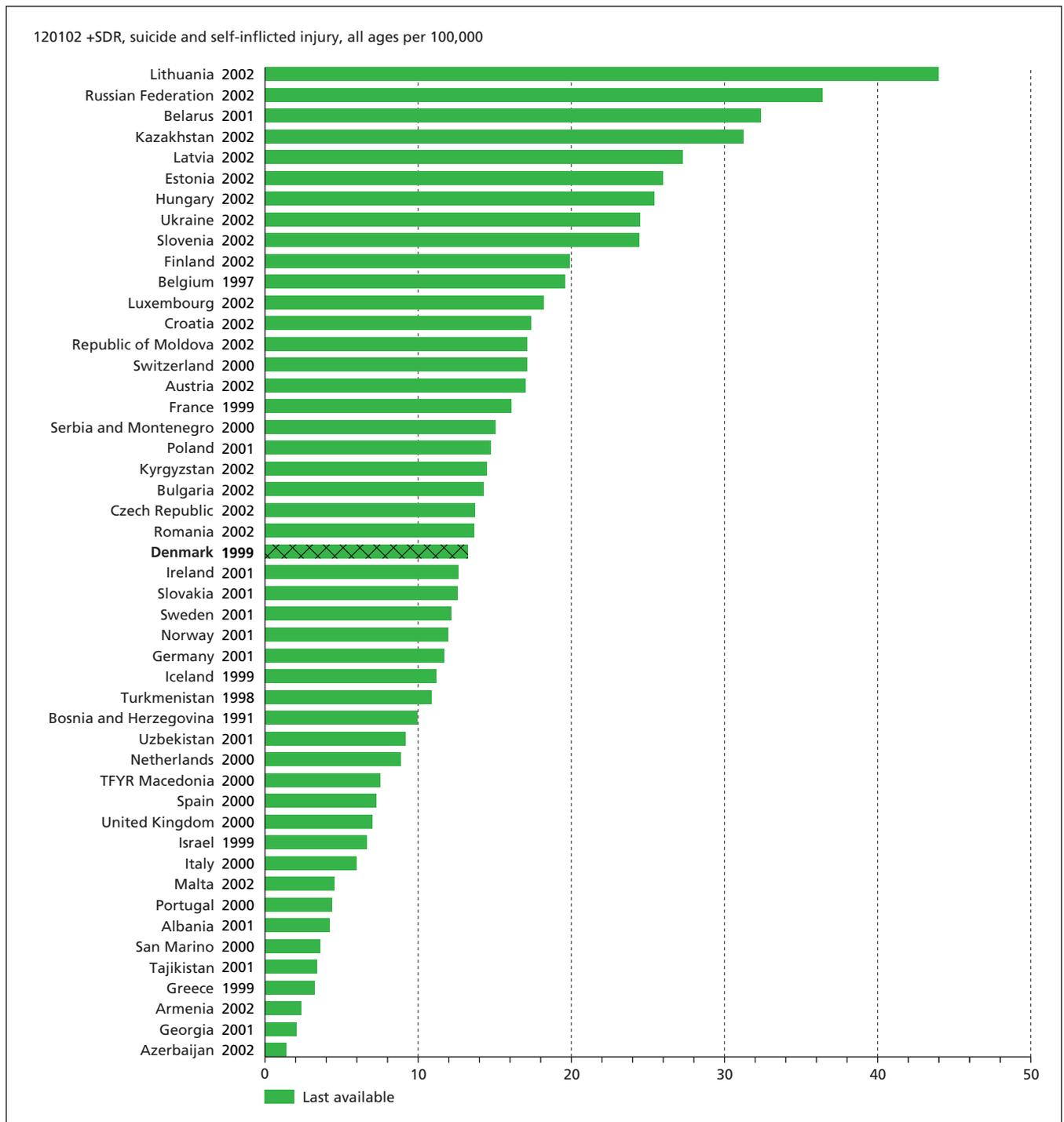
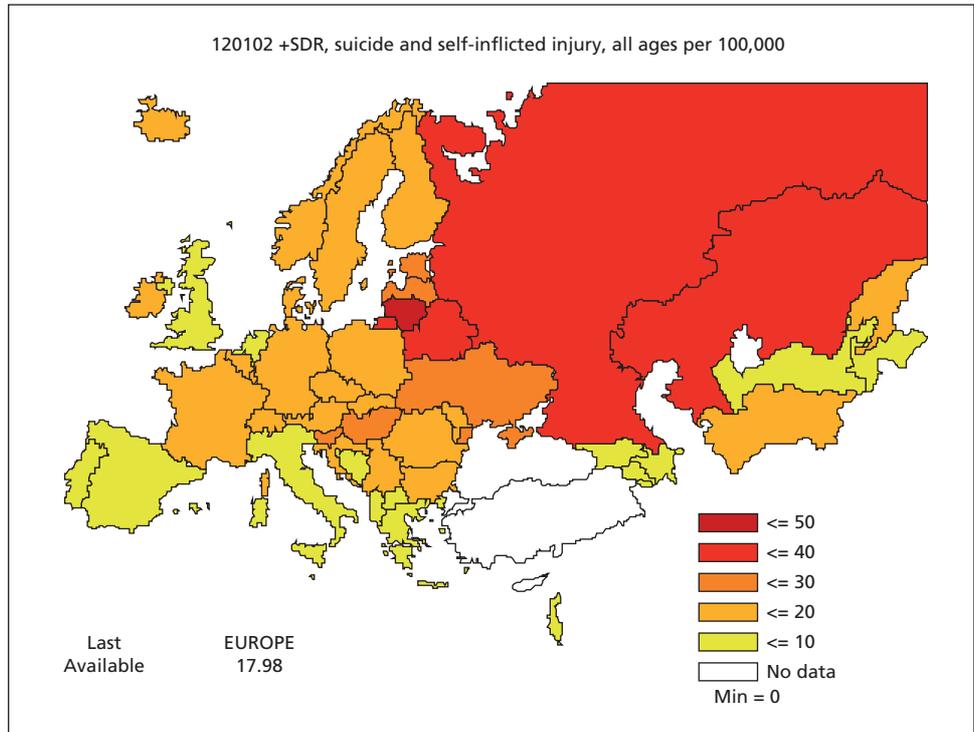


Figure 2A. Suicide and self-inflicted injury, all ages per 100,000, last available. WHO: European Health for All database.



**Figure 2B.** Map of Europe: Suicide and self-inflicted injury, all ages per 100,000, last available. WHO: European Health for All database.

gard to suicide rates [Cantor, 2000]. This fact points to the possibility that common mechanisms lie behind the rates. We know that social factors play an important role, as we can see changes occurring simultaneously with major changes in societies [Mäkinen, 1997].

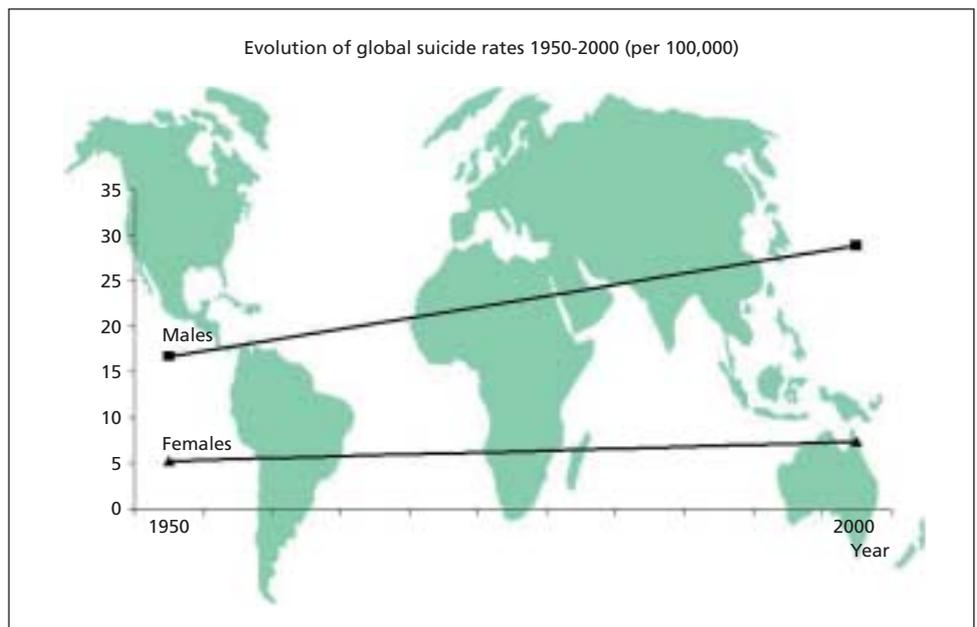
Some basic mechanisms must play a role in suicide since although changes occur, the pattern also shows an element of stability. In most countries, for instance, a very stable pattern is that the suicide rate is higher among men than among women. Based on figures from 53 countries reporting to WHO, the male suicide rate was 24.0 per 100,000 while the female suicide rate was 6.8 per 100,000 (M: F ratio 3.5: 1, see Figure 3).

Although in many countries statistics concerning suicide attempts are not reliable, it is unlikely that the male: female ratio for completed suicide is a reflection of a larger number of men attempting suicide. More likely, it reflects differences in fatality rates for the methods used by men and women for suicidal acts, and gender differences in health-seeking behaviour. Involved in the fatality rate is the untreated lethality of the suicide method and the

capability of the health sector to save the lives of those who attempt suicide.

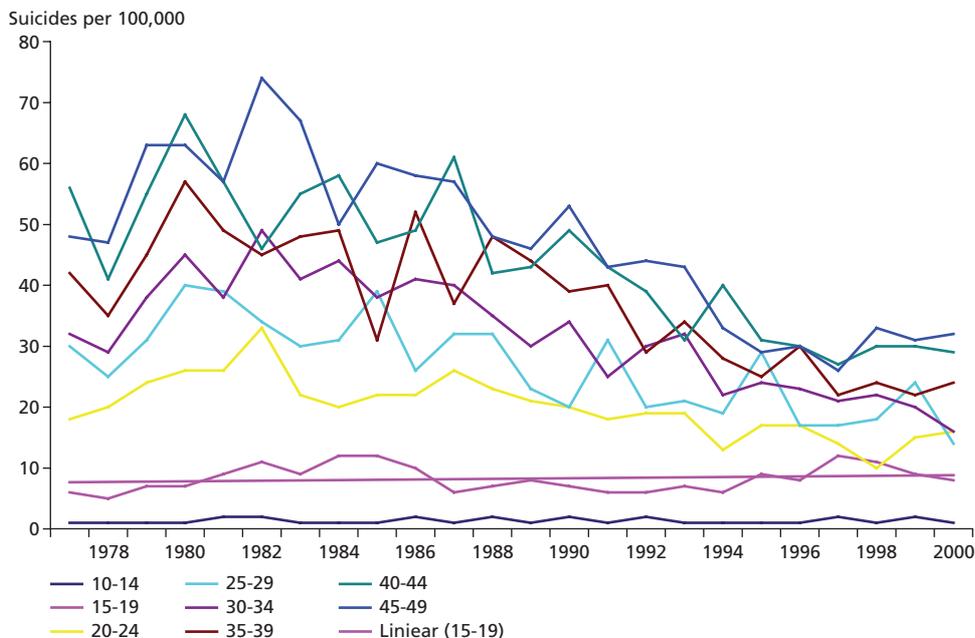
There can be great individual and historical variation in the perception of the means used for suicide. The way suicidal acts are viewed in the society and in subgroups within the society is also different from one society to another and in different historical periods.

In Denmark, suicide rates increased from 1977 to 1980. This change over time is observed in almost all age groups except women aged 50 years and more (Figure 4A, Figure 4B, Figure 5A, Figure 5B). This exception makes it less likely that the increase is due to changed registration procedures, since the Danish National Board of Health used the same registration procedures throughout the period. Suicide rates have declined from 1980 to 2000 for both men and women, and the decline can be seen in almost all age groups. However, for the oldest group (85 y+), the rates are actually increasing for both men and women (Figure 4B and Figure 5B), and for 15-19 year-old men (Figure 4A), there has also been a slight increase, while there have been declining rates in all other age groups.

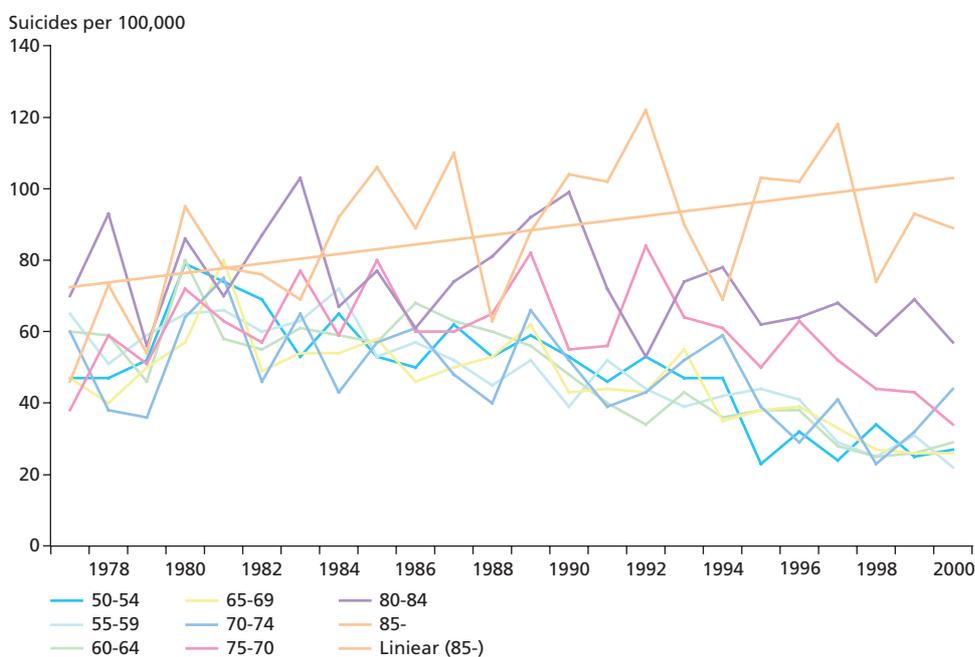


**Figure 3.** Evolution of global suicide rates 1950 to 2000. ([http://www.who.int/mental\\_health/prevention/suicide/evolution/en/index.html](http://www.who.int/mental_health/prevention/suicide/evolution/en/index.html)).

**Figure 4A.** Age specific suicide rates, males, age 10-49, 1977-2000, Denmark.



**Figure 4B.** Age specific suicide rates, males, age 50+, 1977-2000, Denmark.



Suicide rates are very different in different age groups, which can be seen from **Figure 6**. Although the rates change in all age groups, the pattern shown in **Figure 6** has been stable for a very long period.

Danish suicide rates have been high for as long as we have had reliable national statistics. In the late nineteenth century, the suicide rate was high especially for men, and throughout the twentieth century, the suicide rate has been fluctuating but high most of the time, especially for men (see **Figure 7**).

#### APPROACH TO SUICIDE PREVENTION

A range of countries has developed national strategies for suicide prevention. A national strategy can be defined as (Mehlum, personal communication):

“A comprehensive and nationwide approach to reduce suicidal behaviours across the life span through coordinated and culture sensitive response from multiple public or private sectors of society.”

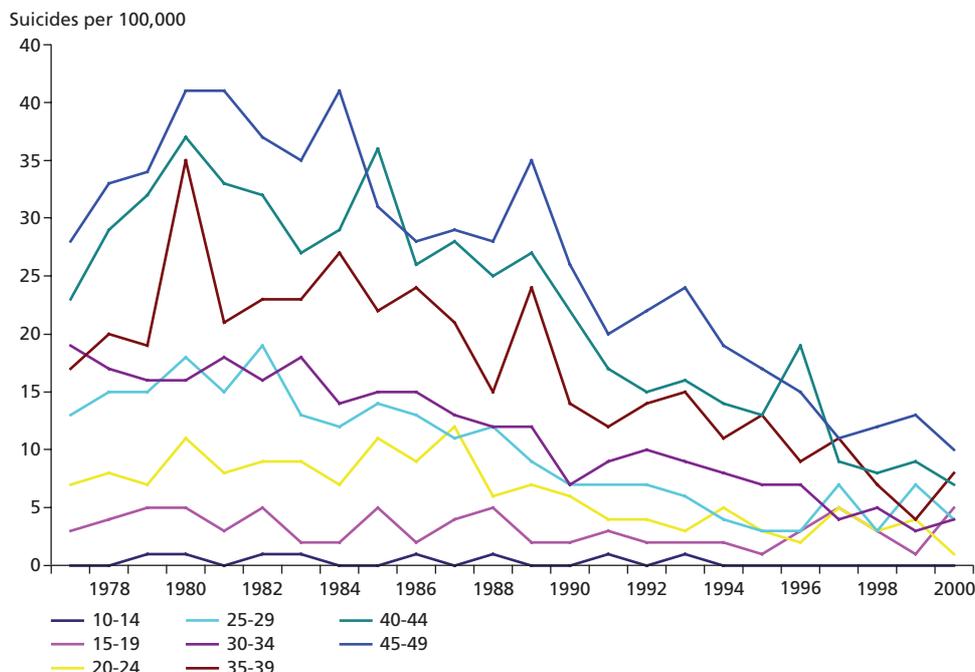
WHO recommends nations to develop and implement suicide prevention strategies:

“Each government needs to adapt or modify specific components

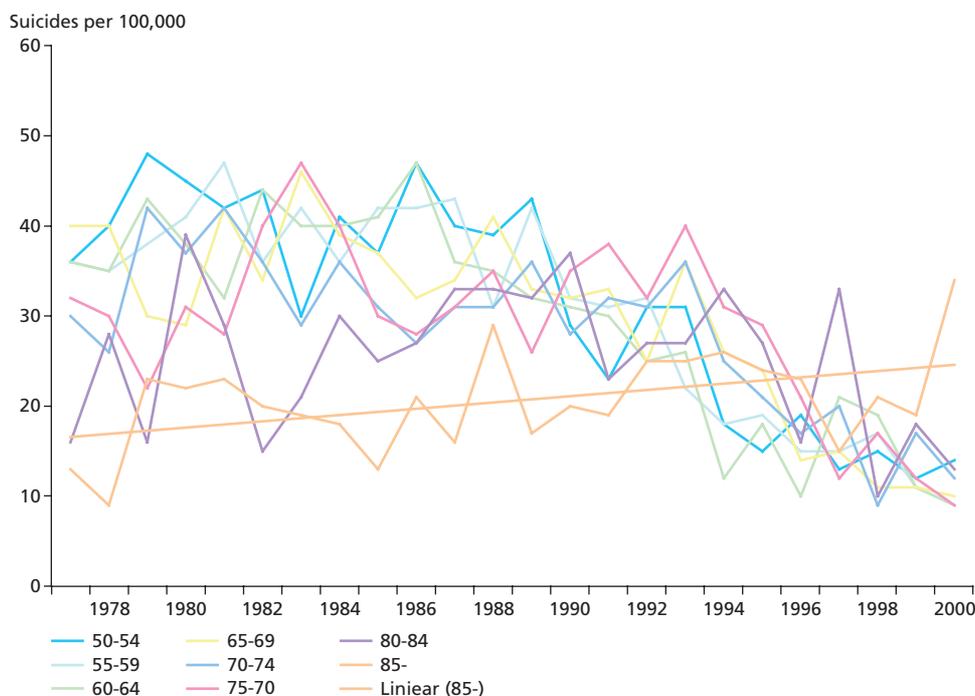
of the National Strategy Guidelines to fit their own cultural, economic, demographic, political and social needs” (UN/WHO Guidelines for the Development of National Strategies for the Prevention of Suicidal Behaviours, 1993).

For at least twenty years, there have been activities in WHO to increase awareness of suicide prevention and to put suicide prevention on the national agenda in all countries. In 1988, WHO EURO issued the “Health for All Strategy”. Target 12 concerned suicide prevention [World Health Organization, 1985]. Since then, an expert meeting in Szeged, Hungary in 1989 agreed on “Consultation on Strategies for Reducing Suicidal Behaviour in the European Region” and recommended establishment of national suicide prevention strategies in all the WHO member states of the region. In 1996, “Global Trends in Suicide Prevention: Toward the Development of National Strategies for Suicide Prevention” was issued in collaboration with WHO and United Nations Secretariat (New York, [Ramsay and Tanne, 1996]. Finally, in 2005, The European Ministerial Conference in Helsinki endorsed “Mental Health Declaration for Europe: Facing the Challenges, Building Solutions”, target v: to develop and implement measures to reduce the preventable causes of mental health

**Figure 5A.** Age specific suicide rates, females, 10-49 years, 1977-2000.



**Figure 5B.** Age specific suicide rates, females, age 50+, 1977-2000.



problems, comorbidity and suicide (<http://www.euro.who.int/document/mnh/edoc06.pdf>) and the “Mental Health Action plan for Europe: Facing the Challenges, Building Solutions”, chapter 5: Prevent mental health problems and suicide (<http://www.euro.who.int/document/mnh/edoc07.pdf>).

Thus, through the consistent effort of recent decades, international focus on the problem of suicide has led to the development of suicide prevention strategies in a range of countries for instance Finland (1992), Norway (1994), Sweden (1995), Greenland (1997), Denmark (1999), Australia (1999), USA (1999), England (2002), Scotland (2002), Germany (2002), Malaysia (2004), New Zealand (2005), and Ireland (2005)

**DEFINITION**

In 1986, WHO Regional Office on Preventive Practices in Suicide and Attempted Suicide defined suicide:

“Suicide is an act with a fatal outcome which the deceased, know-

ing or expecting a fatal outcome had initiated and carried out with the purpose of provoking the change that he desired.”

Kreitman [Kreitman, 1977] initiated the term parasuicide, which was commonly used to cover all non-fatal suicidal acts. Parasuicide was in 1986 defined by the same WHO working group:

“An act with a non-fatal outcome, in which an individual deliberately initiates a non-habitual behaviour that, without intervention from others will cause self-harm, or deliberately ingests a substance in excess of the prescribed or generally recognized therapeutic dosage, and which is aimed at realizing changes which the subject desired via the actual or expected physical consequences.”

**HOW CAN SUICIDE PREVENTION BE UNDERSTOOD?**

Several different ways of subdividing possible interventions have been used: There are many different approaches to suicide prevention. Below, different ways of categorizing suicide prevention are described.

Suicide is a behavioural disorder, and as stated by Morton Silverman: "Inasmuch as most behavioural disorders are multicausal in etiology, so must preventive interventions be multifocal in terms of the behaviours and etiological agents they are designed to target" [Silverman, 1996].

Suicide cannot be understood as a disease or an accident, but suicidal acts can be considered severe and preventable complications to a range of diseases and conditions in which social aspects play an important role. Therefore, it can be difficult to fit prevention of suicide into models for disease or accident prevention, but elements of disease and accident prevention can be compiled.

#### PRIMARY, SECONDARY AND TERTIARY PREVENTION

A common model of disease prevention is to split preventive measures into primary, secondary and tertiary measures [Caplan, 1964]. Primary prevention is aimed at individuals who have not yet shown any signs of illness. The aim is to prevent the disease process from starting. Immunization campaigns, seat belts, and learning a healthy life style during upbringing are examples of primary prevention.

Secondary prevention targets individuals who have had subtle signs of the start of a disease process. The aim of secondary prevention is to start treatment during the early stages of the disease process. Most screening programmes are based on secondary prevention. Tertiary prevention targets individuals who have a diagnosed disease and who need treatment and support to prevent complications from the disease. This includes monitoring the disease, relapse prevention, follow-up programmes.

This model covers specific, well-defined diseases and is based on the assumption that the disease develops through stages that can often be modified and in some cases, stopped or even reversed, which is true for many chronic diseases. The model can be applied with success to cancer, diabetes, chronic obstructive lung disease, cardiovascular diseases, maybe schizophrenia, and a range of other diseases. It might also be a valid assumption to make for the suicidal process, but the pathways to suicide can be very different for different persons and for different groups of persons, and there is no common pathway from stage one to stage three. The suicidal process can in most cases be reversed. Another problem is that this classifi-

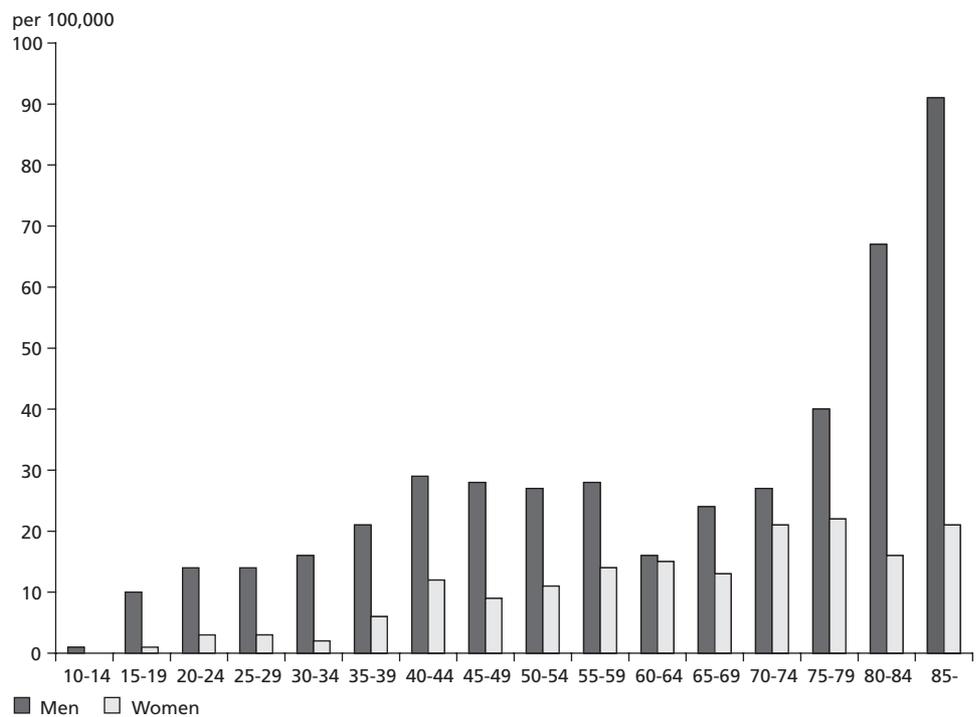


Figure 6. Age-specific suicide rates in Denmark, 2001 (www.Sundhedsstyrelsen.dk).

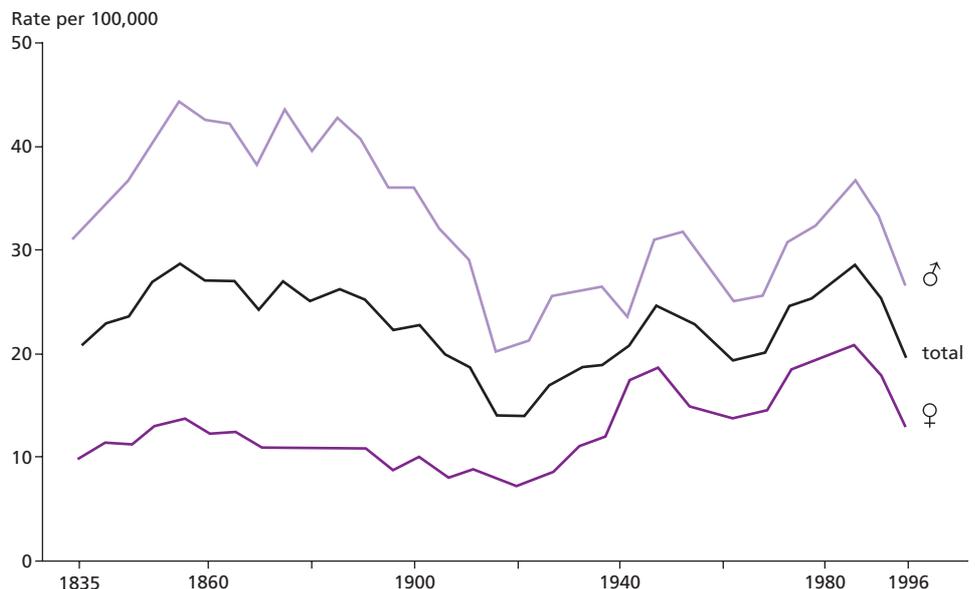


Figure 7. Suicide rates, men and women 1835-1996, crude rates (Center for Selvmordsforskning, Odense).

cation of preventive measures is difficult to use in the case of suicide, since it is not a single disease, and the process leading to suicide can follow a range of different pathways. The preventive elements would have to cover a very broad range of interventions. If suicidal behaviour were to be compared with the fully developed disease dealt with in this model, it could for instance be an endpoint after a process with financial and personal problems; it could be a fatal complication of severe affective disorder; or it could be a complication of alcohol or drug abuse or a range of other social, medical and psychiatric conditions. Finally, another problem with the traditional prevention model is that if suicide is considered the target, the issue of tertiary prevention is meaningless. Jenkins [Jenkins and Singh, 2000] has suggested that tertiary prevention should focus on survivors, but they are independent persons themselves and should rather be considered as a risk group. Silverman has suggested that tertiary prevention should be understood as intervention after the first suicide attempt [Silverman, 1996].

If suicide should be compared to a disease, an acute condition like pneumonia might be a better comparison. As previously mentioned, suicidal acts can be considered to be a severe and preventable complication of a range of diseases or conditions in which social factors play an important role. The problem of suicide fits into a comparison with a disease that can suddenly develop fatally in persons who are susceptible due to some temporary or more permanent condition.

#### UNIVERSAL, SELECTIVE, AND INDICATED PREVENTION

Another classification of preventive measures was suggested by Gordon [Gordon, 1983] and later accepted by the Institute of Medicine in 1994 [Mrazek and Haggerty, 1994]. Prevention was classified into universal, selective and indicated prevention. This model is relevant for use in suicide prevention, but can also be used in other fields. The model is used in the publication from the Institute of Medicine of the National Academies, Committee on Pathophysiology and Prevention of Adolescent and Adult Suicide: Reducing suicide a national imperative [Institute of Medicine, 2002]:

“The prevailing prevention model in the interdisciplinary field of prevention science is the Universal, Selective, and Indicated (USI) prevention model. This USI model focuses attention on defined populations – from everyone in the population, to specific at-risk groups, to specific high-risk individuals – i.e., three population groups for whom the designed interventions are deemed optimal for achieving the unique goals of each prevention type.”

“*Universal* strategies or initiatives address an entire population (the nation, state, the local county or community, school or neighbourhood). These prevention programs are designed to influence everyone, reducing suicide risk by removing barriers to care, enhancing knowledge of what to do and say to help suicidal individuals, increasing access to help, and strengthening protective processes like social support and coping skills. Universal interventions include programs such as public education campaigns, school-based ‘suicide awareness’ programs, means restriction, education programs for the media on reporting practices related to suicide, and school-based crisis response plans and teams.”

“*Selective* strategies address subsets of the total population, focusing on at-risk groups that have a greater probability of becoming suicidal. Selective prevention strategies aim to prevent the onset of suicidal behaviours among specific subpopulations. This level of prevention includes screening programs, gatekeeper training for ‘frontline’ adult caregivers and peer ‘natural helpers’, support and skill building groups for at-risk groups in the population, and enhanced accessible crisis services and referral sources.”

“*Indicated* strategies address specific high-risk individuals within the population – those evidencing early signs of suicide potential. Programs are designed and delivered in groups or individually to reduce risk factors and increase protective factors. At this level, programs include skill-building support groups in high schools and colleges, parent support training programs, case management for

individual high-risk youth at school, and referral sources for crisis intervention and treatment”

#### THE DANISH ACTION PLAN

The Danish suicide prevention strategy is outlined in the Proposal for a National Programme for Prevention of Suicide and Suicide Attempt in Denmark [Sundhedsstyrelsen (Danish National Board of Health), 1998c]. Here, it was decided that the plan should be based on the model illustrated in Figure 8.

Without the involved expert group being aware of it, the Danish action plan was actually based on the model that classifies preventive measures as universal, selective and indicated prevention. The upper segment of the triangle called specific prevention can easily be translated into indicated prevention – as the preventive measures mentioned under this heading are measures directed towards persons who have developed signs of suicidal potential by attempting suicide or by presenting serious suicidal ideation. The selective prevention can be translated to the risk group in the middle segment of the triangle, while the universal approach is covered by the lower part of the triangle directed towards the general population.

This model is much easier to use in suicide prevention than the traditional primary, secondary, tertiary model.

#### STRUCTURAL AND INDIVIDUAL PREVENTION

A third way of classifying preventive measures is structural or individual. Structural measures include restricting the means for suicide, setting an age limit for sale of alcohol, banning internet pages that give instruction in methods for suicide, securing bridges and high places with fences etc. It can also include a more general policy of preventing social disintegration and desperate situations.

Individual measures include media campaigns about possibilities for help seeking, counselling and treatment of suicidal persons and persons at risk of becoming suicidal.

#### ANALYSES OF TIME AND SITUATION

Suicidal acts together with accidents are sudden events related to human behaviour. Therefore, it is also important to think about specific situations and monitor high-risk situations – more than would be considered with chronic diseases.

Thus, the distinction between universal, selective and indicated prevention needs to be specified into situation-specific prevention, since suicidal behaviour and intention fluctuate. Even for a person with a very high risk of suicide, survival is by far the most likely outcome each day. In most cases, suicidal acts are carried out within a short period of time, and in many cases without a long period of warning signals. In a way, suicidal acts resemble heart attacks or epileptic episodes more than other complications that often develop slowly and gradually. This makes the task of creating awareness programmes even more difficult. Suicide constitutes an important public health problem, but suicidal acts are difficult to keep under continuous surveillance.

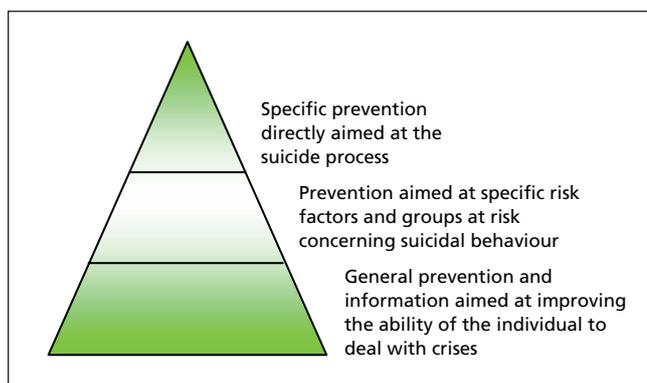


Figure 8. The preventive model used in the Danish Action Plan.

Interventions involve persons who will never commit a suicidal act, and they also involve monitoring persons in high-risk groups for long periods with no suicidal acts.

For other causes of death, such as car accidents, it is possible to identify mechanisms behind the development in mortality rates. The driver can be analysed with regard to age and sex, hours driven, driving skills, alcohol intoxication. The car can be analysed with regard to type, age and condition. The place can be analysed: for instance, whether a fatal accident took place on a highway or other type of road, on a slippery or dry road, on the pavement or the cyclists' lane, on a road with traffic dampening measures, or near a school. The situation can be analysed: for instance, whether the involved persons wore seat belts and which seat the deceased sat on, whether the deceased was in the car or walking or cycling, whether any cyclist involved wore a helmet etc. Of course, all these considerations require well-planned collection of detailed data, but in the case of car accidents, it is pretty clear which data to look for. When the statistics about car accidents appear, the mechanisms behind a positive or negative development can be analysed, and thus the statistics give a direct possibility for planning prevention.

For suicide, it is much more difficult. Suicide mortality rates develop in fluctuating waves, but we do not have sufficient knowledge about the mechanisms behind the fluctuations. Car accidents can be considered as a side effect of driving, and as such this action can be monitored and regulated; and accidents have actually been successfully prevented in such cases, for example when an enormous amount of extra driving has not resulted in a corresponding amount of fatal car accidents.

In contrast to car accidents, suicidal acts are not side effects of something very specific. It is possible to collect data about the persons, the mechanism, the place, and the situation. These data are actually collected and could be analysed more thoroughly, and it would help give us some understanding of the phenomenon, but it is still insufficient. An example of the situational approach is the awareness that persons in crises because of resentment and loss of status are at high risk for suicide, such as people taken into custody and accused of crime. Another situational approach is the awareness of the acute risk of suicide immediately after psychiatric admission of suicidal patients.

#### UNDERSTANDING CULTURE

In implementing health services in different subcultural groups, a deep cultural and anthropological understanding of the way of living is necessary. It is also necessary to have a deep understanding of suicidal people to understand how suicide can be prevented for each individual. Therefore, it is not enough to know that a certain group of persons are at high risk of committing suicide; it is also necessary to know what kind of help it is possible to establish, and whether there is any chance that these interventions can be viewed upon as acceptable and helpful.

#### METHODOLOGICAL PROBLEMS IN RESEARCH OF SUICIDE PREVENTION

There are numerous methodological problems in research of suicide prevention. Some of these are associated with classification and measuring of the outcomes "suicide" and "attempted suicide". These problems are mentioned in the section about reliability of suicide mortality data and in the introduction to the section "indicated prevention".

Even though suicide is a large public health problem, and even though high-risk groups for suicide can be identified, the base rate of suicide is low, also in high-risk groups. It is widely accepted that suicide attempts are estimated to be much more common – probably 10 times more common – than suicides. The population of persons who attempt suicide and those who die by suicide overlap, but the gender distribution in the two groups demonstrate that this overlap is only partial. Also other risk factors only overlap to some extent.

To evaluate an intervention, the best method is a large randomised clinical trial that includes a representative sample of the target group. However, due to the low base rate, the trials should include several thousand participants in order to reduce the risk of type II error [Pocock, 1996]. Randomised clinical trials large enough to provide evidence of effectiveness of suicide preventive measures in risk groups are difficult to organize, and practical, political and ethical considerations may make such trials impossible. It is seldom possible to carry out such large trials; they would necessitate multi-centre trials, which again are associated with methodological difficulties in ensuring that the same interventions are carried out at different sites. Meta-analyses of randomised clinical trials can compensate to some extent for the trials being underpowered, but often the trials included in meta-analyses are different with regard to population group included, duration and intensity of treatment. Reluctance to carry out randomised clinical trials in suicide prevention presents an additional problem.

As suicide attempts are much more common than suicides, many investigators have chosen to solve the "problem" of the low base rate of suicide with the use of suicide attempt as a proxy variable for suicide. If suicide attempt is chosen as outcome measure, it is possible to establish randomised studies with sufficient power to examine a potential effect of preventive measures. Even though risk factors for suicide and suicide attempt are not completely the same, it is likely that preventive efforts effective in reducing frequency of suicide attempts are also effective in preventing suicide.

The number needed in a randomised trial is a function of both the expected rate of repetition (that is, that in the control group) and the size of the difference. If the predicted rate were 10 percent in the experimental group versus 15 percent in the control group, with level of significance ( $\alpha$ ) set at 0.05 and required power ( $\beta$ ) set at 0.90, 913 subjects would be required in each treatment group, whereas if the rates were 20 percent and 30 percent, 388 subjects would be required in each group [Pocock, 1996; Hawton et al., 1998].

If suicide is the outcome, a much larger sample size is needed. If for instance an experimental intervention reduced suicide rate from four percent to two percent, 1522 participants would be needed in each treatment group to detect with a power ( $\beta$ ) of 0.90 and a significance level of ( $\alpha$ ) 0.05 [Pocock, 1996].

Low quality of the randomised clinical trials can bias the results. Criteria for high quality are: Intention-to-treat principles applied in concealed treatment allocation, independent assessors blinded to treatment allocation, low attrition, high validity of measures of outcome. The external validity of the trial is determined by the sample, which should preferably be a consecutive or representative sample of all relevant cases in a catchment area. If only special patient groups are included, the findings cannot be generalized to other patient groups.

Meta-analyses can be used to evaluate the effect of a specific intervention when several trials have examined the effect of the same intervention. It is of importance to examine the above-mentioned factors when carrying out meta-analyses.

The difficulties mentioned above imply that in some cases it becomes necessary to recommend interventions that are known or expected to result in general improvements in the psychiatric service or other services for risk groups with the potential of decreasing suicide rates.

In many cases, it is not possible to carry out a randomised clinical trial of factors likely to play a role in increasing or decreasing suicide rates in the general population or in specific risk groups.

In such cases, it is necessary to carry out naturalistic, individually based, observational studies or ecological studies. Individually based naturalistic studies can identify prognostic factors. In interpreting such studies, it is important to consider the confounding effect of other factors. The quality criteria for randomised clinical trials are well developed, and there is uniform agreement about the CON-

SORT criteria [Altman et al., 2001]. The quality criteria for naturalistic studies of prognostic factors are less developed; therefore, the published literature is of lower quality. Systematic reviews are very much needed, but because of the poor quality of the published literature, formal meta-analyses are warned against [Egger et al., 2001; Altman, 2001]. Naturalistic studies include prospective cohort studies, nested case control studies and case control studies. Nested case control studies have an advantage over case control studies, since selecting controls from a large database implies possibilities for matching on several relevant factors and for adjusting estates of risk for possible confounders. However, naturalistic studies of any kind carry a risk of interchanging cause and effect.

Randomised clinical trials cannot be carried out to evaluate health care reforms, changes in culture or religion, media coverage, unemployment, immigration policy, restrictions in means for suicide, and changed legislation or pattern of use for alcohol and drugs. In these cases, ecological studies or individually based naturalistic studies must be carried out. However, the interpretation of such studies is associated with difficulties, as it can be impossible to disentangle what is the effect of the change that is the subject of the study and what are the effects of confounding factors. Observational studies cannot provide the same strong evidence as randomized clinical trials; nevertheless, there are numerous areas where recommendations for practice will have to rely on weaker evidence.

#### UNIVERSAL, SELECTIVE AND INDICATED PREVENTION, SELECTED REVIEW

In the following, some fields of great importance for suicide prevention are reviewed. The review is structured in universal, selective and indicated prevention, and a public health approach has guided the selection of topics.

A recent review of suicide prevention strategies was published in 2005 [Mann et al., 2005]. In this review, among the several topics evaluated were awareness programmes for general practitioners,

pharmacotherapy and other treatment interventions, means restriction, educational programmes and media influence. Awareness programmes and use of pharmacotherapy will be mentioned together with review of selective prevention; treatment intervention will be mentioned in the review about indicated prevention; and educational programmes, means restriction and media influence will be reviewed under the heading of universal prevention.

#### UNIVERSAL PREVENTION, A SELECTIVE REVIEW

It is evident from the fluctuating suicide rates in different countries that a range of factors play a role, such as changes in social, cultural and political climate, changes in health status and access to alcohol and drugs, access to lethal methods for suicide, and access to health care.

The steep increase in suicide rates in Greenland [Thorslund, 1992] and in the former Baltic countries (Figure 9) that have taken place on the background of turbulent political, social and economic changes could be examples of increasing numbers of "anomic suicides". This concept was developed by Dürkheim [Durkheim, 1897], who hypothesized that anomic suicides were likely to increase in periods when social norms and roles underwent rapid changes. Studies of reliability of official suicide mortality data indicate that these data are reliable [Thorslund, 1992; Wasserman and Varnik, 1998a]. The time changes in the former Eastern European countries are shown in Figure 9. Among the former Eastern USSR countries, only data from countries that were classified as being reliable are included [Wasserman and Varnik, 1998a]. Several countries (Lithuania, Latvia, Estonia, Russian Federation, Kazakhstan, and Ukraine) showed a steep decrease in the mid-1980s, a steep increase in the first years of the 1990s, and a slow decrease thereafter. In other countries, suicide rates had a more stable course, with Poland and Bulgaria showing a slow increase, and Czech Republic, Slovakia, Belarus, Kyrgyzstan, and Republic of Moldova showing a slow decrease. Suicide rates in Hungary, which in the early 1980s were

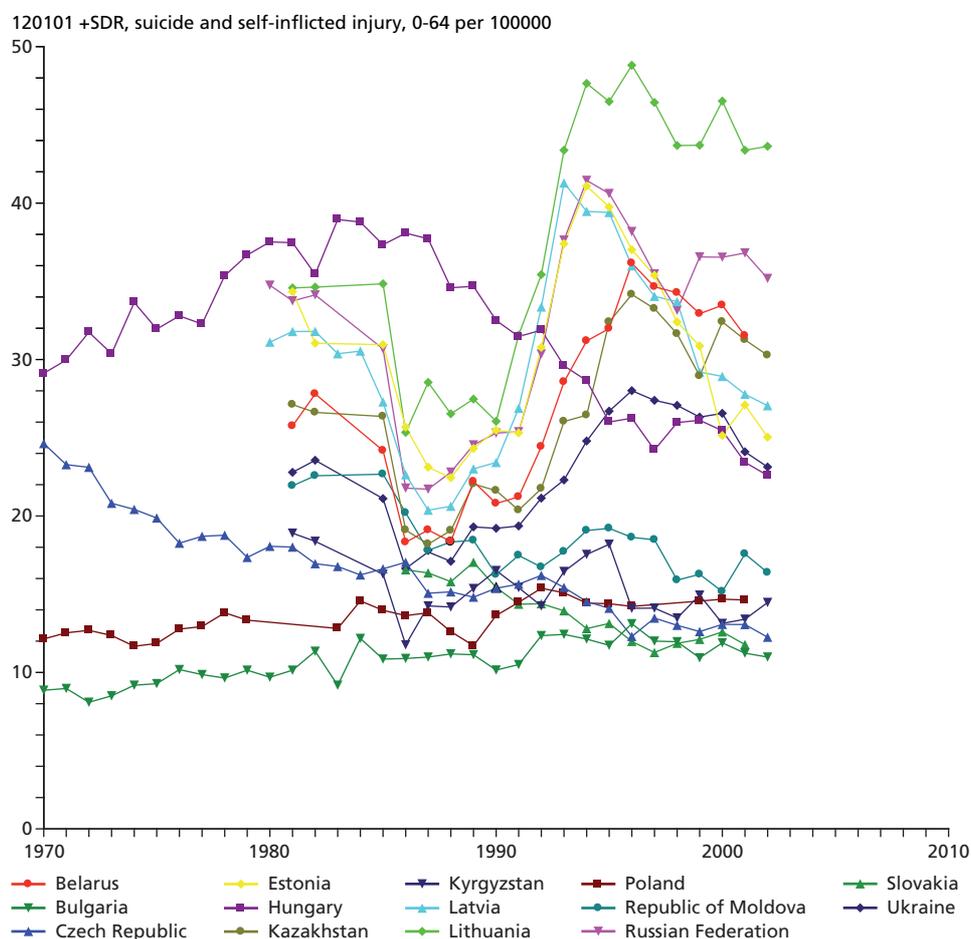


Figure 9. Suicide rate per 100,000, 0-64 year old in former Eastern European countries.

among the highest in the world, had decreased with 40 percent since 1984. It is evident from the figure that changes in suicide rates were substantial, and a range of factors could contribute to these developments. It is beyond the scope of this thesis to evaluate to which extent different factors played a role, but it is relevant to evaluate the influence of the turbulent political and social situation, differences in alcohol policy, differences in access to health care and medication, and differences in access to lethal methods for suicide.

If a universal preventive mechanism is effective, it is often the case that it has not been initiated because of its direct effect on suicide, but because of other factors. If any changes in the political and cultural environment in Denmark have been beneficial for suicide rates during the last 20 years, it is not likely that these changes were initiated because of their direct influence on suicide rates. For example, any efforts made to reduce stalking in workplaces and schools have not only been motivated by the possible effect on suicide risk.

Introduction of school programmes has been proposed aimed at reducing suicidal behaviour, but based on two recent reviews it seems sound to conclude that there is insufficient evidence to either support or refute any benefits from curriculum-based programmes in schools. More broadly based comprehensive school health programmes should be evaluated for their effectiveness in addressing the determinants of adolescent risk behaviour [Ploeg et al., 1996; Guo and Harstall, 2002].

It is well-established that alcohol abuse is associated with increased risk for suicide [Murphy, 2000; Murphy, 1992; Kolves et al., 2006; Qin and Nordentoft, 2005]. Studies from the former USSR indicate that alcohol restriction might positively influence suicide rates [Wasserman and Varnik, 1998b]. Figure 10 is based on data from Statistikbanken (<http://www.statistikbanken.dk/statbank5a/default.asp?w=1280>), and it appears that alcohol consumption in Denmark has been quite stable from 1981 to 2000. On the ecological level, there was no association between sales figures for alcohol and suicide rates for men or women (Pearsons correlation coefficient -0.32 and 0.30, men and women respectively, non-significant). However, the pattern of alcohol use was slightly changed during the same period, so that the total consumption was more evenly distributed, fewer drank during weekdays and fewer drank during the daytime [Sabye-Hansen et al., 1998]. This might indicate that fewer had a large, problematic alcohol consumption, and it might to some degree have influenced suicide rates positively.

Unemployment is associated with a clearly increased risk of suicide [Platt and Hawton, 2000; Agerbo, 2003; Qin et al., 2003], and this can be a result of causal and selective factors. However, as can be

seen in Figure 10, there is no correlation between time change in unemployment rates and suicide rates (Pearson correlation coefficient 0.29 and 0.27 men and women respectively, non-significant).

A range of cultural factors that may be difficult to determine might influence suicide rates. In Figure 10, the number of births in Denmark is listed as well, and reduced suicide rates together with increased number of births might be a proxy variable for hope and optimism in the Danish society. The number of births is strongly inversely correlated with suicide rates for both men and women (Pearson correlation coefficient -0.89 and -0.87 for men and women respectively,  $p < 0.01$ ). The same strong and highly significant correlation was found when fertility (number of children born per 1000 women in the age group 15-49 years) was used instead of number of births (-0.86 and -0.87 for men and women respectively,  $p < 0.01$ ).

It is well established that media attention regarding suicide can also influence suicide rates [Hawton and Williams, 2002; Simkin et al., 1995; Zahl and Hawton, 2004a], and influencing media coverage of suicidal events can be considered to be an element in a universal approach. However, strategies for influencing how the media reports suicide need to be implemented and evaluated. At present, no data can elucidate whether changes in media reports or internet instructions in methods for suicide influence time changes in Danish suicide rates.

The association between sales figures for Selective Serotonin Reuptake Inhibitors (SSRI) and suicide rates for men and women do also demonstrate a strong inverse association (Pearson correlation coefficient -0.98 for both men and women,  $p < 0.01$ ). This issue will be discussed in detail in the section about selective prevention.

Among the possible interventions in universal suicide prevention, restricting access to means for suicide is the best documented. This intervention is recommended as an active ingredient in suicide prevention strategies [Mann et al., 2005]. However, in some cases, restrictions in means for suicide have been decided directly with the aim of influencing suicide rates, whereas in other cases, environmental considerations, for example, have been the main reason for restricting availability of means for suicide.

In the following, evidence concerning the effects of restrictions in access to means for suicide is presented.

#### RESTRICTIONS IN MEANS FOR SUICIDE

There is huge variation in the use of methods for suicide all over the world. In USA, 60 percent of all suicides are committed with firearms, while in Southeast Asia, a similar figure accounts for pesticide suicides [Eddleston et al., 1998; Gunnell and Eddleston, 2003].

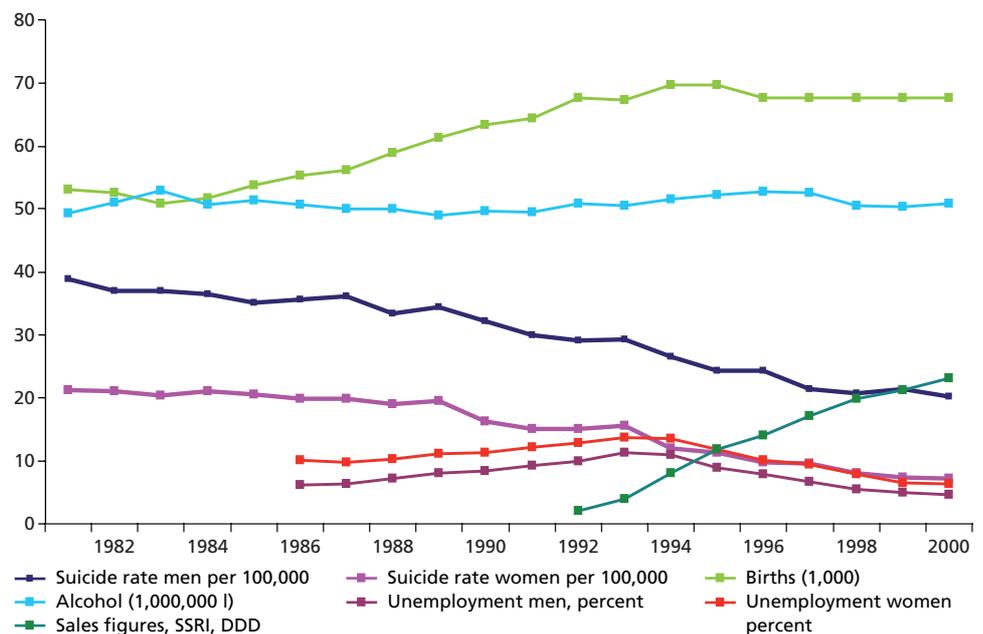


Figure 10. Time changes in suicide rates, alcohol consumption, unemployment rates, and number of births. 1981-2000.

It has long been hypothesized that restrictions of means for suicide can positively influence suicide rates [Marzuk et al., 1992; Farmer and Rohde, 1980], and many studies have been carried out to elucidate the effect of restricting means for suicide. Some studies are based on ecological data, while some are based on data at the individual level. The latter are case control studies and prospective cohort studies, which have the strength of the individual match but are nonetheless natural studies and hampered by the risk of confounding with other risk factors. Some of the ecological studies evaluate the method-specific suicide rate and suicide rate before and after a change in legislation; others evaluate regional differences in the method-specific pattern in one country or between countries; still others evaluate method-specific suicide rates in specific professional groups.

Availability of means for suicide is definitely not the only factor determining suicide. Relying only on crude ecological data, it is thus possible, for instance, in one country for restrictions to seem worthless because other strong factors work against the effect of restrictions. Yet, in another country, the impression of a very strong effect of restrictions may be false because they take place concomitantly with changes in other factors that have a beneficial influence on the suicide rate.

When evaluating the effect of restricting the availability of means, it is obviously most important to restrict the access to the availability of the means with the highest case-fatality rate. Case-fatality is defined as:

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The number of persons who commit suicidal acts using method X

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The number of persons who commit suicidal acts using method X  
(fatal and non-fatal cases)

In a study in seven states, Miller et al. [Miller et al., 2004a] concluded that case fatality for all the evaluated methods was 13 percent, while it was 91 percent for firearms, 3 percent for poisoning/cutting/piercing, 80 percent for suffocation/hanging and 30 percent for all other methods. In a study based on information from eight states, Spicer and Miller [Spicer and Miller, 2000] found that case fatality was 83 percent for firearms, 61 percent for suffocation/hanging, 66 percent for drowning/ submersion, two percent for drug/poison ingestion, and one percent for cutting/piercing. When planning suicide preventive efforts, including restrictions of means for suicide for each method, attention must be paid to case fatality and the proportion of all suicides using the method.

In the following review, studies are classified according to which method was evaluated and then which design was used in the studies. The strongest design is the case control study (in absence of randomised clinical trials), but studies using this design were only identified in relation to firearm suicides.

### **Firearms**

In Denmark, firearms are used in only a minority of suicides, and several changes in legislation during the last 20 years have resulted in more restrictions concerning storing of weapons [Nordentoft et al., 2006]. Firearms were chosen for this review, not because of the proportion of suicides with firearms in Denmark, but because restriction in availability of firearms has been investigated in many studies and can serve as a model for other methods. The validity of the classification of suicides by firearms is assumed to be high, as there is not much doubt about the cause of death, and the police investigation to exclude the possibility of homicide is supposed to be of high quality. Three reviews have been carried out in this field [Miller and Hemenway, 1999; Lester, 1998; Haw et al., 2004]. All three reviews concluded that there was a strong association between gun ownership and gunshot suicide.

The studies of restrictions of availability of firearms are listed in the following table (Table 1).

The case control studies would be hampered by bias if gun owners were more (or less) likely than people without gun ownership to

move out of states, and therefore their mortality would be under- (or over-) estimated. One can only speculate whether it is relevant to consider such a mechanism. If people who were gun owners had other risk factors for suicide in common, such as psychiatric illness, previous suicide attempts, or alcohol and drug abuse, and the gun was only a marker of that increased risk, it could be erroneously concluded in the case control studies and in cohort studies that the gun was the only determining factor. In most of the above-mentioned studies, the OR for suicide was adjusted for other risk factors, thus estimating as purely as possible the increased risk of owning a gun. The studies strongly indicate that even after controlling for other known risk factors for suicide, availability of a gun in the home was associated with increased risk of suicide. The increased risk for suicide associated with firearms in the home was at least two-fold and higher in some groups and for handguns and loaded guns.

In addition to the above-mentioned case control studies, a large prospective cohort study was identified [Wintemute et al., 1999]. In this study, 238,292 handgun purchasers in California in 1991 were followed and compared with the general population. The authors found that in the first year after handgun purchase, suicide was the leading cause of death; in the first week, the firearm suicide rate was 57 times higher than the adjusted state-wide rate; and the standard mortality by suicide rate was elevated to 2.16 as the mean value during an observation period of up to six years. The results in this study were not adjusted for the confounding effect of other risk factors, as information about these was not available.

A range of studies were concerned with the effect of changes in legislation. As mentioned, a problem with time series analyses is that so many factors change over time that it is difficult to disentangle their effect. The legislation with the most well-described effects is the Canadian gun control laws. Bill C-51 was passed in 1978 and involved the most well-described changes. This act required acquisition certification for all firearms, restricted the availability of some types of firearms to certain types of individuals, set up procedures for handling and storing firearms, required permits for those selling firearms, and increased the sentence for firearm offences. Handguns were virtually outlawed. Persons who possessed unregistered guns were required to present them for registration or surrender them, and a nationwide educational campaign about use and storage of firearms was also undertaken. A number of time series studies examined the effect of this legislation. Leenaars [Leenaars et al., 2003] reviewed all studies examining the effect of Bill C-51 and concluded that Bill C-51 may have had an impact on suicide rates, even after controls for social variables (see Table 2). Bill C-17 strengthened the screening of firearm acquisition certificate applicants and introduced a mandatory 28-day waiting period.

In Australia in 1980, gun legislation was implemented in South Australia that required licensing of all gun owners. In 1990 in Queensland, Australia, the Weapon Act required owners of long guns to purchase a license and set a 28-day waiting period, and applicants were required to take a safety test.

In 1976, the District of Columbia in the United States adopted a law banning the purchase, sale, transfer or possession of handguns by civilians. It also introduced registration of firearms, check of purchaser's background, and gun safety standards. In USA, the Brady Handgun Violence Prevention Act was implemented in 1994 (background check of applicants and a five-day waiting period), but 18 states and the District of Columbia already met these criteria before the act was introduced. In Table 3 it is shown that also ecological studies, comparing availability of firearms and suicide rates in different regions, indicate that restrictions may prevent firearms in suicide.

Almost all of the studies reviewed reach the same conclusion, namely restrictions in availability were associated with a decline in firearm suicide rate. In their review of suicide prevention strategies, Mann et al also concluded that suicide by firearms decreased after firearm control legislation [Mann et al., 2005]. The "displacement

hypothesis" put forward by Stengel [Stengel, 1967] was generally not supported, although some studies indicated some evidence of method switch in some age groups.

All three types of the studies reviewed indicate the same conclusion, namely that the availability of firearms increases the risk of firearm suicide in all age groups, including children. All studies of the effect of gun legislation indicate that strict gun legislation reduces firearms suicide rate.

### Carbon monoxide

The availability of carbon monoxide and its relation to suicide rates has been investigated in studies of detoxification of coal gas and in the introduction of mandatory catalytic converters. Kreitman studied the effect of detoxification of domestic gas in UK from 1955 to 1971 [Kreitman, 1976] and found that there was a marked decline in carbon monoxide suicides in both genders concomitantly with reduced availability of toxic domestic gas. It was also found that for men, this was responsible for the decline in the overall suicide rate,

while for women, there was some compensatory use of other methods. The same process was studied in Japan and Switzerland [Lester and Abe, 1989; Lester, 1990b], and in neither of these countries was the reduction in suicide with carbon monoxide compensated by use of other methods. The same author studied the effect of detoxification of domestic gas in the United States and found that the rate of suicide by domestic gas decreased (1950-60). During this time period, there was a parallel increase in the per capita ownership of cars and an accompanying increase in the rate of suicide by motor vehicle exhaust. However, displacement of suicide method from domestic gas to car exhaust occurred only for males and not for females [Lester, 1990c]. In Denmark, we found a significant association between number of households with household gas containing carbon monoxide and the overall suicide rate and the method-specific suicide rate (gas poisoning) for both men and women [Nordentoft et al., 2006].

McClure found that after the decline in suicide for men with carbon monoxide from domestic gas, there was an increase in carbon

Table 1. Availability of firearms and risk of suicide. Case control studies.

Study	Study population	Independent variables	Finding	OR (95% CI)
[Brent et al., 1988]	27 suicide victims compared with 56 controls who had attempted suicide or seriously considered doing so.	Availability of firearms in the home. Information about accessibility (stored loaded, with ammunition separately, or unloaded, locked or unlocked)	Firearms were more likely to have been present in the homes of suicide victims. Way of storage of firearms was not important. Suicide victims and suicidal in-patients had similar high rates of previous suicidal behaviour, affective disorder and family history of psychiatric disorder and suicide	Firearms available in the home OR suicide 2.7 (1.1-6.4)
[Brent et al., 1991]	47 adolescent suicide victims, 47 adolescent suicide attempters, 47 never suicidal adolescent psychiatric controls	Gun ownership	Guns were twice as likely to be found in homes of suicide victims as in the homes of suicide attempters and psychiatric controls. No different finding for guns stored locked or separate from ammunition	After controlling for diagnosis of affective disorder and suicidal intent, guns present in the home was associated with OR suicide was for 2.1 (1.2-3.7) in completers relative to attempters and OR 2.2 (1.4-3.5) for completers relative to psychiatric controls after adjusting for diagnosis of conduct disorder
[Brent et al., 1994]	63 adolescent suicide victims with a history of affective illness were compared to 23 adolescent community controls with a lifetime history of affective illness.		Suicide victims were more likely to have had major depression, co-morbid substance abuse, a past suicide attempt, family history of major depression, treatment with a tricyclic antidepressant, history of legal problems, and a handgun available in the home (41% vs. 0%)	Not computed
[Brent et al., 1993]	67 adolescent suicide victims compared with 67 living community controls	Informant's information about presence of guns, handguns, long-guns, loaded guns in the home	Firearms were more frequently found in the homes of suicide victims than in demographically matched community controls. Handguns and loaded guns were associated with the highest risk of suicide	After adjusting for rates of psychiatric disorder, increased risk of suicide was found: Any gun OR 4.4 (1.1-17.5), handgun OR 12.9 (1.5-110.9) and loaded gun OR 32.3 (2.5-413.4)
[Kellermann et al., 1992]	442 suicide victims who committed suicide in 1987-1990 in two counties in USA at home and for whom proxies could be interviewed, 438 matched (sex, race, age range) controls	Gun ownership	Gun ownership was more likely in cases than in controls. Adjusted odds ratio for suicide was higher with handguns than with long guns only, and higher in loaded guns than in unloaded guns. Also risk was higher with unlocked guns than with locked guns	After controlling for living alone, taking prescribed drugs, having been arrested, alcohol and drug abuse, presence of guns in the home was associated with OR 4.8(2.7-8.5) for suicide. Loaded firearms OR 9.2 (4.1-20.1)
[Cummings et al., 1997]	353 suicide victims and 117 homicide victims and five matched control subjects (sex, age and zip-code) to each victim	Handgun purchase information from Department of Licensing	Legal purchase was associated with a long-lasting risk of violent death	History of handgun purchase from a registered dealer was associated with OR 1.9 (1.4-2.5) for suicide for matched suicide and control subjects
[Bukstein et al., 1993]	23 adolescent suicide victims with substance abuse and 12 community controls with lifetime history of substance abuse	Presence of handgun in the home	Availability of handguns distinguished completers from controls	No controls had a handgun in the home (OR cannot be calculated)
[Grassel et al., 2003]	1998 cases 1,546 firearm suicides 208,738 non-injury death	Purchase of a handgun	Purchase of a handgun within three years before death more likely for persons who died from firearm suicide than for persons who died from non-injury causes	Purchase of a handgun was associated with increased risk of suicide OR 6.8; (5.7- 8.1) and firearm suicide OR 12.5 (10.4-15.0), adjusted for race, age, sex, education and marital status

monoxide suicide rates for car exhaust [McClure, 1987]. Later, the same author found that between 1990 and 1997, the suicide rate decreased for males and females in all age groups, particularly for those using motor vehicle exhaust gas; the latter finding is associated with increasing use of catalytic converters [McClure, 2000].

The effect of mandatory catalytic converters in all petrol cars sold since 1993 was studied from 1991 to 1996 in the UK by Kendell [Kendell, 1998], who concluded that the introduction of catalytic converters decreased the number of suicides without substitution of other methods. However, Amos et al. [Amos et al., 2001] studied the same process from 1987 to 1998 and concluded that the decline in suicide rate by car exhaust asphyxiation for young men and women (15-44 years of age) was substituted by a rising rate of hanging, while for other age groups there was no evidence of method substi-

tion. Evaluating the period 1968 to 1998 in USA, Mott and Wolfe found that the introduction of catalytic converters was followed by a decline of approximately 40 percent in the rate of motor-vehicle-related carbon monoxide suicides [Mott et al., 2002].

In our study of method-specific suicide rates in Denmark, we found an inverse association between number of old cars per inhabitant and method-specific suicide rate (car exhaust) and overall suicide rate for both men and women [Nordentoft et al., 2006].

It is sound to anticipate that the risk of misclassification of suicides with carbon monoxide is small.

### **Drug poisoning**

In before and after studies, Hawton et al. [Hawton et al., 2001; Hawton et al., 2004] studied the effect on suicidal behaviour of UK legis-

**Table 2.** Availability of firearms, ecological studies, before and after changes in legislation.

Study	Design	Outcome	Finding
<i>Canada</i>			
[Rich et al., 1990]	Comparing suicide rates in Toronto, Ontario five years before and five years after gun control legislation in 1978 (Bill C-51)	Overall suicide rate and percent of male suicide by shooting, leaping, and all immediate fatal methods together	Immediately after the legislation the percent of men committing suicide with firearms fell, but it was to some extent replaced by an increasing number of suicides by leaping. The year before the legislation change the overall suicide rate reached a peak, but otherwise it was stable throughout the period
[Carrington, P.J. & Moyer, S. Am J Psych 1994]	Comparing suicide rates in Ontario 13 years before (1965-1977) and 11 years after (1979-1989) the Canadian gun control law 1978 (Bill C-51)	Firearm and non-fire arm suicide rates. Age standardized	There was a decrease in level of firearm and overall suicide rates. No substitution of method accompanied the decreased use of firearms in Ontario that followed the enactment of gun control laws
[Leenaars and Lester, 1996]	Comparing periods eight years before (1969-1976) and nine years (1977-1985) after Bill C-51, 1978 in Canada	Firearm suicide rate, overall suicide rate, and suicide rate for other methods	For men, there were increasing suicide rates with firearms and with all other methods after implementation of Bill C-51, and the opposite was seen for women. Passage of the law seems to have had the intended impact on women suicide rates, but not on men
[Leenaars and Lester, 1998]	Comparing periods before and after restrictive legislation	Suicide with firearms and other methods	After the change in legislation, suicide rate with firearms was significantly reduced, and the same tendency could be seen for all other methods, although the latter was not significant
[Bridges, 2004]	Before and after Bill C-17 in 1991 in Canada. Waiting period of 28 days and strengthened screening of applicants	Suicide with firearms, other methods and overall suicide rate	After change in legislation suicide with firearms was reduced with 22.4 percent (P=0.001), overall suicide rate declined with 1.4 percent (P=0.59), thus a small decline but also a switch to other methods
<i>Australia</i>			
[Snowdon and Harris, 1992]	Firearm suicide rates in five Australian states with different legislation (licensing of gun owners), 1968-1989	Firearm suicide rate	Firearm suicide rates declined in South Australia Australia following gun legislation, in contrast to four other Australian states. Only means for different periods were reported, no trends
[Cantor and Slater, 1995]	License for long guns, 28-day waiting period in Australia	Firearm and overall suicide rate	There was a 40 percent decline in firearm suicide rate in metropolitan and provincial Cities from two years before to two years after the change in legislation, but not in rural areas. The overall suicide rate declined for men in metropolitan areas, but not in provincial or rural areas. The decline in firearm suicide rate in metropolitan areas was partially compensated by switch to other methods
<i>USA</i>			
[Loftin et al., 1991]	In 1976, District of Columbia adopted a law banning the purchase, sale, transfer or possession of handguns by civilians, as well as introducing registration of firearms, background check of purchasers and gun safety standards	Firearm suicide rate and overall suicide rate	Prompt decline in suicide rate with firearms of 23 percent. No indication of method substitution. No change in surrounding states where firearms legislation was not altered
[Ludwig and Cook, 2000]	Comparing states before and after legislation introducing waiting periods and background check for handgun sales with control states with no change in legislation	Firearm suicide rate and overall suicide rate for United States for 1985 through 1997	Reduction in firearm suicide rate for persons aged 55 years and older was much stronger in states that had instituted both waiting periods and background checks

lation (October 1998) limiting the size of packs of paracetamol and salicylates sold over the counter. The legislation limited pack size sold over the counter to 32 tablets in pharmacies and 16 in free sale. All packages should be blister packed. Suicidal deaths from paracetamol and salicylates were reduced by 22 percent during the year after the change in legislation, and this reduction persisted for the next two years. Liver unit admissions and liver transplants for paracetamol-induced hepatotoxicity were reduced by around 30 percent for four years after the legislation. Numbers of paracetamol and salicylate tablets in non-fatal overdoses were reduced for three years after the legislation. Large overdoses were reduced by 20 percent for paracetamol and by 39 percent for salicylates in the second and third years after the legislation. Ibuprofen overdoses increased after the legislation, but with little or no effect on deaths. The effect on over-

all suicide mortality was not mentioned [Hawton et al., 2001], but in a review of the epidemiology and prevention of suicide by hanging in UK, Gunnell found increasing rates of suicide by hanging in England and Wales during the last decade [Gunnell et al., 2005a]. The overall suicide rates in United Kingdom declined in the period 1999-2002 ([www.who.int/healthinfo/morttables/en/index.html](http://www.who.int/healthinfo/morttables/en/index.html)).

Few other studies of legislation changes have been carried out, but our own study [Nordentoft et al., 2006] revealed that the suicide rate with barbiturates decreased markedly after changed prescription rules in 1986 without any indication of method switch. However, as shown in the study, the decline in barbiturate suicides began before legislation change, reflecting that to a large extent doctors had changed the prescription pattern before the new prescription rules.

Several other studies investigated restrictions on the prescription

**Table 3.** Ecological studies of firearm availability, comparing regions

Study	Design	Outcome	Independent variables	Finding
[Boor and Bair, 1990]	Comparing regions	Overall suicide rate	Legislation restrictions on buyers and sellers	The meta-analysis was based on data from the United States only. The effect of handgun control laws affecting the buyer (waiting period, registration, ownership licence) and the seller (licence to purchase handgun) was investigated. In a multiple regression analysis, controlling for socio-demographic variables, divorce rate, crime rate and unemployment rate, both handgun control laws affecting buyers and sellers of handguns were determining for the overall suicide rate
[Kaplan and Geling, 1998]	Comparing regions	All suicides in USA in 1989-91, regional information	Proportion households with gun ownership	Strong correlation between proportion households with gun ownership and proportion suicides involving guns
[Lester, 1990a]	Comparing regions	Suicide rates and suicide rate with firearms in 20 countries	Proportion homicides using guns	Percentage of homicides with firearms was positively correlated with the firearm suicide rate
[Miller et al., 2002c]	Comparing regions	Suicide rates and firearm suicide rates in 50 US states from 1988 to 1997	Level of household firearm arm ownership	Suicide mortality rate ratio was four times higher in high gun states than in low gun states
[Miller et al., 2002a]	Comparing regions	Female suicide rates and firearm suicide rates in 50 US states from 1988 to 1997	Level of household firearm ownership	Suicide rates among women were disproportionately higher in states where more prevalent. Findings were not entirely explained by state's poverty or urbanization
[Miller et al., 2004b]	Comparing regions	Suicide rates and firearm suicide rates in 7 states 1996-2000	Proportion households with firearms	Firearm prevalence was positively related to the suicide rate
[Miller et al., 2002b]	Comparing regions	Suicide rate among 5-14 year olds in 50 states in USA	Four different proxies for firearm availability	A disproportionately high number died from suicide in regions where guns were more prevalent
[Smith and Stevens, 2003]	Comparing nations	Firearm suicide rates in 14 nations in 1992-1996: Austratrailia, Canada, Czech Republic, Estonia, Finland, Germany, Japan, Malaysia, New Zealand, Peru, Sweden, Trinidad & Tobago, UK, USA.	Proportion of households owning a gun	Significant association between suicides carried out with a gun and proportion of households owning a firearm (Spearman 0.85, $p < 0.001$ ). Association with overall suicide rate was not significant (Spearman 0.43, $p = 0.06$ )
[Killias, 1993]	Comparing nations	Firearm suicide rate and overall suicide rate in 11 European countries, Australia, Canada and United States	Proportion of households that in a telephone interview reported to have at least one gun	Significant association between national proportion of households with gun presence and firearm suicide rate and overall suicide rate. No confounder control
[Kleck and Paterson, 1993]	Comparing cities	Firearm suicide rate and overall suicide rates in 170 US cities with a 1980 population of at least 100,000	Restrictions put on purchasers or dealers, corrected for socio-economic and other known risk factors	Firearm suicide rate was reduced if purchasers should have permission, and if it was forbidden for mentally ill to possess a gun. Both firearm suicide rate and overall suicide rate were reduced if dealers should have a state or city licence
[Sloan et al., 1990]	Comparing regions	Suicide rates and firearm suicide rates in Vancouver metropolitan area, British Columbia and King County, Washington 1985-1987	Similar cities with different regulation of handguns (more strict in Vancouver)	No difference in overall suicide rate. Significantly higher suicide rate by firearms in Kings County, explained by a 5.7 fold higher rate of suicides involving handguns in Kings County. Among 15-24 year olds the relative risk of suicide with handgun was 9.56 fold higher in Kings County

and sale of barbiturates [Crome, 1993; Oliver, 1972; Carlsten et al., 1996; Retterstol, 1989] and when the method was common the restriction led to reduction of the overall suicide rate [Oliver, 1972]. A range of studies investigated the changes in method-specific suicide rates [Carlsten et al., 1999; Finkle, 1984; Whitlock, 1975; Ohberg et al., 1998; Ohberg et al., 1995; Schapira et al., 2001; Moens et al., 1989; McClure, 1987; De Leo et al., 1997; Bille-Brahe and Jessen, 1994] and showed as a consistent pattern that method-specific suicide rates decreased when sales figures or other changes revealed that the method became less available; in some cases, however, the positive development in one method-specific suicide rate was partly compensated by an increase in suicide rates with other methods.

When evaluating studies of suicide by drug poisoning, it must be kept in mind that there is a risk of misclassification between suicides and accidents.

### Method substitution

When restricting methods for suicide, method substitution must be considered. When restrictions are limited to methods with high case fatality, the problem of method substitution seems to be negligible. If the case fatality of the method is low, it is necessary to consider the possibility that the suicidal person will choose a method with a higher case fatality. All the reports about restrictions successfully leading to lower suicide rates deal with methods with high case fatality. Only the study of restrictions in packet size of paracetamol and salicylates in UK considers a method with low case fatality [Hawton et al., 2001; Hawton et al., 2004]. The authors found that the method-specific suicide rate decreased, but there was no effect on the overall suicide rate.

Our study indicates that the decline in household gas suicides and suicide with barbiturates was for a period partially substituted by rising rates of car exhaust suicides for men. However, the general pattern was that the steep decline in Danish suicide rates, especially for women, was to some extent explained by reduced rates of carbon monoxide suicides, suicides with barbiturates, tricyclic antidepressants, dextropropoxyphen, and benzodiazepine, which again was associated with sales figures or other measures of availability of the compound [Nordentoft et al., 2006].

Gunnell re-analysed the effect of method availability in England and Wales (1950 to 1975) and concluded that the accessibility of household gas containing carbon monoxide profoundly affected overall suicide rates; but in women and in younger men, the effect was partially offset by increases in drug overdoses [Gunnell et al., 2000].

### Suicide among doctors

Several studies have indicated a high suicide risk among doctors [Carpenter et al., 1997; Hawton et al., 2000; Juel et al., 1997; Nordentoft, 1988; Kelly et al., 1995]. In some of the studies, it was possible to investigate method of suicide, and these studies revealed that suicide by self-poisoning was responsible for the increased numbers of suicides [Hawton et al., 2000; Juel et al., 1997; Carpenter et al., 1997]. This was especially pronounced in the study by Hawton

[Hawton et al., 2000], where it was found that a large proportion of suicides among anaesthesiologists involved use of anaesthetic drugs. Together, these studies support the notion that easy access to means for suicide increases suicide risk.

### Does choice of method mirror suicidal intent?

It is a widespread myth that choice of method mirrors the intention to die. However, studies of suicide after suicide attempt have shown conflicting results concerning the predictive value of the dangerousness of the attempt with regard to later suicide. It is a consistent finding in studies worldwide that women are more likely to die from self-poisoning, while men more often die from more fatal methods such as shooting, car exhaust, and hanging. Denning et al. [Denning et al., 2000] used data from a psychological autopsy study (n=141) and showed that there was a strong association between gender and choice of method (violent versus non-violent) even after adjusting for intention to die, presence of psychiatric disorder, substance abuse and socio-demographic variables. However, it can be hypothesized that a high number of women with low suicidal intent survived the suicidal act and were therefore not included in the above-mentioned study. The optimal design for studying the question of suicidal intention and lethality of the method is a cross-sectional study involving a consecutive sample of persons committing fatal or non-fatal suicidal acts. To my knowledge no such study has been carried out.

### Gender differences in suicide rate and case fatality

The distribution of methods for suicide and suicide attempt for men and women in Funen in 2001 is shown in Table 4. In Denmark, the national statistics for suicide attempt are insufficient, but in "Register for Suicide Attempt", data from the county of Funen is included, and data from this register was used to describe the distribution of methods for suicide attempt for men and women. The calculation of case fatality in Funen was based on data from the registers, and the estimates of case fatality for each method listed in Table 4 is drawn from Miller [Miller et al., 2004a] and Spicer [Spicer and Miller, 2000]. The calculated and estimated case fatality rates are not very different.

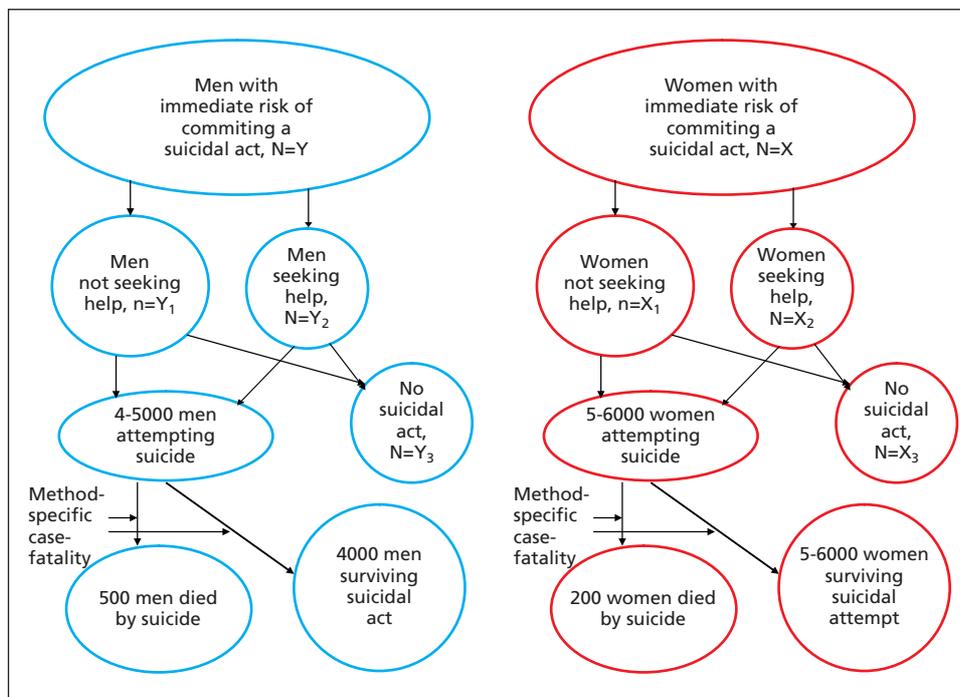
Figure 11 shows some of the factors involved in determining the differences in suicide rates between men and women. We do not have data or estimates for the number of men and women at immediate risk of committing a suicidal act ( $Y$  and  $X$ ), nor do we know which proportion seek help or treatment ( $Y_2$  and  $X_2$ ) and which proportion do not ( $Y_1$  and  $X_1$ ). We have an estimate of approximately 4-5,000 men and 5-6,000 women attempting suicide. Thus, based on the assumption that there are more than 10 times as many suicide attempts as suicides and that the sex-distribution among persons who attempt suicide is distributed according to a male: female ratio of 1:1.23 (Center for Selvmordsforskning, mean based on data from 1992-2001, www.selvmordsforskning.dk), there is a small majority of women with great variation in different age groups. We know that men, compared with women, use methods with a higher case fatality rate for both suicide attempts and suicides. Estimation of case fatality rate for men and women can be based on the estim-

	Suicides, women, Funen 2001	Suicidal acts, women, Funen 2001	Case fatality, women, Funen 2001	Suicides, men, Funen, 2001	Suicidal acts, men, Funen 2001	Case fatality, men, Funen 2001	Case fatality rate, County of Funen 2001	Estimated case fatality (Miller)
Other method . . . . .	3	16	0.19	4	26	0.15	0.17	0.3
Drowning . . . . .	6	9	0.67	3	7	0.43	0.56	0.6
Poisoning . . . . .	10	331	0.03	7	224	0.03	0.03	0.02
Hanging . . . . .	7	12	0.58	28	37	0.76	0.71	0.7
Cutting . . . . .	1	86	0.01	2	96	0.02	0.02	0.01
Shooting . . . . .	0	2	0	8	9	0.89	0.73	0.9
All . . . . .	27	456	0.06	52	399	0.13	0.09	

Table 4. Distribution of suicidal act on method for men and women.

Based on data from Center for Selvmordsforskning, suicides and attempted suicide from 2001 are included (www.selvmordsforskning.dk)

Figure 11. Help seeking and case fatality among men and women.



ated number of suicide attempts and number of suicides. Using the numbers in Figure 11 gives an estimated case fatality rate of 11 percent for men and four percent for women.

The overall case fatality for suicide attempts for men and women can be calculated based on the figures in Table 4; the result is six percent for women and 13 percent for men. Table 4 includes the distribution of all suicidal acts. The method-specific case fatality rate was calculated for Funen 2001. The case fatality rate for men and women calculated on basis of the figures in Table 4 is higher than the figures calculated on the basis of the information of the total number of suicides and the estimated number of attempted suicides, but this might be due to stochastic variation, due to too few suicide attempts being reported to Register for Suicide Attempt or the estimated number of attempted suicide in Denmark in Figure 11 being too high. However, it seems sound to conclude that the methods used for suicidal acts by women have a lower case fatality rate than the methods used by men. It also seems sound to conclude that the differences in choice of method and differences in method-specific case fatality rates are the most important factors in identifying gender differences in suicide rates. Therefore, it seems sound to conclude that the reduced case fatality rate for suicide methods most often used by women was responsible for the relatively more positive time trend for women compared to men. That case fatality is important, is encouraging from a public health point of view, as it points to areas where effective interventions can be implemented in terms of restricting access to dangerous means for suicide. It is also encouraging because it indicates that suicidal impulses are temporary and can be stopped, reduced or modified by the suicidal person herself or himself or by interventions by others.

#### RECOMMENDATIONS CONCERNING RESTRICTIONS IN MEANS FOR SUICIDE

When examining suicide rates in different countries at different points in time, it is obvious that methods for suicide are different in different countries during different time periods. It is beyond doubt that both the availability but also the awareness and cultural acceptance of a method determine whether it is a frequently used method or not. It is obvious that suicide with car exhaust was introduced as a method for suicide after it had been available for decades. One can even speak of a method for suicide being marketed, as for instance asphyxia-suicide with plastic bags [Humphry, 1992]. As stated by Gunnell, accessibility to and the lethality of a particular

method may have profound effect on the overall suicide rate. Such effects appear to depend on the popularity of the method, and the extent to which alternative methods that are acceptable to the individual are available [Gunnell et al., 2000]. Therefore, when recommending restrictions in access to dangerous methods for suicide, it must also be considered how to avoid marketing of lethal methods for suicide.

Lester [Lester, 1998] published a review, primarily of his own research papers, that concluded by recommending a range of ways to limit access to lethal methods for suicide. These included strict gun laws, car emission control of carbon monoxide content, natural domestic gas, restricting access to tops of buildings, fencing bridges, limiting packet size of medication frequently used for suicidal acts, enclosing pills in plastic blisters, removing lethal agents before releasing suicide attempters to their homes.

On the basis of the above-mentioned studies, it must be recommended to adopt strict laws concerning firearms, to make available domestic gas without content of carbon monoxide, to make catalytic converters mandatory and control carbon monoxide emission from cars and other vehicles, to secure controlled environments such as hospitals and prisons with regard to possibilities for hanging, to prescribe less toxic medication and small amounts of toxic drugs, to limit packet size of over-the-counter sale of medication often used for attempted suicide.

#### SELECTIVE PREVENTION IN RISK GROUPS

##### WHICH ARE THE RISK GROUPS?

Suicide risk differs according to age and sex groups, but in the following, these groups are not considered as risk groups. In the Danish National Suicide Preventive Strategy, several risk groups are mentioned. The most important are the mentally ill, alcohol and drugs abusers, those with a newly diagnosed severe somatic disease, prisoners, institutionalized persons and suicide survivors.

It is well documented that mental illness in all diagnostic groups is a risk factor for suicide [Mortensen et al., 2000]. In the following, suicide risk in two risk groups is reviewed: the homeless and patients with schizophrenia. Suicide risk in connection with alcoholism and affective disorder is also referred to.

##### Homelessness

A literature search was performed in five databases. The search strategy used was:

#### Medline

Homeless (Mesh) AND (Suicide (Mesh) OR Suicide, Attempted (Mesh) OR Mortality (mesh))

#### PsycInfo

Homeless AND (Suicide OR Suicide, Attempted OR Mortality)

#### The Cochrane Library

None

#### Cinahl

Homeless Persons AND (Suicide OR Mortality)

#### Embase

Homelessness AND Suicide OR Mortality

This procedure resulted in 275 abstracts, which were all read and supplemented with the result of hand search. Only prospective studies that included mortality figures as endpoints were included.

The setting from which the participants were recruited was different in the different studies. Several were based on homeless in shelters, but some included also homeless in the street; some were based on programmes for homeless, including homeless living both on the street or in shelters. Even across shelters, the population of homeless might be very different, as the cultural setting of shelters might differ and some shelters might direct their services toward special target groups. Some studies included only homeless who attended a psychiatric clinic; others those who were willing to participate in a clinical trial. Thus, direct comparison between studies is not possible. Information about mortality was considered reliable, but in some cases the unsettled character of the population might infer that some were lost to follow-up, and this would in some of the analyses lead to a slight underestimation of the mortality rate; the persons lost to follow-up were considered to be still alive at end of follow-up.

In all the identified studies (Table 5), increased mortality among the homeless was found compared to the general population. The excess mortality was highest in the youngest age groups. Only five studies evaluated suicide mortality, but unfortunately different methods were used to estimate suicide mortality; therefore, the studies cannot easily be compared. However, in all these studies, increased suicide mortality was found, and in the studies that evaluated suicide risk in different age groups, the excess suicide mortality was most dominant in younger age groups.

Apart from analyses of age, predictors of suicide were only investigated in our own study [Nordentoft and Wandall-Holm, 2003]. Only one study was an intervention study, and it did not report analyses of differences in mortality in the two treatment groups [Shern et al., 2000].

#### Schizophrenia

Schizophrenia is a life-shortening disease, as stated by Allebeck in 1989 [Allebeck, 1989]. Much attention has been paid to the risk of suicide in schizophrenia. Since Miles [Miles, 1977] in a review estimated that the risk of suicide was 10 percent, this figure had been repeated many times in reviews and comments. However, to give a true estimate of suicide risk in schizophrenia, it is necessary to base the estimates on follow-up of first-episode schizophrenia patients. If the patient group followed is not a consecutive or representative sample of first-episode patients, as is the case in most studies, the estimates of the suicide risk might be inflated, because the mixed sample consists of the most severe cases; or it might be underestimated, because they represent the positively selected survivors of the initial high-risk suicide period after first admission. Also, varying duration of follow-up or difficulties in following patients over longer periods may make studies difficult to compare and interpret. Statements like "10 percent die from suicide" were sometimes based on the calculation

of the proportion of suicides in relation to all deaths, but since follow-up periods are not lifelong, there is an obvious risk of overestimating the suicide risk, since suicides often occur early in the course of schizophrenia, whereas natural deaths occur later in life [Inskip et al., 1998]. Or the suicide rate can be underestimated because of survival bias as mentioned above. Another way of expressing suicide risk is to estimate suicide rate as number of suicides per 100,000 person years. This measure does take into account the fact that follow-up periods are different in different studies, but as the case fatality rate, the suicide mortality rate does not take into account the fact that suicide rates are higher during the first years after first admission. Estimating the suicide risk in first-episode schizophrenia also depends on diagnostic criteria, on setting, and on age limits in the sampling. The gender distribution in the sample might also play an important role.

In a recent review, Palmer, Pankratz and Bostwick [Palmer et al., 2005] identified all first-episode studies. From this review, it can be concluded that most studies are small, and that the two largest studies are Danish and Swedish register-based studies [Mortensen and Juel, 1993; Osby et al., 2000a]. In Table 6, first-episode studies or studies involving a large proportion of first-episode patients are listed. However, in some studies, it could not be clarified whether the patient had previously been admitted to another hospital, since the records from only one hospital provided the data. Both antipsychotic treatment and the organization of psychiatric treatment have undergone changes; therefore, only studies published after 1965 were included.

In their estimation of lifetime risk of suicide in various disorders, Inskip et al. [Inskip et al., 1998] estimated the lifetime risk in schizophrenia to be four percent. Palmer et al. [Palmer et al., 2005], in their recent review, estimated the lifetime risk to be 5.6 percent. Their meta-analysis was split into an evaluation of mixed samples and of first-episode studies. In the latter analysis, two large studies estimated a case fatality rate of six and five percent after a follow-up period of nine and 14 years, respectively [Mortensen and Juel, 1993; Osby et al., 2000a]. High case fatality rates due to suicide were mostly found in smaller studies [Carone et al., 1991; Krausz et al., 1995; Tsoi and Wong, 1991; Wiersma et al., 1998; Finnerty et al., 2002]. Thus, it seems reasonable to conclude that case fatality due to suicide will not reach as high figures as 10 percent, since suicide risk is highest the first years after first admission. It is more likely that the true case fatality is between five or six percent. However, estimating lifetime suicide risk is very complicated and also susceptible to change along with changes in the treatment support offered to the patient group and in the general features of society. It is likely that large prospective studies of first-onset cases with a long follow-up period will provide a better estimate of the suicide risk, but an inherent problem with such studies is that by the time the results of such studies become available, the risk for new first-episode patients may have changed because of changes in treatment and other factors.

Studies also should be reviewed with regard to age of onset, since cases with early onset have worse outcomes than cases with later onset with regard to other outcome measures.

There were differences in the criteria for the diagnosis of schizophrenia in the studies identified. Criteria were different in different countries and in different time periods. This might imply that recent European studies using International Classification of Diseases, 10th edition, criteria (ICD 10) [World Health Organization, 1992] included a broader diagnostic sample, as the time limit for presence of symptoms before diagnosing schizophrenia in ICD 10 is shorter than in Diagnostic and Statistical Manual for Mental Disorders (DSM III R and DSM IV) [American Psychiatric Association, 1994; American Psychiatric Association, 1987]. Our own study indicated no major differences in suicide mortality between patients diagnosed with schizophrenia and other psychosis in schizophrenia spectrum [Nordentoft et al., 2004]. The differences in diagnostic criteria are not assumed to bias the results severely.

**Table 5.** Suicide mortality among homeless.

Study	Country	N	Inclusion criteria	Follow-up	Overall mortality	Suicide mortality	Comments
[Babidge et al., 2001]	Sydney Australia	708	Homeless person in large refugees attending psychiatric clinic, 1988-1991. Data missing for 59	7-11 years (mean 9.5)	12% SMR Men: 3.14 Women 3.76 Excess mortality highest in young age groups	2.6% SMR: Men with schizophrenia: 20-29 year 17.4 30-39 year 11.8 40-49 year 16.7	Selected group of homeless persons referred to psychiatric clinic. 71% diagnosed with schizophrenia. Mortality statistics were complete
[Barrow et al., 1999]	New York USA	1,260	Representative sample of shelter residents in 1987. 26 shelters participated. Random or consecutive selection	7 years	SMR: Men 2.2, Women 3.7 Excess mortality highest among young women. Among men SMR was approximately doubled in all age groups	Not analysed	Random selection implies risk of length bias. 5% refused or were unable to continue interview. Mortality statistics were complete
[Cheung and Hwang, 2004]	Toronto Canada	1,981 women	Women who used homeless shelters in Toronto	Mean 2.6 years	1.3% 498 per 100,000 person years SMR 18-44 years old: 10.1 SMR 45-64 years old: 1.2	0.15%	Mortality statistics did not include women who left Ontario. Mortality might therefore be underestimated
[Hibbs et al., 1994]	Philadelphia USA	6,308	Two service teams registered all homeless persons from 1985/1987	Until end of 1988. 1-4 years. Mean 1.5 years. 10,429 person years	SMR 3.5	Not analysed	Prospective study of a cohort of recipients of service service in different service teams in Philadelphia Mortality statistics did not include persons who could not surely be identified or who left Philadelphia
[Hwang et al., 1998]	Boston USA	558	Adults seen in health care programme for homeless (shelters, outpatient clinics, dropin facilities, street) 1988-1993	Case-control study	HIV, CVD and other medical conditions raised the risk of dying		Case-control study. Mortality could not be analysed
[Hwang et al., 1997]	Boston USA	17,292	Adults seen by health care for homeless programme 1988-1993		3.5% 1,114 per 100,000 person years Mortality rates for men: 18-24 years 563 25-44 years 1298 45-64 years 2227 per 100,000 person years	Suicide mortality rates for men: 18-24 years 36 25-44 years 41.9 45-64 years 11.0 per 100,000 person years	Homicide was the leading cause of death. Mortality statistics were apparently complete. National Death Index was used
[Hwang, 2000]	Toronto Canada	8,933	Men aged 18 years or older who used homeless shelters in Toronto in 1995	Mean 2.6 years	Mortality rates for men: 18-24 years 421 25-44 years 669 45-64 years 1680 per 100,000 person years	Suicide mortality rates for men: 18-24 years 76.6 25-44 years 57.4 45-64 years 125.4 per 100,000 person years 18-24 years SMR 10.3 25-44 years SMR 3.1 45-64 years SMR 50.2	Cohort of male shelter users. It is not mentioned if cohort members who left Ontario were included in calculation of mortality figures
[Kasprow and Rosenheck, 2000]	Connecticut USA	8,429	Homeless persons treated by two specialized Department of Veteran Affairs 1989-1990		2,210 per 100,000 person years compared to 1,586 per 100,000 for general population of males	Not analysed	No mention of cohort members who migrated out of the area
[Roy et al., 2004]	Montreal Canada	1,013	Street youth aged 14 to 25 years	0-7 years	SMR 11.4 921 per 100,000 person years. Predictors were male sex, drug injection, daily alcohol use, HIV, homelessness in the last six months	1.3%, 578 per 100,000 person years. 13 suicides, all used violent methods. 8 more died by drug overdose	Some drug overdoses might have been suicides. There might be slight underestimation of mortality figures due to the fact that deaths outside the province of Quebec are not included in the analyses
[Shern et al., 2000]	New York USA	168	Randomised Clinical Trial	2 years	9 deaths during 24 months 2.5% per year (2500 per 100,000 person years)	Not reported	Eligible but refused participation 140, fewer had been hospitalized (38% vs. 62% in study group)
[Nordentoft and Wandall-Holm, 2003]	Copenhagen Denmark	579	All persons registered at a hostel for homeless persons in Copenhagen 1991. Register-based follow-up	10 years	141 deaths 2603 per 100,000 person years O/E 2.6 O/E highest in young age groups. Persons with short stay and more than one stay during 1991 had increased risk of dying	8 suicides (1.4% in ten years) 147 per 100,000 person years. O/E 6.0 Persons with short stay and more than one stay during 1991 had increased risk of dying by suicide	Small attrition. Persons were excluded if they could not be followed up because of incorrect personal code (CPR-number). If immigrated, persons were censored on the day of immigration

**Table 6.** First admission or recent onset of schizophrenia and suicide mortality.

Study	Country	Sample size (N)	Follow-up (%)	Follow-up period (years)	Deaths during follow-up period	Suicides during follow-up period	Suicide mortality per 100,000 person years (SMR)	Case Fatality (Suicides/N)	Comments
[Achte, 1967]	Finland	200	100%	5	10	3	300 per 100,000 py	1.5%	Mean age of onset 34 years
[Allebeck and Wistedt, 1986]	Sweden	1190	100%	10	231	33	SMR 12.3 (9.9 for men, 17.5 for women)	2.7%	
[Allebeck and Allgulander, 1990a; Allebeck and Allgulander, 1990b]	Sweden	304	100%	0-23	Not given	25	Not given	8%	Young men who at the time of conscription previously had been admitted with a diagnosis of schizophrenia
[Biehl et al., 1986]	Germany	70	100%	5	3	3		4%	
[Bland and Orn, 1978]	Canada	45	96%	14	2	1		2%	
[Bland et al., 1976]	Canada	92	96%	12	12	2		2%	
[Blumenthal et al., 1989]	Germany	33	100%	5	3	3		9%	
[Finnerty et al., 2002]	Ireland	46	72%	15	8	5	Not given	11%	Part of DOSMeD. Schizophrenia and acute schizophrenia-like disorder
[Carone et al., 1991]	US	79	100%	5	8	8	Not given	10%	Mean age 23 years. 59 percent had no or one previous admission
[Goldstein et al., 1993]	US	332	98%	0-42 Mean follow-up time was 26 years	125	6	Not given	2%	82 percent were first admissions, the rest of the patients were early in the course of illness
[Harrison et al., 1996]	UK	99	96%	13	9	2	Not given	2%	First treated incidence
[Helgason, 1990]	Iceland	107	98%	22	23	10	439 per 100,000 py	9%	
[Jarbin and Von Knorring, 2004]	Sweden	45	100%	11	Not given	1	(RR 28.9)	2%	Teenage onset schizophrenia spectrum disorder
[Johansson, 1958]	Sweden	138	100%	14	23	3	Not given	2%	
[Krausz et al., 1995]	Germany	61	100%	5-11	9	8		13%	Median age was 17 years
[Lim and Tsoi, 1991]	Singapore	482	100%	15	71	41	567 per 100,000 py	9%	
[Lindelius and Kay, 1973]	Sweden	187	90%	18	16	11	357 per 100,000 py	6%	
[Mason et al., 1995]	UK	67	94%	12	5	3		4%	
[Mortensen and Juel, 1993]	Denmark	9156	100%	9	1100	508	(20.7 SMR)	6%	Suicide mortality highest in young persons and in first year of follow-up
[Niskanen et al., 1973]	Finland	200	100%	5	Not given	4		2%	
[Niskanen et al., 1973]	Finland	100	100%	15	Not given	3		3%	
[Nordentoft et al., 2002b]	Denmark	341	100%	1	2	1	Not given	0%	First episode psychosis, 66% schizophrenia
[Noreik, 1966; Noreik, 1975]	Norway	967		5	Not given	11	Not given	1%	First admitted schizophrenia patients in Gaustad Sjukhus 1938-1959
[Nyman and Jonsson, 1986]	Sweden	110	100%	15	18	10	Not given	9%	

Table 6 to be continued next page

Table 6. Continued.

Study	Country	Sample size (N)	Follow-up (%)	Follow-up period (years)	Deaths during follow-up period	Suicides during follow-up period	Suicide mortality per 100,000 person years (SMR)	Case Fatality (Suicides/N)	Comments
[Osby et al., 2000a]	Sweden	7784	99%	14	1849	380	(males 15.7 O/E females 19.7 O/E)	5%	
[Pokorny, 1983]	US	834	100%	5	65	19	456 per 100,000 py	2%	First admission in Veteran Administration Hospital
[Peuskens et al., 1997]	Belgium	502	100%	6	Not given	27		5%	Mean age 24 years. Not only first admissions
[Salokangas, 1983]	Finland	175	99%	2	14	8		5%	
[Salokangas and Stengard, 1990]	Finland	227	100%	2	8	5		2%	First contact patients with schizophrenia
[Sartorius et al., 1987]	Various	756	90%	5	42	14	Not given	2%	
[The Scottish Schizophrenia Research Group, 1992]	UK	47	96%	5	1	0		0%	
[Soskis et al., 1969]	US	39	100%	5	2	2		5%	
[Thara, 2004]	India	90	85%	20	16	7	454 per 100,000 py	9%	
[Tsoi and Wong, 1991]	Singapore	330	100%	15	48	34	687 per 100,000 py	10%	Only Chinese ethnic groups were included
[Wiersma et al., 1998]	Netherlands	82	93%	15	9	8	Not given	10%	Most suicides occurred during first three years
[Wilkinson, 1982]	UK	43	91%	13	7	3	Not given	7%	First admission in Camberwell

This table was modified from Palmer [Palmer et al., 2005].

Most of the studies had a very high follow-up rate, and those with follow-up rates lower than 95 percent were all rather small studies, with sample size less than 200 patients.

### **Risk factors for suicide in schizophrenia**

Risk factors for schizophrenia have been the subject of several studies. The studies listed below were studies of risk factors identified in mixed samples of patients with schizophrenia. Some studies were case-control studies, while others were prospective studies. Even though schizophrenia is a high-risk condition for suicide, suicide is still a rare event in schizophrenia; therefore, large sample size and long follow-up are needed in prospective studies. For this reason, case-control studies might be more powerful in identifying risk factors for suicide in schizophrenia.

In a review of studies evaluating risk of suicide in schizophrenia, Caldwell and Gottesman retrieved a long list of studies of first-episode and mixed samples [Caldwell and Gottesman, 1990]. They concluded that a range of studies found that young age, male gender, white race, social isolation, depressed mood, past history of suicide attempt, family history of suicide, unmarried, unemployed, deteriorating health, recent loss, limited external support, family stress or instability, chronic illness with numerous exacerbations, high level of psychopathology and functional impairment, fear of deterioration, and loss of faith in treatment were risk factors. Hawton et al. recently published a systematic review of risk factors and identified 29 eligible studies. They found robust evidence of increased risk of suicide in schizophrenia for depressive disorders, previous suicide attempts, drug abuse, agitation and motor restlessness, fear of mental disintegration, poor adherence to treatment and recent loss [Hawton et al., 2005]. Other reviews and meta-analyses were also reviewed for the purpose of identifying relevant papers [Brown, 1997; Miles, 1977; Simpson, 1988; Drake et al., 1985; Caldwell and Gottes-

man, 1990; De Hert and Peuskens, 2000; Heilä and Lönnquist, 2003; Palmer et al., 2005; Inskip et al., 1998].

Haw et al. conducted a systematic review of schizophrenia and deliberate self-harm and identified past or recent suicidal ideation, previous deliberate self-harm, past depressive episode, drug abuse or dependence and high number of psychiatric admissions as risk factors for deliberate self-harm among patients with schizophrenia [Haw et al., 2005].

The studies identified in Table 6 were all reviewed to extract predictors of suicide.

A literature search was conducted in the following databases, using the search terms mentioned below:

- PubMed
- Schizophrenia (Mesh) AND (Suicide (mesh) OR Suicide, Attempted (mesh)) AND Cohort studies (mesh)
- Cinahl
- Suicide AND Schizophrenia
- Embase
- Schizophrenia AND (Suicide OR Suicide, Attempted) AND (Longitudinal studies OR Follow-up)
- PsycInfo
- Schizophrenia AND (Suicide OR Suicide, Attempted) AND (Longitudinal study (Publication type) OR Follow-up Study (Publication type))
- The Cochrane Library

This procedure resulted in a large number of abstracts. Some studies were excluded, the reasons for exclusion being:

- Sample includes different diagnostic categories, and the material description does not make it possible to distinguish patients with

**Table 7.** Risk factor for suicide in schizophrenia

Study	Country	Population	Follow-up	Suicides	Predictors of suicidal behaviour	Design and sample
[Allebeck et al., 1987]	Sweden	96	100%	32	Not married (only women), previous suicide attempt, suicidal thoughts	Case control study: 32 suicides and 64 non suicides
[Black and Winokur, 1988]	US	636	100%	13	Young age, male gender. No survival analysis	Prospective study, mixed sample
[Breier and Astrachan, 1984]	US	101	100%	20	White, men, non-protestants	Case control study: 20 suicides and 81 non suicides among patients with schizophrenia. Mixed sample
[Casadebaig and Philippe, 1999]	France	3470+		83	Male gender, age less than 35 years, recent hospitalization, drug abuse (cannabis 90%), previous suicide attempt, severe illness, first ten years of treatment	Prospective study, mixed sample, 4 years follow-up. Suicide and probable suicide included in the analyses. No survival analysis
[Cheng et al., 1990]	China	148	100%	74	Number of previous admissions, suicidal ideas or suicide attempt, reason for last admission, depression, violent act, previous suicide attempt, higher dose of antipsychotic treatment	Case control study: 74 suicides, 74 non suicides among patients with schizophrenia
[Cohen et al., 1990]	US	122	100%	8	Low age of onset, low age at first contact with mental health services and first psychiatric hospital admission, hopelessness, hostility, paranoid ideation, obsessive compulsive	Prospective study. Age 18-30 years; schizophrenia, schizotypal disorder or schizoaffective disorder. No survival analysis
[De Hert et al., 2001]	Belgium	126	100%	63	Male gender, chronic illness with relapse, frequent short hospitalization, negative attitude towards treatment, impulsive behaviour, parasuicide, high premorbid IQ, psychosis, depression, suicide threats, suicide attempts, previous attempt with lethal method, antidepressant medication, non-compliance with treatment, major loss last six months, impulsivity, psychotic condition, depression, not receiving community care, not symptom free	Case control study, 63 suicides and 63 non suicides among patients with schizophrenia. Age <30. Mixed sample
[Dingman and McGlashan, 1986]	US	163	98%	38	High quality of mothering, absent or little adolescent asociality, low age of onset, identity disturbance, elevated or irritable affect, decreased need for sleep, shorter length of previous hospitalizations, ability for abstract thinking	Prospective study of 460 patients, of whom 163 were diagnosed with schizophrenia. Suicides and nonsuicides were compared in diagnostic groups. Mixed sample. No survival analysis
[Drake and Cotton, 1986]	US	104	100%	15	Hopelessness, suicidal ideation, worthlessness, persistent depression	Case-control study: 15 suicides and 89 non-suicides among patients with schizophrenia. Mixed sample. Blind rating
[Fenton et al., 1997; Fenton, 2000]	US	252	91%	17	High IQ and high capacity for abstract thinking, high age at first hospitalization, suspiciousness, positive symptoms, depression, previous suicide attempt, promiscuity, identity disturbance absence of negative symptoms and thought disorder	Prospective study of 252 patients with schizophrenia. Schizophrenia patients were previously reported by Dingman (shorter follow-up). No survival analysis
[Funahashi et al., 2000]	Japan	160	100%	80	Command hallucinations, suicide ideation, hostility, anxiety, guilt feeling, tension, depression, poor impulse control, and being a middle child with regard to birth order. Blunted affect, emotional withdrawal and disturbance of volition were inversely associated with suicide	Case control study. 80 suicides and 80 non suicides with no history of suicide attempt, matched for sex and illness duration. In and out-patients
[Goldstein et al., 1993]	US	322	98%	6	Same suicide mortality for male and female patients with schizophrenia	Prospective study of 322 patients diagnosed with schizophrenia. Patients were primarily in the early stages of their illness (82% were first admissions). Survival analysis was used
[Hu et al., 1991]	US	126	100%	42	Previous suicide attempt, depression, previous psychiatric hospitalization, not married, living alone, unemployed	Case control study. 2 suicides 84 controls, sex and age matched
[Krausz et al., 1995]	Germany	61	100%	8	Male gender, suicide attempt before first admission, suicidal ideations, suicide attempts and motor stereotypes during follow-up	Prospective study of 61 adolescents. No survival analysis
[Lim and Tsoi, 1991]	Singapore	482	100%	41	Young age, less delusions	Prospective study of 482 patients with schizophrenia. No survival analysis
[Modestin et al., 1992]	Switzerland	106	100%	53	Swiss born, lowest social class, vocational disability, early onset, long duration, long hospitalization, previous suicide attempt, suicidal behaviour during index admission	Case control study. 53 inpatients who committed suicide and 53 non-suicides, matched for age, sex and date of admission

*Table 7 to be continued next page*

Table 7. Continued

Study	Country	Population	Follow-up	Suicides	Predictors of suicidal behaviour	Design and sample
[Mortensen and Juel, 1993]	Denmark	9156	100%	508	SMR for suicide was 21 for both men and women. Young age and short time since first admission were independent predictors of suicide	Record linkage study, including all patients who at first or later admission received a diagnosis of schizophrenia
[Nordentoft et al., 2004]	Denmark	18744	100%	756	Currently admitted, short time since discharge, young age, first admission	Nested case-control study. 20 controls for every suicide. Risk factors analysed separately in each diagnostic group (schizophrenia, schizophrenia-like choses, non-psychotic schizophrenia spectrum disorder
psy-						
[Nyman and Jonsson, 1986]	Sweden	110	100%	15	Frequent suicide thoughts, suicide attempt during follow-up	Prospective study of 110 consecutive first admission patients. No survival analysis
[Rossau and Mortensen, 1997]	Denmark	5588	100%	508	Male gender, young age, short duration of illness, many admissions during last year, short time since discharge, co-morbid depression	Nested case-control study, register-based: 508 suicides, 5080 controls. The 508 suicides were the same as reported by Mortensen and Juel 1993
[Roy, 1982]	Canada	30	100%	30	Acute exacerbation, depression	Case control study 30 suicides, 30 non-suicides. All chronic patients with schizophrenia
[Shah and Ganesvaran, 1999]	Australia	84	100%	62	Previous deliberate self-harm, suicidal ideation at admission and during admission, suicidal attempt during admission, not continuously suicidal	Case control study. 62 inpatient suicides, 22 inpatient non-suicides, all patients from control group were admitted next to a patient who committed suicide
[Stebalj et al., 1999]	Slovenia	72	100%	36	Previous suicidal behaviour, unsatisfactory relationship with family members, social withdrawal, depression, lack of insight	Case control study. 36 suicides and 36 non-suicides matched for age and sex
[Taiminen and Kujari, 1994a]	Finland	56	100%	28	Previous suicide attempt, depressive symptoms, absent or few positive symptoms, low dose anti-psychotic medication	Case control study. 28 suicides, 28 non-suicides matched for sex, age and year of hospitalization
[Taiminen et al., 2001]	Finland	138	100%	69	Male gender, depression and observed depression, loss of job, previous suicidal plans or attempt	Case control study: 69 suicides, 69 non-suicides
[Westermeyer et al., 1991]	US	148	100%	13	Male gender, white, chronic or sub-chronic disorder	Prospective study. Majority of suicides occurred within first six years after index hospitalization. Mixed sample. No survival analysis
[Wolfersdorf et al., 1989]	Germany	230	100%	115	Previous suicide attempt. Hallucinations other than command hallucinations were associated with reduced risk, as was persecutory delusions, and alcohol and drug abuse	Case control study. 115 suicides and 115 non-suicides matched for age and sex
[Wolfersdorf and Neher, 2003]	Germany	160	100%	80	Previous suicide attempt, suicidal ideation at index admission, suicidal behaviour since index admission, psychotic episodes after index admission, poor outcome. Depressive symptoms, command hallucination, obsessional thoughts, absence of thought disorder	Case control study 80 inpatient suicides, 80 inpatient nonsuicides matched by age and sex

schizophrenia from other diagnostic groups. An exception is studies where more than 80 percent were patients with schizophrenia or schizophrenia-like psychosis.

- Retrospective studies and cross-sectional studies of correlates between attempted suicide and clinical characteristics.
- Psychological autopsy studies that did not include controls.
- Studies with patient samples recruited before 1960.
- Studies with poorly defined or different control group
- The publication could not be procured through DNLB (Dansk Natur og Lægevidenskabeligt Bibliotek) or the Library at Psychiatric Hospital Risskov
- Articles written in other languages than Scandinavian, English, German and French

Both mixed samples and first-episode samples were included. Both prospective studies and case-control studies were included.

The results of the literature review are summarized in Table 7. Some of the studies are based solely on information from registers, and in these studies, clinical characteristics can only be included if they are reported as a co-morbid diagnosis – for instance, depres-

sion or substance abuse. Other predictors that had been investigated were male gender, young age, abuse, and in some cases, previous suicide attempts. The studies that included more detailed information about clinical characteristics are often smaller, as the practical work involved in clinical assessment is substantial.

Three large Danish register-based studies of suicide risk in patients with schizophrenia indicate that male gender, young age, short duration of illness, many admissions during last year, current inpatient, short time since discharge, co-morbid depression were independent risk factors [Nordentoft et al., 2004; Rossau and Mortensen, 1997; Mortensen and Juel, 1993].

Some of the clinical studies have small sample size; therefore, some risk factors might not be identified because of lack of power. Previous suicide attempt is taken into consideration in almost all clinical studies, but apart from that, since different studies evaluate different risk factors, it cannot be concluded that not mentioning a risk factor in a specific study excludes this risk factor from being a significant predictor of suicide. The information extracted from the clinical studies supplies the register-based studies with the following risk factors as the most important and frequently observed predic-

tors: previous suicide attempt, co-morbid depression, drug abuse, poor compliance with medication, poor adherence to treatment, high IQ, and suicidal ideations. The results of analyses of psychotic symptoms as risk factor for suicide are contradictory, and results are reported in different categories. In the meta-analysis of risk factors for suicide in schizophrenia, Hawton concludes that pooled odds ratio for suicide for positive symptoms were not significantly different from 1.0, but when symptoms were divided in hallucinations and delusions both hallucinations and delusions seemed to be protective (delusions: OR= 0.53 (95% CI 0.28-1.01); hallucinations: OR=0.5 (95% CI 0.35-0.71)), but there was a non-significant tendency that command hallucinations were associated with higher suicide risk [Hawton et al., 2005]. One study identified high dose of antipsychotic medication as a predictor [Cheng et al., 1990], while another found low dose of antipsychotic medication as a risk factor [Taiminen and Kujari, 1994b]. This could be interpreted as a proxy variable for positive psychotic symptoms, but it could also reflect lack of compliance with medication, mirrored in lower prescribed doses. Several studies reported that negative symptoms were protective, but in the meta-analysis by Hawton it turned out to be insignificant [Hawton et al., 2005].

### **Alcoholism and affective disorder**

Also affective disorder and alcoholism have been considered to have high lifetime risk of suicide. Miles [Miles, 1977] estimated that the lifetime risk of suicide in alcoholism would be 15 percent, opiate addiction five percent, and depression 15 percent. Inskip et al. [Inskip et al., 1998] estimated the lifetime risk in alcohol dependence to be seven percent and six percent in affective disorder. Bostwick and Pankratz [Bostwick and Pankratz, 2000] divided the suicide risk in affective disorder in several different risk groups with different estimation of lifetime risk for suicide. Their estimate of lifetime risk for patients with affective disorder hospitalized for suicidality was 8.6 percent, while for patients with affective disorder with no specific history of suicidality, the lifetime risk estimation was 4.0 percent and for outpatients with affective disorder 2.2 percent.

### **Interventions**

The low base rate of suicide indicates that very large randomised trials are needed if suicide is chosen as the primary outcome measure. Even in a high-risk group like patients with schizophrenia, a thousand patients in each intervention group would be needed to detect a reduction from six percent to three percent [Pocock, 1996]. Therefore, in some studies, deliberate self-harm has been chosen as the outcome measure, even though it is well known that the population of persons who attempt suicide are overlapping but not identical with the group of persons who die from suicide.

From the review of homelessness, it was evident that there were no studies investigating effect of preventive measures on mortality or suicide. The primary outcome measure in intervention studies among homeless was being able to live in independent housing [Tsemberis et al., 2004; Barrow et al., 1991; Shern et al., 2000].

Among patients with schizophrenia, there were no large studies investigating the effect on suicide of psychosocial interventions. The analyses of data from the OPUS trial indicates that the study did not have sufficient power to detect any effect on suicide, and that there was no indication of a positive effect on deliberate self-harm [Nordentoft et al., 2002b; Petersen et al., 2005].

In schizophrenia, no randomised controlled trial of specific antipsychotic drugs has proven an effect on suicide [Meltzer, 2002]; however, a recent study indicates that Clozapin is superior to Olanzapin with regard to reducing the risk of deliberate self-harm [Meltzer et al., 2003].

In spite of lacking evidence, it must also be anticipated that interventions with documented effect on symptoms in schizophrenia also might be effective in preventing suicide; consequently, it is natural to recommend evidence based on psychiatric treatment in

schizophrenia [Sekretariatet for referenceprogrammer, 2004; National Institute for Clinical Excellence, 2006; American Psychiatric Association, 2004].

The randomised clinical trial is the gold standard when evaluating possible effects of an intervention. Since large randomised studies with suicide as outcome measure are almost practically impossible, it must be considered whether other study designs can provide evidence about possible treatment effect. The nested case-control study is an effective tool for examining the influence of risk factors for which information is available in Danish registers. In the nested case-control design, it is possible to control for some social and psychiatric confounders. Prospective cohort studies can also be used for assessing the influence of risk factors, but even with the most meticulous confounder control, all kinds of non-experimental studies must be interpreted with caution, as the subjects who receive a specific treatment and follow treatment recommendations might constitute a selected group, characterized by positive (or negative) prognostic factors that increase (or decrease) the likelihood that the patients would benefit from this specific treatment, from other types of treatment or even without treatment.

### **Affective disorders**

#### *Awareness programmes*

Depression and other psychiatric disorders are reported to be under-recognized and under-treated in primary care setting [Munk-Jorgensen et al., 1997], and on average as many as 45 percent had contact with a primary care provider the last month before suicide [Luoma et al., 2002]. Studies examining suicidal behaviour in relation to primary care physician education programmes, mostly targeting depression recognition and treatment, have all reported increased prescription rates for antidepressants and often substantial declines in suicide rates [Rutz et al., 1989; Rutz, 2001; Rihmer et al., 2001; Rutz, 1992]. However, these studies were small and considerable variation might be due to change.

#### *Lithium*

In affective disorders, many studies of the effect of Lithium have been conducted, the majority being naturalistic studies. A recent Danish study, based on linkage of the Cause of Death Register and the Medicinal Product Statistics register, analysed differences in suicide mortality between patients who purchased lithium only once and patients who purchased lithium at least twice and concluded that purchasing lithium twice or more was associated with decreased risk of suicide compared to purchasing only once [Kessing et al., 2005]. However, as the authors point out, undefined individual factors associated with acceptance and adherence to long-term treatment might tend to select for lower suicide risk during treatment.

A recent meta-analysis [Geddes et al., 2004; Burgess et al., 2001] summarizes the evidence from randomised controlled trials of the effect of long-term Lithium therapy for bipolar disorder and concludes that Lithium therapy reduces the risk of relapse. The authors concluded that there is no definitive evidence from this review as to whether or not Lithium has an anti-suicidal effect.

#### *Selective Serotonin Reuptake Inhibitors*

There is a current debate about the effect of Selective Serotonin Reuptake Inhibitors (SSRI) on suicidal behaviour.

Systematic reviews confirm that SSRIs provide effective treatment for adult depression [American Psychiatric Association, 2000; Gijsman et al., 2004] and are better tolerated than tricyclic antidepressants [Macgillivray et al., 2003].

Several meta-analysis of published and unpublished randomised clinical trials have been conducted comparing SSRI and placebo among adults [Hammad et al., 2006b; Fergusson et al., 2005; Gunnell et al., 2005b] and children and adolescents [Whittington et al., 2004; Hammad et al., 2006a]. In a review of reports of randomised

clinical trials of SSRI versus other antidepressants and placebo for U.S. Food and Drug Administration, analysing 77 suicides among 48,277 depressed patients participating in the trials, Khan et al found that suicide rates were comparable in the placebo and the SSRI treated groups [Khan et al., 2003], but other authors concluded that even with the meta-analytic approach, data are insufficient to provide any evidence about the effect on completed suicide [Hammad et al., 2006b; Gunnell et al., 2005b]. In the meta-analyses of published and unpublished placebo controlled trials among children and adolescents, there were no suicides. Both meta-analyses reach the same conclusion, namely that treatment with SSRI is associated with modest but significant increased risk of suicidal ideation or suicidal behaviour [Whittington et al., 2004; Hammad et al., 2006a]. However, a recent Danish register-based study showed that in 17 suicides among children and adolescents (10-17 years) in Denmark, none were treated with SSRI during the two weeks before suicide [Sondergard et al., 2006a].

Among adults, two meta-analyses reached similar results. In an analysis of all published and unpublished trials of SSRI compared to placebo for any condition, Fergusson et al. found an increase in the odds of suicide attempts (odds ratio 2.28, 95 percent confidence interval 1.14 to 4.55) [Fergusson et al., 2005]. In their analysis of randomised controlled trials of SSRIs and placebo submitted by pharmaceutical companies to the safety review of Medicines and Healthcare Products Regulatory Agencies, Gunnell et al. found the same modestly increased risk of self-harm (odds ratio 1.57, 95 percent confidence interval 0.99 to 2.55) and weak evidence of a possible protective effect against suicidal thoughts [Gunnell et al., 2005b].

Thus, the randomised clinical trials of SSRI compared to placebo do not have enough power to detect differences in completed suicide; concerning suicidal ideation and behaviour, there is no evidence of a protective effect.

To support the notion that introduction of SSRI positively influenced suicide rate, there is a long list of ecological studies demonstrating that in many countries increased use of SSRI coincided with falling suicide rates [Rihmer et al., 2000; Carlsten et al., 2001; Hall et al., 2003; Isacson, 2000]. However, there are also examples of increased use of SSRI without a concomitant decrease in suicide rate. For example, the suicide rate in the United States has been almost constant for both men and women from 1980 to 2000 (World Health Statistics), although it was possible to demonstrate an association between increasing sales figures for SSRIs and decreasing rates in some states [Gibbons et al., 2005]. In Iceland [Helgason et al., 2004], Italy [Guaiana et al., 2005], and Japan [Takahashi, 2003], there was no association, or even an inverse association, and in some countries the decreasing suicide rates started before the sales figures for SSRI's started to increase.

A recent Danish pharmacoepidemiological study demonstrated that suicide rates were lower among patients who purchased SSRIs twice or more compared to those who purchased only one prescription [Sondergard et al., 2006b]. This might indicate that SSRI protected against the risk of suicide, but it must be considered that in the group purchasing prescriptions twice or more, compliant responders might be overrepresented.

In conclusion, at the present stage, ecological studies and naturalistic studies seem to indicate a protective effect of SSRIs, but the randomised clinical trials have failed to demonstrate indications of such effect and point to the risk of increased suicidal behaviour in some individuals.

### INDICATED PREVENTION

Indicated prevention is focused on the high-risk group of persons who have attempted suicide or have presented themselves to health services because of suicidal ideation. Help lines, psychiatric emergency rooms, psychiatric emergency outreach and other crisis interventions can play a role in preventing suicide attempts among per-

sons in a suicidal crisis, and there are different interventions aiming to reduce risk of suicidal acts after suicide attempt. Many studies have been conducted with the aim of elucidating risk of repetition of fatal and non-fatal suicidal acts.

A study of the published follow-up data was carried out identifying repeated, fatal and non-fatal suicidal acts after suicide attempt. Search strategies for the following four databases were used:

#### Medline:

(Suicide (Mesh) OR Suicide, Attempted (Mesh)) AND (Recurrence (Mesh) OR Parasuicide (text word) OR Repetition (text word) OR Previous suicide attempts (text word)) AND (Cohort Studies (Mesh) OR epidemiological (text word))

#### PsycInfo

(Suicide OR Suicide, Attempted) AND (Recurrence (text word) OR Parasuicide (text word) OR Repetition (text word) OR Previous suicide attempts (text word)) AND (Follow-up Study (publication type) OR Longitudinal Study (publication type))

#### The Cochrane Library

(Suicide OR Suicide, attempted) AND (Parasuicide OR Recurrence OR Repetition)

#### Embase

(Suicide OR Suicide, Attempted) AND (Recurrence (text word) OR Parasuicide (text word) OR Repetition (text word) OR Previous suicide attempts (text word)) AND (Follow-up OR Longitudinal Study)

#### Cinahl

Suicide AND (Compulsion (subject) OR Parasuicide (text word) OR Repetition (text word) OR Previous suicide attempts (text word)) AND Prospective Studies

This resulted in a large number of abstracts, which were all read. The papers listed in the tables below (Table 8, Table 9 and Table 10) were selected because they fulfilled the following criteria: written in English, German or French, available from DNLB or Psychiatric Library Risskov, include patients with deliberate self-harm, follow patients prospectively, have attempted suicide or suicide as outcome measure. The papers were supplemented with a hand search of the literature referred to in the selected papers.

Owens et al. [Owens et al., 2002] conducted a systematic review of fatal and non-fatal repetition of self-harm. The authors constructed two scales for evaluation of the quality of studies evaluating risk of non-fatal repetition and suicide. Proper sample size, representative sample, quality of ascertainment of outcome, proper denominator and use of survival methods with censorship were among the criteria. Based on power calculation, they concluded that the sample size in studies examining risk of repeated suicide attempt should be at least 200, and preferable 600 and more, and that sample size for evaluating suicide should be at least 500, but preferably 950 or more. The authors concluded that the body of research was too heterogeneous for meta-analysis [Egger et al., 1998]. Owens found that the median one-year repetition rate was 16 percent non-fatal and two percent fatal. After more than nine years, around seven percent of patients had died by suicide. To compare with the review from Owens et al. [Owens et al., 2002], we identified some additional papers. However, few papers examined the differences in repeated self-harm between first-time deliberate self-harm patients and repeaters, and those who did find as expected that the repetition rate was much higher among repeaters than among patients with first ever attempted suicide. The proportion of repeaters can vary very much from one study to another, and this fact represents a major difficulty in comparing studies. Also other methodological differences play an important role. Most important, some studies only include patients

**Table 8.** Short time follow-up after suicide attempt. Predictors of repetition.

Short term follow-up (≤ 1year)	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt
[Kapur et al., 2002]	Leeds UK	604 100% follow-up	Patients aged over 16 years who attended six general hospitals in northwest England for deliberate self-poisoning. Mixed sample	12 weeks. Based on case notes	Previous suicide attempt. No psychosocial assessment at index attempt. Dangerousness was not predictive	15%
[Spirito et al., 1992]	Rhode Island USA	113 88% follow-up	Patients aged 13-18 years seen immediately after suicide attempt in general or psychiatric hospital	3 months. Telephone interview parents and children	Not analysed.10%	
[Spirito et al., 2003]	Rhode Island USA	76 76% follow-up	Youth who have attempted suicide and received medical care in emergency department or paediatric clinic	3 months. Telephone interview adolescents + parents reports	Depression	10%
[Sakinofsky et al., 1990; Sakinofsky and Roberts, 1990]	Hamilton UK	228 Follow-up on 82%.	Consecutive patients presented at general hospitals with parasuicide	3 months. Interviewed	Depression, low self-esteem, hostility, sensitivity and poor social adjustment were associated with repetition. Problem solving was not predictive	16%
[Brittlebank et al., 1990]	Newcastle upon Tyne UK	61 No information about follow-up	All consecutive cases of deliberate self-harm, aged 16 to 70 years	3-8 months. Based on case notes	Hopelessness and hostility	21%
[Batt et al., 1998]	Rennes France	632	Patients referred to emergency award of university hospital after suicide attempt in 1994	6 months. Based on case notes	Previous suicide attempt, alcoholism. Neither demographic variables nor impulsivity or psychiatric diagnosis was predictive	11%
[Kapur et al., 2004]	Manchester and Salford UK	658	Prospectively identified patients over 16 years of age managed in Emergency Department after deliberate self-poisoning	6 months. Subsequent referral with deliberate self-poisoning	Young age, male sex, drug and alcohol dependence, current psychiatric contact, previous self-poisoning	14.6%
[Kreitman and Foster, 1991]	UK	1852	Parasuicide patients, two cohorts from 1985 and 1986 (791 men, 1061 women)	6 months (mean). Subsequent admission with attempted suicide to Accident and Emergency Department	Scale containing 11 items were predictive (e.g. previous parasuicide, personality disorder, alcohol abuse, psychiatric treatment, unemployment)	21% men 17% women
[Buglass and Horton, 1974a; Buglass and Horton, 1974b]	Edinburgh Scotland	2809	Admission in 1968-1970 to Regional Poisoning Treatment Centre. Women 62%	1 year Readmission to Regional Poisoning Treatment Centre	Sociopathy, alcohol abuse, previous in- or outpatient care, previous suicide attempt, living alone	16%
[Carter et al., 1999]	Newcastle Australia	1238	Consecutive patients with deliberate self-poisoning referred to hospital 1992-1994. Mixed sample	1 year. Subsequent admission for deliberate self-poisoning	Age between 25 and 44 years, women	13.3%
[De Leo et al., 2002]	8 European cities	63	Patients aged 60 years or more presented at hospitals after attempted suicide. Mixed sample	1 year. Only based on patients interviewed at follow-up.	Death of father during childhood	11%
[Gardner et al., 1977]	Addenbrooke UK	273 follow-up on 90%	Patients with self-poisoning admitted to acute medical ward in general hospital in 1974-1975. Patients were randomised to evaluation by psychiatrist or medical staff	1 year. Interview, contact to GP, casenotes	Same repetition rate among patients randomised to psychiatric evaluation and evaluation by medical team plus social worker	30%
[Gardner et al., 1977]	Addenbrooke UK	314 follow-up on 92%	Consecutive patients with mild self-poisoning seen in the accident department, 1978-1979	1 year. Not mentioned how repetition was determined	Repetition rate was the same among discharged patients and patients treated at medical department. Patients who took their own discharge had a higher risk of repetition	23%
[Garzotto et al., 1976]	Verona Italy	120	Parasuicide patients admitted to University Clinic of Verona in 1970-1973	1 year. Not mentioned how repetition was determined	Sociopathy, alcohol at time of admission, previous parasuicide, victim of violence, short time at present address	26%
[Gilbody et al., 1997]	York UK	1576	Consecutive patients presented at an inner city hospital. Mixed sample	1 year. Repeated referral to psychiatric evaluation after deliberate self-harm	Previous deliberate self-harm. Repeats occurred shortly after index attempt	12%

Table 8 to be continued next page

Table 8. Continued.

Short term follow-up ( $\leq$ 1 year)	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt
[Hjelmeland, 1996]	Sør Trøndelag, Norway	1220	All parasuicides (15 year+) admitted to any health facility in the county	1 year. Selected sample of those who participated in baseline and one-year follow-up interview	Alcohol abuse was a predictor among repeaters, and being a victim of sexual abuse was predictive among "first ever"	10% first ever 20% repeaters
[Hjelmeland et al., 1998]	5 Nordic regions	776	Patients included in WHO/EURO Multicenter Study on Parasuicide. Representative for all patients treated for deliberate self-harm	1 year. Selected sample of those who participated in one-year follow-up interview	Lower suicidal intent was predictive of repetition, lower intention to die, fewer precautions against discovery	17%
[Kerfoot and McHugh, 1992]	Manchester UK	100 Follow-up on 90%	Children under 16 years of age admitted to hospital after deliberate self-poisoning. 90 percent was followed	1 year. Interviewed	Not analysed	10%
[Kapur et al., 2005]	Manchester and Salford UK	7612	All people with self-harm presented to emergency department in one of four hospitals in 1997-2001. Mixed sample	1 year. Subsequent readmission to hospital	Not analysed	13.6%*
[Kessel and McCulloch, 1966]	Edinburgh Scotland	511	Consecutive patients presented at hospitals in Edinburgh region after deliberate self-harm in 1962-1963. Mixed sample	1 year. Subsequent readmission to hospital	Repetition occurred shortly after index attempt. Impulsiveness, past and current psychiatric treatment, alcohol and drug abuse. Dangerousness of index attempt was not predictive	19%
[McFarland and Beavers, 1986]	Portland Oregon	282	All cases of self-inflicted injury admitted to University Hospital, Register-based. Portland in 1979-1980	1 year.	Not analysed	7%
[Myers, 1988]	Staffordshire UK	365	All hospital-treated patients with deliberate self-harm from 1981 to 1984	1 year. Casenotes	Brief clinical scale: young age, female sex, felt suicidal, previous suicide attempt, no emotional attachment to husband or children	16%
[Ojehagen et al., 1992] [Öjehagen et al., 1991]	Lund Sweden	79 Follow-up of 75%	Patients admitted to medical intensive care unit after suicide attempt. Repeaters and non-repeaters were interviewed after one year	1 year. Interviewed.	Hopelessness, hostile feelings, unemployment, need of mental health care. Previous suicide attempt, less suicidal intention at index attempt, psychiatric treatment	27%
[Owens et al., 1991]	Nottingham UK	992	Consecutive patients with deliberate self-harm presented to hospital 1985-1986	1 year. Medical records	Not analysed	12%
[Rosen, 1970]	Edinburgh Scotland	886	Patients admitted to the poisoning treatment centre because of self-poisoning	1 year	Not analysed	Repetition not reported, eight suicides
[Siani et al., 1979]	Verona Italy	147 Follow-up on 91%	All patients first ever, admitted after deliberate self-harm to Psychiatric University Clinic of Verona, 1973-1976	1 year. Interviewed at home visit	Several scales were predictive of repetition: Diagnosis of sociopathy, previous inpatient psychiatric treatment, previous parasuicide, recent change of address, unemployment and criminal record	27%
[Stenager et al., 1994]	Odense Denmark	139	Representative sample of patients admitted to psychiatric department 1990-1991	1 year. Interviewed	No predictors, small sample size	19%
[Stocks and Scott, 1991]	Edinburgh Scotland	42	Patients who had been admitted three times in one week at to the Regional Poisoning Treatment Centre	1 year. Subsequent readmission	Almost all patients were diagnosed with personality disorder and/or alcohol and drug abuse	86% Re-admissions 5.9 (mean)
[Vajda and Steinbeck, 2000]	New South Wales Australia	118	All patients, aged 13-20 presented at inner city teaching hospital with attempted suicide (E950-E959) from 1994 to 1996. Mixed sample	1 year. Subsequent readmission	Alcohol and drug abuse, non-affective psychotic disorder, chronic mental condition. Previous attempts were not predictive	27%

\* Personal communication (N Kapur)

Table 9. Medium-term follow-up of patients after suicide attempt. Predictors of fatal and non-fatal suicide acts.

Long-term follow-up	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt	Predictors of suicide	Completed suicide	Comments
[Colman et al., 2004]	Alberta	507 (follow-up of 369)	Patients aged over 15 years presented at five emergency departments in Edmonton after parasuicide and accepting to participate in research interview (EPSIS)	1-2 years. 72% follow-up interview	Previous suicide attempt, lifetime history of schizophrenia or depression, poor physical health	25%			Follow-up of a selected sample of the 33% of eligible patients who accepted interview
[Crawford and Wessely, 1998]	London, UK	308	All incidents of deliberate self-harm in 16 general practices	18 months. No information about follow-up method	Previous suicide attempt, substance abuse patients who discharged themselves before completion of assessment	18%		2.8%	
[Hassanyeh et al., 1989]	Newcastle upon Tyne, UK	98 (follow-up of 71)	Patients with deliberate self-harm	18 months. 72% interviewed or dead (2)	Past history of self-harm	28%			
[Dieserud et al., 2003]	Bærum, Norway	50	Consecutive patients admitted to general hospital after suicide attempt, 1995-1996. Mixed sample	18 months. 94% interviewed or dead (2)	Low problem-solving capacity, low self-efficacy, hopelessness	16%			
[Suleiman et al., 1989]	Iran	92	Consecutive parasuicidal patients seen at Kuwaiti general hospital	2 years. 89% interviewed or dead (1)	Highest risk the first months after index attempt. Previous suicide attempt, self-poisoning with prescribed drugs, previous depression or dependence, life events, social status as housewife, poor social readjustment	20%		1%	
[Haw et al., 2003]	Oxford, UK	150 (follow-up of 118)	Representative sample of patients presented to general hospital after DSH in 1997. Mixed sample	13 - 20 months. 79% interviewed	No correlation with suicidal intent or with lethality of initial attempt	33%	Not reported. Only one suicide	0.7%	
[Bagley and Greer, 1971; Greer and Bagley, 1971]	London, UK	211 follow-up of 204	All patients presented with deliberate self-harm in 1968	1-2 years 97% traced through interviews, medical record, GPs or social registers	Patients who left hospital without psychiatric evaluation were more likely to repeat attempt (39% vs 23%)	26%		2%	
[Morgan et al., 1976]	Bristol, UK	279 (follow-up of 241)	Patient who attended emergency department in 1972 after deliberate self-harm	1-2 years Follow-up of 97% interviews with patients or relatives, casenotes, GP and other	Previous psychiatric treatment, previous suicide attempt, criminal record, low social class, separation, separation from mother before age 15, personality disorder, regret surviving, alcohol or drug dependence	24% in 12 months. 8% first ever attempt. 28% previous attempters			
[Wilkinson and Smeeton, 1987]	Edinburgh, Scotland	1376	All patients admitted to Edinburgh Regional Poisoning Treatment Centre in 1980	1-2 years. Readmission for parasuicide	No predictor analysis	19% total sample 10% first ever			
[Adam et al., 1983]	Christchurch, NZ	98	Consecutive patients admitted after suicide attempt	18-24 months. 97% traced, interviewed, answered questionnaire or died (2)	Psychosis or personality disorder, interviewers prediction of high risk	35%		2%	

Table 9 to be continued next page

Table 9. Continued

Long-term follow-up	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt	Predictors of suicide	Completed suicide	Comments
[Bancroft and Marsack, 1977]	Oxford, UK	690	All patients presented to a general hospital with self-poisoning or self-injury in 1972-73	2 years. Case notes about hospital admission and emergency room visit due to attempted suicide		18%			Most repeats during first six months after index attempt. No survival analysis
[Pallis et al., 1984]	Chichester, East Glamorgan, and South-hampton, UK	1263	Patients who attempted suicide and were treated in Chichester, East Glamorgan or Southampton	1 year. Death Register, death certificates scrutinised			Higher suicidal intention was predictive. The prediction was strongest in the first six months	1.5% and 3.3% in different subpopulations.	Some analyses were only possible in part of the sample. Different scales were used in different populations. No survival analysis
[Goldacre and Hawton, 1985]	UK	2492	Patients aged 12-20 years who presented with overdose at hospitals in Oxford region 1974-1978. Mixed sample	2.8 years (mean). Repeated attempt treated at hospital in Oxford region		6% within first year.			
[van Aalst et al., 1992]	Nashville, USA	118	All violent suicide attempts surviving index attempt. 38 died from index attempt. 72% of survivors used guns at index attempt	2.8 years (mean). 88% interviewed	Young age, prior attempt, history of suicide, schizophrenia, living in none-home condition	7%		None.	
[Hulten et al., 2001]	Seven European centres	1264	Patients aged 15-19 years presented with attempted suicide. Mixed sample	204 weeks (mean). Study based on interviews. Attrition from the study is not mentioned	Previous suicide attempt. Hard method	7% first ever attempt. 24% previous attempters.			
[Hengeveld et al., 1991]	Leiden and Utrecht, NL	276 women	Female suicide attempters 1985-1986	11-33 months. 95% follow-up with interview, registration data, information from GP			Suicide risk in group of women not participating in follow-up was not different from that of women participating	6%	No survival analysis
[Harris et al., 2005]	Oxford, UK	2489	Patients presented to hospital following deliberate self-harm	12 months and 3 years. Presentation at general hospital in Oxford due to self-harm	Males with low Suicidal Intent score repeated suicide attempt more than males with high score. For females the opposite was found	16.5% in 12 mo.			Suicide was analysed after 5.2 year follow-up. Data concerning suicide is included in long-term follow-up
[Adam et al., 1981]	Christchurch, NZ	195	Consecutive patients admitted to hospital after suicide attempt	3 years. 77% interviewed, returned questionnaires or died (7)	Clinical prediction: patients »highly likely« or »likely« as opposed to »possible« to repeat suicide attempt	29%		3.3%	No survival analysis
[Buglass and McCulloch, 1970]	Edinburgh, Scotland	511	All patients admitted to Edinburgh Regional Poisoning Treatment Centre 1962-1963	3 years. Admission to Edinburgh Regional Poisoning Centre, or Edinburgh public health department (suicides)	Men: Alcoholism, alcohol taken at index attempt, violence in relation to partner, recent loss of partner. Women: Psychiatric treatment previous attempted suicide, psycho-pathy, drug addiction, frequent change of address, poor relationship with children, poor work record, separation from father or mother during childhood, violence in relation to key individual	25%	Predictors of suicide could not be distinguished from predictors of repetition	1.7%	The nine suicides were included in repeated suicide attempts. No survival analysis

Table 9 to be continued next page

Table 9. Continued

Long-term follow-up	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt	Predictors of suicide	Completed suicide	Comments
[Rodger and Scott, 1995]	Edinburgh, Scotland	42	Patients who had been admitted three times in one week to the Regional Poisoning Treatment Centre	3-8 years. 95% traced, information about hospital-treated suicide attempts		98%		2.3%	All patients alive at follow-up had repeated suicide attempt at least once. Selected sample of repeaters. No survival analysis.
[Hepple and Quinton, 1997]	Oxford, UK	100	Patients over 65 years consecutively referred to general hospital 1989-1992. Women 64%. 5 died at index attempt. Mixed sample	3.5 years mean. 97% of cases followed up with interview, GP's report, or subject had died (42)	Depression, psychiatric illness and psychiatric treatment.	5% per year	Previous suicide attempt, divorce, previous psychiatric treatment	7%	No survival analysis.
[Scocco et al., 2000]	Padua, Italy	257	Patients admitted to hospital following attempted suicide from 1990 to 1994. Women 70%. Mixed sample	3.5 years (mean). No information about method of follow-up. Only cases from Padua included			Previous psychiatric treatment and family history of mental illness. Previous attempted suicide was not predictive	5.5%	Different follow-up time. No survival analysis.
[Nordentoft and Rubin, 1993]	Copenhagen, Denmark	100	Patients referred to general hospital after attempted suicide. Randomly chosen from a consecutive group referred to hospital. 71% women. Mixed sample	4 years. 100% register-based. Death certificates reviewed			Borderline personality disorder, affective psychosis, unemployment, several previous suicide attempts, violent suicide attempt	9%	Suicides occurred with same intensity during first 4 years of observation. Survival analysis used.
[Nimeus et al., 1997]	Lund, Sweden	212	Adult suicide attempters evaluated at the Medical Intensive Care Unit and during psychiatric hospitalization	4.2 years. Presumably register-based			Hopelessness. Suicidal Intent Score was not predictive	6.1%	No survival analysis.
[Nimeus et al., 2002]	Lund, Sweden	550	Adult suicide attempters evaluated at Medical Intensive Care Unit	4.5 years. Register-based			Age above 55 years, mood disorder, high suicidal intent	4%	No survival analysis.
[Lonnqvist and Ostamo, 1991]	Finland	1600	Patients with first-time attempted suicide treated in emergency department at Helsinki University Hospital and receiving psychiatric consultation, from 1973-79	4.5 years Register-based. 100% follow-up			Previous psychiatric outpatient care, ongoing psychiatric treatment, severe lethality and severe suicidal intention at index attempt.	3.5%	Survival analyses.

Table 10. Long-term follow-up studies after suicide attempt. Predictors of repeated fatal and non-fatal suicidal acts.

Long-term follow-up	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt	Predictors of suicide	Completed suicide	Comments
[Johnson et al., 1996]	Lund, Sweden	75	Patients admitted to suicide Research Centre after suicide attempt in 1987 to 1989	5 years. 100% register-based 66% interview	None identified, small sample size	40%	None identified, small sample size	13.3%	80% of suicides occurred during first two years
[Nielsen et al., 1990]	Odense, Denmark	207	Patients admitted to department of psychiatry after attempted suicide. 52% men	5 years. 100% register-based		27%	Chronic somatic disease, depression, medicine abuse, alcohol abuse	11.6%	Same cohort as [Nielsen et al., 1995] No survival analysis
[Suokas and Lönnqvist, 1991]	Helsinki, Finland	1018	All self-poisoned patients treated in 1983 in emergency room in Helsinki University Hospital. Mixed sample	5 years. 100% register-based			Male, advanced age, mental disorder, previous suicide attempt, non-impulsive index attempt	3.2% Annual rate 589/100,000	Survival analysis
[Pierce, 1981]		500	Consecutive patients with self-injury treated at district general hospital 1973-1974 (self-poisoning 94%)	5 years. 100% death certificates. Only hospital-treated repeated attempts	Not analysed	21%	Repeated suicide attempts during follow-up. High scores on suicidal intent scale	1.4%	No survival analysis
[Rosenman, 1983]	Adelaide, Australia	262	Patients who attempted suicide in 1976 by taking an overdose of a drug	5 years. Register-based, coroners records were reviewed			German immigrants more likely to commit suicide	2.7%	No survival analysis
[Rygnestad, 1988b]	Trondheim, Norway	253	All self-poisoned patients referred to the regional hospital in Trondheim during 1978	5 years. 100% register-based		20% females 22% males	The first three years after suicide attempts were associated with higher mortality than later years	6% females and 12% males	Death by suicide and unexpected deaths were collapsed. No survival analysis
[Kotila and Lönnqvist, 1988; Kotila and Lönnqvist, 1989]	Finland	362	15-19 year old patients (120 boys, 302 girls) who attempted suicide in Helsinki area in 1973-1982	Mean 5 years. 100% register-based			Male sex, unclear reason for suicide attempt, psychotic condition, seriousness of intent	2.2%	No survival analysis
[Harris and Hawton, 2005; Harris et al., 2005]	Oxford, UK	2719	Patients presented to hospital following deliberate self-harm	5.2 years mean. 2489 with full access to data about vital status were followed up, register-based	Males with low Suicidal Intent score repeated suicide attempt more than females with high score. For females the opposite was found	16.5% in 12 mo.	High Suicidal Intent score	2.2%	No survival analysis
[Ruchholtz et al., 1999]	Essen, Germany	35	Severely injured patients referred to university trauma centre after suicide attempt	6 years. 3 patients could not be traced		0%		0%	Originally 65 patients were included, but 21 died from index attempt
[Sundqvist-Stensman, 1988]	Uppsala, Sweden	1273	All patients admitted to intensive care unit 1977-1985. Mixed sample	Up to 9 years Follow-up % not mentioned. Autopsi records scrutinised				5.8%	No survival analysis
[Bratfos, 1971]	Oslo, Norway	316	All patients with attempted suicide referred to psychiatric department	Up to 13 years, mean 8 years. 100% register-based			Male gender	2.5%	No statistical test

Table 10 to be continued next page

Table 10. Continued

Long-term follow-up	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt	Predictors of suicide	Completed suicide	Comments
[Lonnqvist et al., 1975]	Helsinki, Finland	100	Consecutive patients who in 1963 were admitted because of deliberate self-poisoning	8 years. 99% register-based			Male gender	4%	No survival analysis
[Curran et al., 1999]	Dublin, Ireland	85	All patients referred to general hospital after suicide attempt in 1986-1987	Mean 8.5 years. 86% register-based			Small sample size	3.5%	12 patients were untraceable; some of these may have died
[Tejedor et al., 1999]	Barcelona, Spain	150	Patients admitted to psychiatric department after suicide attempt from 1983 to 1990. 56% Women. 38% had attempted suicide previously. Mixed sample	10 years. 100% register-based	Previous suicide attempt	25%	Lower GAF-score. Gender was not predictive, previous suicide attempt was not predictive	12%	Highest risk for repeated suicide attempts and suicides during first three years. Survival analysis
[Ekeberg et al., 1994; Ekeberg et al., 1991]	Oslo, Norway	926	Unselected patients treated in medical departments in Oslo for self-poisoning in 1980	10 years. 100% register-based			Serious suicidal intent. Age and gender was not predictive. Age above 50 years: suicide attempt on admission was associated with suicide at 5-year follow-up	4.9% women 5.3% men	No survival analysis
[Hawton et al., 2003; Zahl and Hawton, 2004b]	Oxford, UK	11583	Patients presented at hospital after deliberate self-harm in Oxford from 1978 to 1997	Up to 19 years. 100% register-based. Only based on cases with information about vital status			Increasing age, male gender	0.7% first year, 1.7% after 5 years 2.4% at 10 years 3.0% at 15 years	Survival analysis
[Allgulander and Fisher, 1990], Women	Stockholm, Sweden	5515	All women admitted between 1974 and 1985 in somatic or psychiatric department, discharged with a diagnosis of intentional drug self-poisoning with prescribed drugs. Mean age 39 years	0-10 years. 100% register-based information about suicide or admission for self-poisoning	Young age, prior suicide attempt. Risk was markedly reduced after one year	20%	Increasing age, prior suicide attempt, neurotic and affective disorder, absence of drug and alcohol self-poisoning, long index admission. Risk was markedly reduced after 4 years	4.8%	Survival analysis used
[Allgulander and Fisher, 1990], Men	Stockholm, Sweden	3380	All men admitted between 1974 and 1985 in somatic or psychiatric department, discharged with a diagnosis of intentional drug self-poisoning with prescribed drugs. Mean age 39 year	0-10 years. 100% register-based information about suicide or admission for self-poisoning	Young age, prior suicide attempt, CNS-disease and absence of neuroleptic drug poisoning. Risk was markedly reduced after one year	19%	Increasing age, prior suicide attempt, prescribed drug abuse. Risk was markedly reduced after 4 years	6.8%	Percentages are average over follow-up period. Survival analysis
[Cohen et al., 1966]	San Francisco, California	193	Patients admitted to general hospital after suicide attempt 1956-1957	5-8 years. Percent follow-up not mentioned		30%	Score containing: male, Caucasian race, age (increasing), single, previous hospitalization, violent method, previous suicide attempt, alcohol or drug abuse, delinquency, recent loss, poor physical health.		Suicide and attempted suicide were collapsed
[Steer et al., 1988]	Philadelphia, Pennsylvania	499	Patients admitted between 1970 and 1975 after recent suicide attempt. 58% women. Mean age 30 years	5-10 years	95% interviews, or registers		Patients who were prevented from performing a suicidal act by another person were more likely to die from suicide	5.6%	Same cohort as [Beck and Steer, 1989] No survival analysis

Table to be continued next page

Table 10. Continued

Long-term follow-up	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt	Predictors of suicide	Completed suicide	Comments
[Beck and Steer, 1989]	Philadelphia, Pennsylvania	413	Patients admitted between 1970 and 1975 after recent suicide attempt. 58% women. Mean age 30 years	5-10 years. 95% interviews, or registers			Unemployment, alcoholism, precaution subscale in Suicidal Intent Scale (Beck)	4.8%	No survival analysis
[Nordstrom et al., 1995]	Stockholm, Sweden	1573	Suicide attempters referred to psychiatric emergency room from 1981 to 1988	Mean 5 years. 100% register-based, medical and forensic records reviewed			Young men	6.0% (Men 8.3%, women 4.3%)	Survival analysis
[Ostamo and Lonqvist, 2001]	Helsinki, Finland	2782	All attempted suicide admissions in Helsinki 1989-1996	5.3 years. 97% register-based information			Previous suicide attempt, male sex, no alcohol	5.6%	Survival analysis
[Ettlinger, 1975]	Stockholm, Sweden	1351	All patients admitted to intensive care unit in general hospital in 1964-1966 (intervention group) compared with all patients who were admitted to the same unit the preceding 3 years (control group)	5.5 years. 100% register-based, review of death certificates			No difference between intervention and control group	12% (Men 13%, women 10%)	No survival analysis
[Hawton and Fagg, 1988]	Oxford, UK	1959 (full follow-up 1501)	Patients (67% women and 33% men) referred to general hospital in Oxford 1972-1975	6-9 years. (mean 8 years) Only 77% followed with vital information about status			Psychiatric disorder, use of, hypnotics major row before attempt, behavioural retardation, poor physical health	1.6% O/E=23.7	No survival analysis.
[Nordentoft et al., 1993a]	Copenhagen, Denmark	999	Patients referred to poisoning treatment centre after deliberate self-poisoning in 1980	10 years. 97% register-based, 3% excluded, moved abroad			Increasing age, living alone, two or more previous attempts, not respirator treated at index admission	10.6%	Survival analysis
[Nielsen et al., 1995]	Odense, Denmark	207	Patients admitted to department of psychiatry after attempted suicide. 52% men	10 years. 100% register-based			No gender difference. Lethality of index attempt, abuse of medicine	12.1%	Survival analysis
[Rygnestad, 1997b; Rygnestad, 1997a]	Norway	253	All patients aged more than 12 years old, presented at Regional Hospital, Trondheim after self-poisoning. Mixed sample	15 years. 100% register-based			Advanced age, male gender, serious intent. Mortality was highest the first 5 years	Women 7.2% (SMR 65.5). Men 13.0% (SMR 41.5)	Same cohort as [Rygnestad, 1988a]. No survival analysis.
[Cullberg et al., 1988]	Sweden	163	All suicide attempts in contact with psychiatric services from a suburban area, 1975-1976. Mixed sample	8-10 years. 100% register-based, review of death certificates			Alcohol or drug abuse.	6.1%	No survival analysis
[Granboulan et al., 1995]	Paris, France	265 (follow-up suicide attempt 1971-1980 on 127)	All adolescents hospitalized for a follow-up suicide attempt 1971-1980	7-17 (mean 11.5) No information about vital status of 52% of sample			Not analysed.	4%	48 percent could be traced. Poor follow-up on adjustment disorder
[Pokorny, 1966]	Houston, Texas	618	Patients referred to psychiatric consultation because of suicidal attempts, ideas or threats during 14 years (1949-1963)	Up to 14 years. 99.5% Register-based.			Suicide rate was highest among 50-59 years old males. No association between dangerousness of suicidal attempt and later suicide	3.4%	Suicide rate per year was calculated: 740 per 100,000 Survival analysis

Table 10 to be continued next page

Table 10. Continued

Long-term follow-up	Country	N	Included patients	Follow-up	Predictors of repeated suicide attempt	Repeated suicide attempt	Predictors of suicide	Completed suicide	Comments
[Paarreagaard, 1975]	Copenhagen, Denmark	484	Patients (198 men, 286 women) admitted unconscious after suicide attempt	10 years. 100% register-based			Schizophrenia, depression, early age pension, previous suicide attempts	11%	Suicides occurred mostly in the beginning of follow-up period. Survival analysis
[Hall et al., 1998]	Scotland	8304	All patients discharged from Scottish general hospitals in 1981 with a diagnosis of attempted suicide. Women 60%. Mixed sample	13 years. Apparently 100% register-based	Not analysed.	31.6%	Living in an affluent area. No further analyses presented. Suicide mortality was highest the first 5 years after index attempt	2% (+ 0.6% undetermined death) O/E 12.6	No survival analysis
[Suokas et al., 2001]	Helsinki, Finland	1018	All patients treated for deliberate self-poisoning during 1983 in emergency unit, Helsinki University Hospital. Mixed sample	14 years. 100% register-based			Male gender, previous suicide attempt, previous psychiatric treatment, somatic disease, wish to die at index attempt	6.7%	50% of all suicides occurred during the first two years of follow-up. Survival analysis
[Owens et al., 2005]	Nottingham, UK	976	Consecutive patients attending accident and emergency unit in 1985-1986. Women 60%	16 years. 94% register-based			Male gender, increasing age, drowsiness, living alone. 50% of all suicides occurred during the first four years of follow-up	3.5%	Survival analysis
[de Moore and Robertson, 1996]	Sydney, Australia	223		18 years. No information about vital status if some cases moved abroad			Narcotic overdose, more than one episode of DSH in the year of the study, planned episode	6.7%	No survival analysis
[Jenkins et al., 2002]	London, UK	223 (follow-up of 140)	Weekday referrals of patients after parasuicide to psychiatric services	22 years. 63% register-based, review of death certificates				8.5% Rate 4.3 per 1000 years	Risk persisted for many years, no tendency to decline. Survival analysis
[Dahlgren, 1977]	Malmö	229		21-42 years, mode 35 years. Follow-up percent not mentioned				10.9% (14% men, 9% women)	8 suicides occurred more than 15 years after initial suicide attempt. No survival analysis
[Suominen et al., 2004]	Helsinki, Finland	100	Consecutive self-poisoned patients in Helsinki 1963	37 years. 98% register-based				8% women, 26% men	Survival analysis

with self-poisoning, while others only include patients with severe self-poisoning that requires referral to an intensive care unit; others again only include violent suicide attempts. This selection is important as there is a tendency to use the same method in a later attempt, and choice of method at the index attempt might therefore be determinant for eventual suicide. As pointed out by Owens et al., there is an obvious risk of publication bias, reflected in the finding of a higher fatal and non-fatal repetition rate in studies with quality below median score than in studies with quality above median score. High quality studies are characterized by consecutive patients treated in both the emergency room and as inpatients, large sample size, analyses separated in risk of repetition of first ever deliberate self-harm and repeaters, long follow-up, high follow-up rate, use of national registers and use of survival analysis. Randomised clinical trials were excluded from the analyses of repetition rate, as these studies are assumed to recruit a selected group of patients. An exception from this was a randomised study by Gardner, including all cases with deliberate self-poisoning [Gardner et al., 1977].

The information about repetition was in most studies based on case notes or register-based diagnosis. This implies that only patients who were referred to that particular hospital with an event registered as suicide attempt were included as repeaters in the analyses. Most of these studies do not take into consideration that some patients might have moved out of the catchment area, and that the repetition rate therefore might be underestimated. Suicide attempts treated at other hospitals, at the general practitioner, or not treated at all, were not included in the analyses. In some studies, the patients or the parents of young patients were interviewed. In these cases, also suicide attempts for which patients were not admitted to hospital could be identified, but this method might be hampered by under- (or over-) reporting for other reasons.

#### SHORT-TERM FOLLOW-UP STUDIES OF PATIENTS AFTER SUICIDE ATTEMPT

In Table 8 are listed all identified studies with follow-up up to one year, with information of the frequency of repeated suicidal attempts. The repetition rate within one year ranged between six percent and 86 percent. Based on studies in which number of repeaters was clearly stated, the weighted mean was calculated and found to be 15 percent. This figure is similar to the figure identified in the systematic review by Owens [Owens et al., 2002].

Only two studies reported suicide mortality [Sakinofsky et al., 1990; Sakinofsky and Roberts, 1990] and [Kessel and McCulloch, 1966] with respectively 1.8 percent and 1.3 percent who died by suicide after one year.

The populations in the above-mentioned studies are not comparable. The sampling was in some studies determined by age and method (self-poisoning), and in others by severity (unconsciousness). Risk factors in repeaters might differ from risk factors in "first-ers", and in many studies there was no information of the proportion of repeaters. The risk factors examined in different studies were not the same. Many studies evaluated if previous suicide attempt and alcohol and substance abuse were predictive, while factors such as frequent change of address, victim of violence or sexual assault were only examined in few studies. Several risk factors are supposed to be overlapping, such as unemployment, alcohol abuse, sociopathy and previous suicide attempt. The heterogeneity of the studies and the difference in outcome measured makes a formal meta-analysis unfeasible [Altman, 2001; Egger et al., 1998; Egger et al., 2001].

The most frequently reported risk factor for repetition was previous suicide attempt, thus confirming the notion that there are substantial differences in the risk of repetition among "first-ers" and repeaters. The other risk factors investigated in more than two studies and found to be predictive were: alcohol and drug abuse, depression, previous inpatient treatment, sociopathy, unemployment, frequent change of address, hostility, hopelessness, and living alone.

Conflicting results were found with regard to whether suicidal intention predicted repetition. Most of the predictors were already identified in early studies of factors predictive of repetition of suicide [Kreitman and Foster, 1991].

#### MEDIUM-TERM FOLLOW-UP STUDIES OF PATIENTS AFTER SUICIDE ATTEMPT

In medium-term follow-up studies of suicide attempters, the weighted mean value of repetition rate was 16 percent. This value is calculated on the basis of studies in Table 9 without considering differences in the follow-up period, but in most cases, the follow-up time was 18 months to four years. All studies that separated the sample in first-ers and repeaters found that repetition rate was higher among repeaters. One study was based only on patients who were admitted at least three times in one week to Regional Poison Treatment Centre, and this study revealed repetition rates as high as 98 percent. In the systematic review of fatal and non-fatal repetition of self-harm, Owens found that for medium-term follow-up (one to four years), the repetition rate was 21 percent [Owens et al., 2002]. The main reason for the higher repetition rate in Owens review than in the present review, is that the present review included the studies conducted by Goldacre and Hultén, which both had a large sample size and a low repetition rate [Goldacre and Hawton, 1985; Hultén et al., 2001]. The weighted mean proportion of suicides in the same follow-up period was 2.8 percent. This figure is similar to the figure identified in Owens' review.

Analyses of attempted suicide were in most cases based on a high follow-up rate, which was achieved by combining interviews with patients and relatives, use of questionnaires, and contact to general practitioners or registers. Even though this method ensures a high follow-up percent, suicide attempts might be under-reported, since the general practitioner, for instance, will most likely not be aware of all episodes. Medium-term follow-up studies of suicide following suicide attempts were in most cases based on register information, which in several studies was supplied through scrutinization of death certificates or coroners reports. Also in medium-term follow-up studies the most common predictor of repetition was previous suicide attempt. Like Hjelmeland, Wilkinson found a higher repetition rate among repeaters (20 percent) as opposed to "first-ers" (10 percent) [Hjelmeland, 1996; Wilkinson and Smeeton, 1987]. Other predictors for repeated non-fatal suicidal act, as analysed and identified in more than one study, were alcohol and substance abuse, schizophrenia, depression, previous psychiatric treatment, low social class or unemployment, self-discharge before evaluation. The predictors of suicide identified in more than one study were previous suicide attempt, high suicidal intent score, violent suicide attempt or suicide attempt with severe lethality, and ongoing or previous psychiatric treatment.

#### LONG-TERM FOLLOW-UP STUDIES AFTER SUICIDE ATTEMPT

The risk of suicide in long-term follow-up studies ranged from zero to 13 percent, and the follow-up periods ranged from five to 37 years (Table 10). In most of the studies from United Kingdom and in studies from the Nordic countries, register-based information was available about vital status, and in most studies, only a small, or a presumably small (but not mentioned) number of persons could not be traced due to moving abroad. In some of the studies, all death certificates were reviewed in order to ascertain manner of death. The follow-up percentage was low in one of the early studies from United Kingdom [Hawton and Fagg, 1988], and in an Irish [Curran et al., 1999] and a French study [Granboulan et al., 1995], thus leaving a risk of underestimating the suicide risk.

When only studies with a follow-up period ranging from 10 to 15 years were included, the weighted mean proportion of suicide was 3.5 percent. The Nordic studies consequently revealed proportions of suicide that ranged from 6.7 percent [Suokas et al., 2001] to 12.1

**Table 11.** Randomised clinical trials of efficacy of psychosocial treatments in preventing repetition of suicide attempt.

Randomised controlled trials	N	Included patients	Interventions	Follow-up period	Repetition experimental group	Repetition control group	Odds ratio (95% CI)
<i>Problem solving</i>							
[Gibbons et al., 1978]	400	Patients aged 17 years or more referred to casualty after self-poisoning 1975-1976. Repeaters (>1 attempt) and first timers; 71% female. 14% ineligible	Experimental: crisis orientated, time limited, task centred social work at home (problem-solving intervention. Control: routine service	1 year	13.5% 27/200	14.5% 29/200	0.92 (0.52-1.62)
[Hawton et al., 1987]	80	Patients over 16 years admitted to general hospital for self-poisoning; 31% repeaters; 66% female. 87% ineligible	Experimental: outpatient problem orientated therapy by non-medical clinicians. Control: GP care (for example, individual support, marital therapy) after advice from clinician	1 year	7.3% 3/41	15.4% 6/39	0.43 (0.10-1.87)
[Salkovskis et al., 1990]	20	Patients aged 16-65 years (mean 27.5) referred by duty psychiatrist after antidepressant self-poisoning assessed in A&E department; all repeaters with high risk of further repetition; 50% female. Selected group of repeaters with high risk of future repetition	Experimental: domiciliary cognitive behavioural problem-solving treatment. Control: treatment as usual (GP care)	1 year	25.0% 3/12	50.0% 4/8	0.33 (0.05-2.24)
[McLeavey et al., 1994]	39	Patients aged 15-45 years (mean 24.4) admitted to A&E department after self-poisoning; 35.6% repeaters; 74% female. Excluded: Need of psychiatric treatment, history of severe mental illness	Experimental: interpersonal problem-solving skills training. Control: brief problem solving therapy	1 year	10.5% 2/19	25.0% 5/20	0.35 (0.06-2.09)
<b>Total</b>					<b>35/272</b>	<b>44/267</b>	<b>0.73 (0.45-1.18)</b>
<i>Intensive care plus outreach versus standard care</i>							
[Chowdhury et al., 1973]	155	Patients (all repeaters) admitted to general hospital after deliberate self-harm; 57% female. Excluded: 42 repeaters judged to be in high risk of further parasuicide	Experimental: special aftercare with regular outpatient appointments; patients also seen without appointments; home visits to patients who missed appointments; emergency 24 hour telephone access. Control: standard aftercare: outpatient appointment with psychiatrist and/or social worker; non-attenders not pursued	6 mo.	23.9% 17/71	22.6% 19/84	1.08 (0.51-2.27)
[Welu, 1972]	120	Suicide attempters over 16 years brought to Accident and Emergency department; 60% repeaters; % female not given. Excluded: students in college and institutionalized persons	Experimental: special outreach programme - community mental health team contacted patient immediately after discharge; home visit arranged; weekly/twice weekly contact with therapist. Control: routine care - appointment for evaluation at the community mental health centre next day at request of treating physician	4 mo.	4.8% 3/62	15.8% 9/57	0.27 (0.07-1.06)
[Hawton et al., 1981]	96	Patients >16 years (mean 25.3) admitted to general hospital after deliberate self-poisoning; 32% repeaters; 70% female Excluded: psychiatric treatment, drug or alcohol abuse	Experimental: domiciliary therapy (brief problem orientated) as often as therapist thought necessary; open telephone access to general hospital service. Control: outpatient therapy once a week in outpatient clinic in general hospital	1 year	10.4% 5/48	14.6% 7/48	0.68 (0.20-2.32)
[Allard et al., 1992]	126	Patients seen in Accident and Emergency department for suicide attempt; 50% repeaters; 55% female Excluded: no fixed address, expecting to move soon, physical handicap preventing attendance, socio-pathology. Analyses based on 84% not lost to follow-up	Experimental: intensive intervention schedule of visits was arranged including at least one home visit; therapy provided when needed; visits made if appointments missed. Control: reminders (telephone or written) and home treatment by another staff team in the same hospital	1 year.	34.9% 22/63	30.2% 19/63	1.24 (0.59-2.62)
[Van Heeringen et al., 1995]	389	Patients >15 years treated in Accident and Emergency department after suicide attempt; 30% repeaters; 43% female. Excluded: patients in need of medical care other than in the intensive care unit	Experimental: special care home visits by nurse to patients who did not keep outpatient appointments, reasons for not attending discussed and patient encouraged to attend. Control: outpatient appointments only; non-compliant patients not visited	1 year	10.7% 21/196	17.4% 34/195	0.57 (0.32-1.02)
[Van der Sande et al., 1997]	274	Patients >16 years (mean 36.3) admitted to hospital after suicide attempt; repeaters; 66% female. Excluded: patients living outside catchment area, acute psychosis, psychiatric hospitalization, imprisonment, and drug or alcohol addiction	Experimental: brief psychiatric unit admission, encouraging patients to contact unit on discharge; outpatient therapy plus 24-hour emergency access to unit. Control: usual care, 25% admitted to hospital, 65% outpatient referral	1 year	17.1% 24/140	14.9% 20/134	1.18 (0.62-2.25)
<b>Total</b>							<b>0.83 (0.61-1.14)</b>

Table 11 to be continued next page

Table 11. Continued

Randomised controlled trials	N	Included patients	Interventions	Follow-up period	Repetition experimental group	Repetition control group	Odds ratio (95% CI)
<i>Emergency card versus standard care</i>							
[Morgan et al., 1993]	212	Mean age 30 years; patients admitted after first episode of deliberate self-harm; % female not given. Patients with no previous history of deliberate self-harm	Experimental: standard care plus green card (emergency card indicating that doctor was available and how to contact them). Control: standard care - for example, referral back to primary health care team, psychiatric inpatient admission	1 year	5.0% 5/101	10.8% 12/111	0.43 (0.15-1.27)
[Cotgrove et al., 1995]	105	Patients aged 12.2-16.7 years (mean 14.9) admitted after deliberate self-harm; % repeaters not given; 85% female. Excluded?*	Experimental: standard care plus green card (emergency card) - green card acted as passport to readmission into paediatric ward in local hospital. Control: standard follow up treatment from clinic or child psychiatry department	1 year	6.4% 3/47	12.1% 7/58	0.50 (0.12-2.04)
Total							0.45 (0.19-1.07)
<i>Dialectic behavioural therapy versus standard care</i>							
[Linehan et al., 1991]	63	Patients aged 18-45 years who had self-harmed within 8 weeks before entering study; all female; all multiple repeaters of self-harm. Excluded: patients with schizophrenia, bipolar disorder, substance abuse or organic disorder	Experimental: dialectical behaviour therapy (individual and group work) for 1 year; telephone access to therapist. Control: treatment as usual; 73% individual psychotherapy	1 year	26.3% 5/19	60.0% 12/20	0.26 (0.08-0.92)
<i>Inpatient behaviour therapy versus inpatient insight-oriented therapy</i>							
[Lieberman and Eckman, 1981]	24	Patients (mean (range) age 29.7 (18-47) years) all repeaters; patients referred by psychiatric emergency service or hospital A&E department after deliberate self-harm; 67% female. Excluded: psychosis, organic brain syndrome, substance abuse	Experimental: inpatient treatment with behaviour therapy. Control: inpatient treatment with insight-orientated therapy; both groups received individual and group therapy plus aftercare at community mental health centre or with private therapist	2 years	2/12	3/12	0.62 (0.09-4.24)
<i>General hospital admission versus discharge</i>							
[Waterhouse and Platt, 1990]	77	Patients with recent episode of self-poisoning without need for immediate medical or psychiatric care. All in need of immediate psychiatric or medical care (n=274) were excluded	Experimental: general hospital admission. Control: discharge from hospital; on discharge both groups advised to contact general practitioner if they needed further help.	16 weeks	7.9% 3/38	10.3% 4/39	0.75 (0.16-3.53)
<i>Studies published after the meta-analysis</i>							
[Brown et al., 2005]	120	Individuals who attempted suicide and received medical or psychiatric evaluation within 48 hours after the attempt. Emergency Department at University Hospital. Randomised to cognitive therapy or usual care. Excluded: 66 who refused to participate and 164 ineligible	Experimental: 10 individual outpatient cognitive behavioural therapy sessions, weekly or biweekly plus usual care from clinicians in the community and referral service from case-manager. Control: usual care from clinicians in the community and referral service from case-manager	18 mo.	24.1%	41.6%	0.76 (0.62-0.85)
[Dubois et al., 1999]	84	Patients aged 15-34 years with a suicidal act not demanding more than hospitalization. Not in current psychiatric treatment. Excluded patients are not mentioned	Experimental: brief psychotherapeutic protocol proposed to a young population. Control: treatment as usual. Patients were discharged to psychological or psychiatric treatment	1 year	18.6% 8/43	24.4% 10/41	0.71 (0.26-2.40)
[Evans et al., 1999]	34	Patients aged 16-50 years who deliberately harmed themselves, had personality disorder and at least one previous episode of deliberate self-harm. Excluded: patients with organic disorder, schizophrenia and alcohol and drug dependence	Experimental: manual-assisted cognitive-behavioural-therapy, two to six problem-focused sessions. Control: treatment as usual in the two centres	6 mo.	56% 10/18	71% 10/14	0.5 (0.10-2.29)
[Guthrie et al., 2001]	119	Adults who deliberately harmed and presented themselves to emergency department of a teaching hospital. Excluded: 114 who refused to participate and 354 ineligible	Experimental: four sessions of psychodynamic interpersonal therapy delivered in the patient's home. Control: treatment as usual, most often referral back to general practitioner	6 mo.	9% 5/58	28% 17/61	0.24 (0.08-0.70)
[Tyrer et al., 2003]	480	5 centres. Patients with recurrent deliberate self-harm, did not require in-patient treatment. Excluded: patients with psychotic disorders or bipolar mood or substance abuse	Experimental: Up to seven sessions of manual-assisted cognitive-behavioural therapy. Control various: problem solving, dynamic therapy, voluntary group referral and short-term counselling	1 year	39% 84/213	46% 99/217	0.78 (0.53-1.14)
[Vaiva et al., 2006]	605	13 centres. Patients aged 18-65 years who were discharged from emergency department after deliberate self-poisoning	Experimental: telephone call after discharge from a psychiatrist with experience in managing suicidal crises 1) at one month, 2) at three month Control: no telephone contact	13 mo.	16% 24/147 14% 20/146 (3 mo.)	19% 59/312	0.76 (0.49-1.16)

This table was based on the review by Hawton et al [Hawton et al., 1998;Hawton et al., 1999]. Studies published after the reviews were added.

[Nielsen et al., 1995], while the large studies from UK revealed figures like two percent [Hall et al., 1998] and three percent [Hawton et al., 2003]. As pointed out by Owens [Owens et al., 2002], the suicide rate among suicide attempters in UK is clearly lower than in the Nordic countries. It might be possible that differences in procedures for classification of suicide are partly responsible for these differences.

Predictors of suicide that were analysed and identified in more than two long-term studies were male gender, increasing age, previous suicide attempt, serious suicide attempt, alcohol and substance abuse, somatic disease, mental illness, and planning of suicide attempt.

## INTERVENTIONS

A systematic review of randomised clinical trials of psychosocial and pharmacological interventions for persons who have attempted suicide revealed that until now, no intervention has proven effective in reducing suicide rate or repetition rate [Hawton et al., 1999]. The main results of the meta-analysis are presented in (Table 11). The authors identified non-significant trends toward reduced repetition of deliberate self-harm for problem-solving therapy compared with standard aftercare, for provision of an emergency contact card in addition to standard care compared with standard aftercare alone, and for intensive aftercare plus outreach compared with standard aftercare. In one relatively large study in this group, which evaluated community follow up of patients who did not attend outpatient appointments, there was a near significant difference in repetition of deliberate self-harm of 10.7 percent compared with 17.4 percent (0.57; 0.32 to 1.02), (see Table 11 [Van Heeringen et al., 1995]).

The comparison intervention for most of the studies in the meta-analysis of psychosocial intervention was standard care [Hawton et al., 1999; Hawton et al., 1998]. In some studies details of this care were not provided, particularly in terms of treatment content, and the authors recommend that future studies in which standard care is included should define precisely the nature of the treatment patients received. Hawton et al. concluded that the results of the systematic review indicate that there is currently insufficient evidence on which to base firm recommendations about the most effective forms of treatment for patients who have recently deliberately harmed themselves. Given the size of the problem, they consider this situation serious. The main problem with nearly all trials in the meta-analysis was that they included far too few subjects to have the statistical power to detect clinically meaningful differences in rates of repetition of deliberate self-harm between experimental and control treatments, if such differences existed. Even when the results from similar trials were synthesized with meta-analytical techniques, there were insufficient numbers of patients to detect such differences.

After the Cochrane review, six randomised clinical trials have been published, among them the the POPMATIC study, which has a large sample size of 480 patients. The study examines the effect of up to five plus two booster sessions of manual-assisted cognitive-behavioural-therapy sessions versus various control conditions, some of which bear some resemblance to cognitive therapy (problem solving). In the study, there was no significant difference in repetition of self-harm between experimental group and control group [Tyrrer et al., 2003]. In a randomised clinical trial, Brown et al. found that cognitive therapy (mean 9 sessions) for adults who attempted suicide (N=120) reduced repetition rate and increased the repetition-free period [Brown et al., 2005]. Recently, Vaiva et al. published the results of a large French multi-centre trial in which telephone contact after one and three months were compared to standard treatment [Vaiva et al., 2006]. Comparison of both experimental groups combined versus standard treatment did not show that telephone contact was superior to standard treatment, but the authors point out that there was a significant difference between the proportion that repeated suicide attempt in the one-month telephone call group compared to control treatment in the first 6 months of the

trial. The odds ratios in all trials point in the same direction, namely toward a protective effect of the experimental conditions.

As pointed out by Hawton, it might be necessary for such conditions to be combined with assertive outreach.

## SUMMARY OF PAPERS

### UNIVERSAL PREVENTION, INTRODUCTION TO PAPER

Universal prevention covers a broad range of measures influencing everyday life of the general population. One very important area within the field of universal prevention is availability of means for suicide. I have chosen to focus on the availability of means for suicide, because much evidence indicates that interventions in this area are effective. Data from different Danish registers made the study possible.

### PAPER I: TIME-TRENDS IN METHOD-SPECIFIC SUICIDE RATES COMPARED WITH THE AVAILABILITY OF SPECIFIC COMPOUNDS. THE DANISH EXPERIENCE

[Nordentoft et al., 2006]

#### *Objective*

The aim of this paper is to evaluate the effect of restriction of means for suicide, which is an important part of suicide preventive strategies in different countries. The specific objective was to compare death by overdose of specific drugs with the availability of the drugs.

#### *Method*

All suicides in Denmark between 1970 and 2000 were examined in the Danish cause of Death Register with regard to method used for suicide. Overall suicide mortality, and method-specific suicide mortality was compared with official information about availability of medical compounds (barbiturates, benzodiazepines, analgesics, antidepressants) and carbon monoxide in vehicle exhaust and household gas.

#### *Results*

In Denmark, suicide rates increased from 1970 to 1980 for both men and women and decreased thereafter. For both men and women, there was a step increase in suicide by all violent methods and self-poisoning except barbiturates and household gas from 1970 to 1980. Thereafter, there was a decrease in suicides with all methods, most pronounced for self-poisoning. This development is illustrated in the paper, but for the sake of clarity, four figures illustrating the time change in different specific methods are presented in the following (Figure 12, Figure 13, Figure 14, and Figure 15). The study indicates that availability of means for suicide reflects on suicide rate and method-specific suicide rate. It is especially evident that restrictions in sales of barbiturates, reduced availability of carbon monoxide in household gas and car exhaust, and reduced sales figures for dextropropoxyphen and tricyclic antidepressants had huge influence on the suicide rate among women, and the reduced availability of these dangerous means for suicide did not result in women switching to other methods for suicide. The same pattern, although weaker, can be observed for men. Danish women had the highest suicide rate in the world [World Health Organization, 1983] in 1980, and this must be anticipated to be partly due to the availability and widespread use of different dangerous compounds that can be used for suicide. However, not the whole change in suicide between 1970 and 2000 can be explained by the change in drug availability. Suicide rates were increasing in the 1970s for both men and women, while sales figures for barbiturates were decreasing. Changes in method-specific suicide mortality were also found, but to a smaller degree, for methods for which there has been no change in availability (hanging, drowning, jumping, and cutting). The changes in suicide mortality by these methods must be due to other factors in society.

Figure 12. Method specific suicide per 100,000 men, Denmark 1970-2000, self-poisoning.

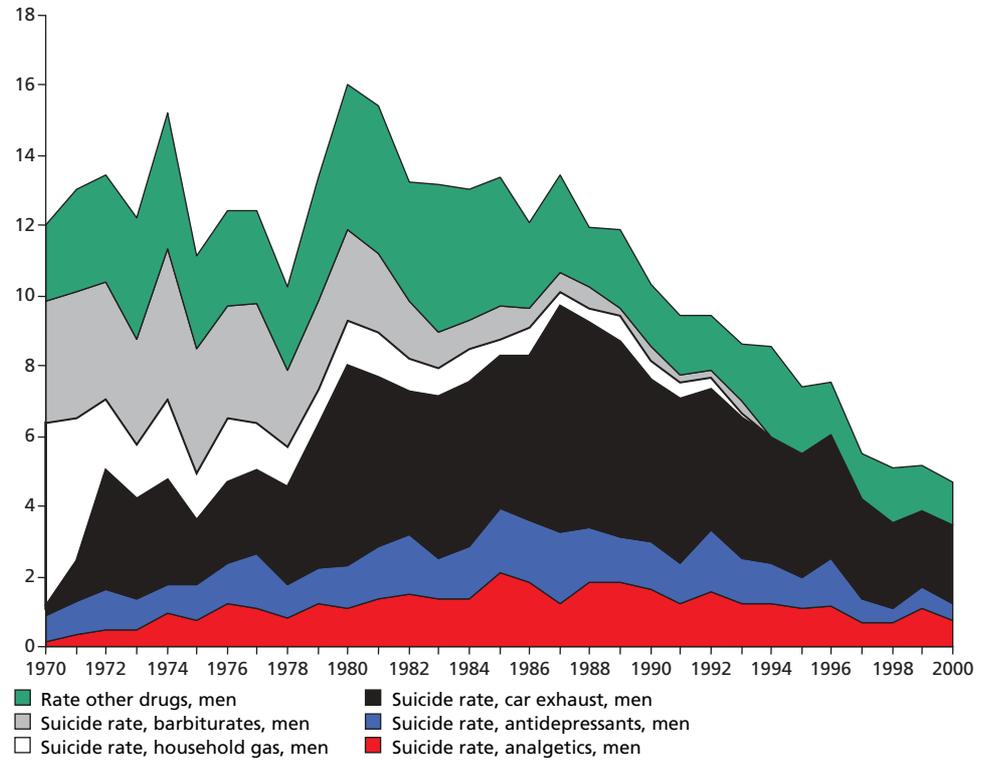
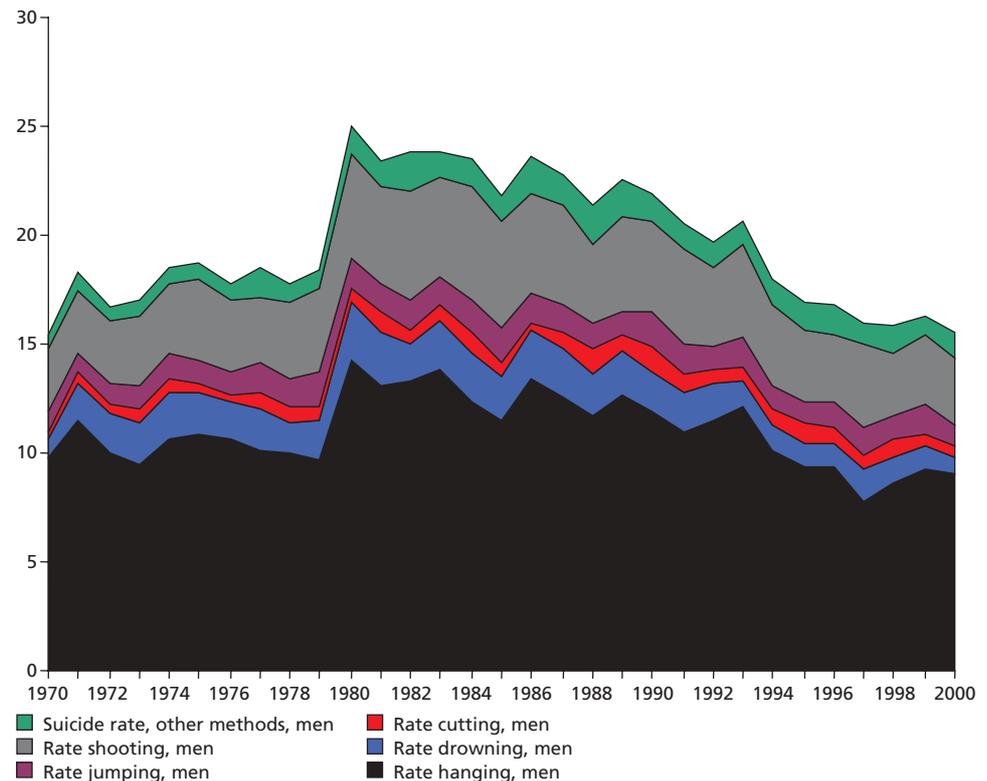


Figure 13. Method specific suicide per 100,000 men, Denmark 1970-2000, violent methods.



## Discussion

### Methodological considerations

The Danish National Cause-of-Death Register was used as basis for measuring the outcome in this study. The validity of the register is discussed in the section about reliability of suicide mortality data.

Since cause-of-death classification changed from ICD-8 to ICD-10 during the period, it was necessary to translate methods-specific suicide from the one diagnostic system to the other. In most cases, this could be done without difficulties, but for antidepressants the category until 1994 contained deaths by antidepressants and benzodiazepines, and from 1995 it contained deaths by antidepressants,

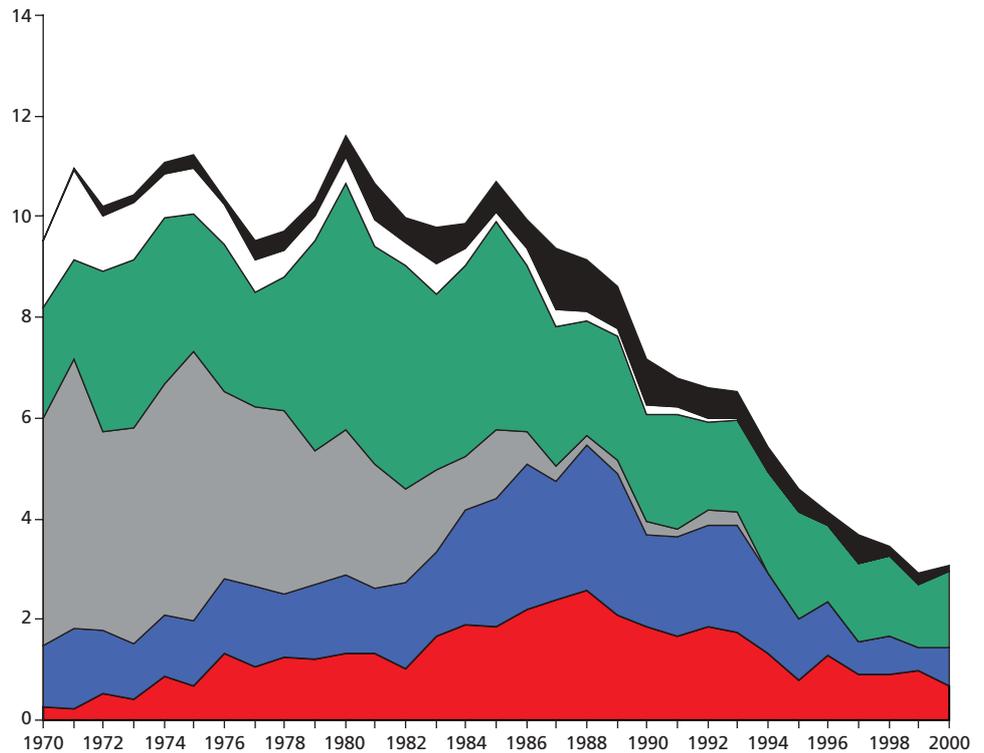
barbiturates, and neuroleptics. However, barbiturates played a very little role at that time, since barbiturates after 1986 could no longer be prescribed as hypnotics. Also, since 1995, the category "antidepressant" has also included death by neuroleptics, which was anticipated to be rare.

The data in this paper are by nature ecological, and the associations we see may be due to coincidence. Therefore, we cannot infer a causal relationship between sales figures for different compounds and suicide mortality. There is a possibility that other changes in society that are unrelated to risk of suicide, could coincidentally have the same association with suicide mortality.

The ecological nature of the study also implies that the time changes in suicide rates could have been caused by other changes in society. It might be that changes in alcohol consumption, immigration, changes in unemployment rates and other factors influenced the suicide rate. However as can be seen from Figure 10, there seems

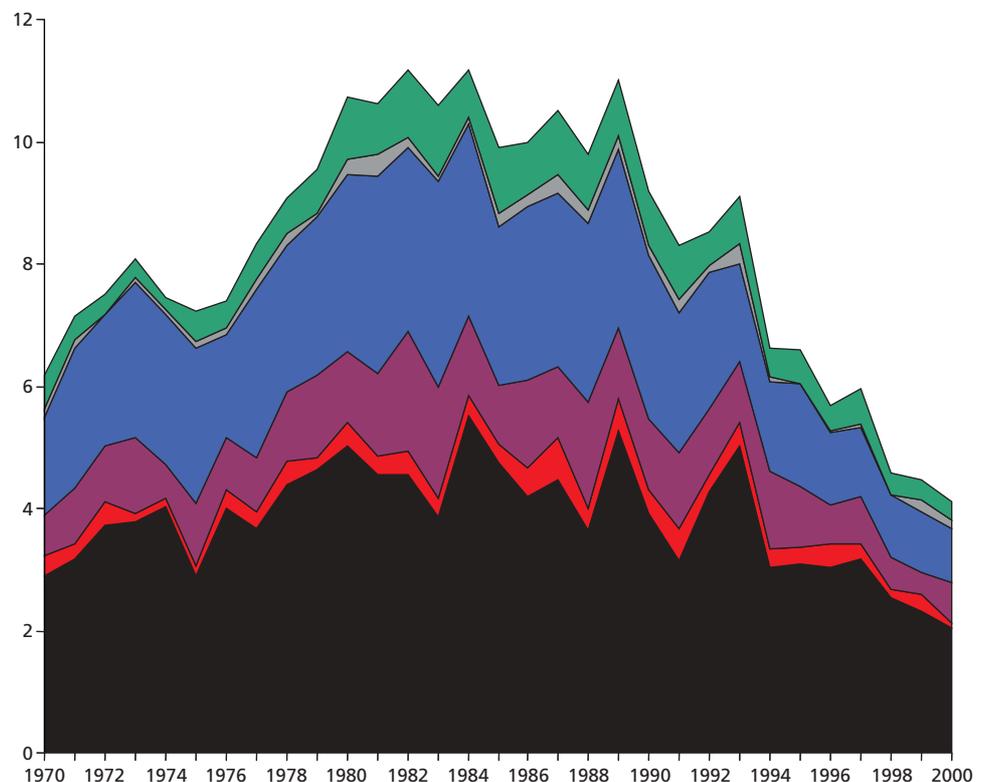
to be no simple association between alcohol consumption or unemployment rates and suicide rates in Denmark. Sales figures for SSRI had a strong inverse correlation with suicide rate as had the number of births.

The number of immigrants and second-generation immigrants in



**Figure 14.** Method specific suicide rates per 100,000 Danish women, from 1970 to 2000, self-poisoning.

■ Suicide rate, car exhaust, women      ■ Suicide rate, barbiturates, women  
 □ Suicide rate, household gas, women    ■ Suicide rate, antidepressant, women  
 ■ Rate other drugs, women                ■ Suicide rate, analgetics, women



**Figure 15.** Method specific suicide per 100,000 Danish women, from 1970 to 2000, violent methods.

■ Suicide rate, other methods, women    ■ Rate jumping, women  
 ■ Rate shooting, women                    ■ Rate cutting, women  
 ■ Rate drowning, women                 ■ Rate hanging, women

Denmark has increased since 1980 as have the number of foreigners gaining Danish citizenship. A Danish study has reported lower suicide risk among non-Danish citizens compared to Danish citizens (Odds Ratio 0.86 (95% CI 0.76 to 0.97)) [Qin et al., 2003]. A recent Swedish study identified increased suicide risk among Finnish first- and second-generation immigrants, while there was reduced suicide risk for first- and second-generation immigrants from the Middle East [Hjern and Allebeck, 2002]. It cannot be excluded that immigration influenced the time change in Danish suicide rates positively. In order to evaluate this possible influence, a more detailed analysis of country of migration and suicide rates in different ethnic groups should be performed.

It is especially puzzling that suicide rates with violent methods also increased in the 1970s and decreased in the 1980s. This implies that other factors than availability of means for suicide played a role for the peak in suicide rate that was present for both men and women in the early 1980s. In Figure 10, the number of births in Denmark is listed as well and reduced suicide rates together with increased number of births might be a proxy variable for hope in the Danish society. In the late 1970s, the number of births decreased rather steeply.

It is possible that restriction in means for suicide only has an impact on the overall suicide rate when the restricted method has a high case fatality. The methods restricted during the time period observed were all methods with a rather high case fatality. Restricting high case fatality methods will ensure that even in cases with switch of method the chance of surviving a suicide attempt is increased. Self-poisoning and wrist-cutting are the most frequently used methods for suicide attempt, and in Denmark, both methods are associated with low case fatality. Access to hanging and jumping was not systematically restricted, although there may have been some initiatives at psychiatric wards to limit inpatients' the access to items that could be used for strangulation and to non-secured high places. It is possible, though not likely, that restriction in access to carbon monoxide and barbiturates led to a switch to methods with even higher case fatality such as hanging, thereby slowing down the reduction in suicide by hanging. However, data seems to indicate that the most marked reduction in overall suicide rate and in method-specific suicide rate occurred with methods to which access was restricted, while there was no consistent pattern with other methods: Our findings are strengthened by the fact that the associations are also visible in the analyses of method-specific suicide mortality corrected for calendar year.

The statistics are based on changes in relative risk for every ten-percent change in availability. This indicates that when RR is 1.10, a ten-percent increase in availability is associated with a ten-percent increase in method-specific suicide mortality, thus a very direct association.

#### *Clinical implications*

Suicide is a major public health issue worldwide with 815,000 lives lost in the year 2000, corresponding to 1.5 percent of all deaths. In a study in seven states, Miller et al. concluded that case fatality for all the evaluated methods was 13 percent, while it was 91 percent for firearms, 3 percent for poisoning/cutting/piercing, 80 percent for suffocation/hanging, and 30 percent for all other methods [Miller et al., 2004a]. It is important to restrict access, especially to methods for suicide with high case fatality rate. Restricting the means for suicide should be a part of National Suicide Prevention Strategies, which is also recognized in a recent review of suicide prevention strategies [Mann et al., 2005].

Suicide prevention must be multi-faceted, and reducing availability of means for suicide should only represent one aspect of the total suicide prevention strategy. The huge differences in case fatality rates for different methods may imply how important it can be if highly lethal methods are replaced by less dangerous methods. The present study indicates that reduced availability of some of the most

preferred compounds (barbiturates, carbon monoxide gas, dextropropoxyphen and tricyclic antidepressants) was associated with reduced overall suicide mortality and method-specific suicide mortality. Although switch from restricted methods to unrestricted methods cannot be excluded, there was no data at the end of the period 1970-2000 indicating that reduced availability of one method led to a switch to other methods. Since the study is based on ecological methods, other factors than availability of means for suicide are also likely to play a role in the changing suicide rates. The Danish experience, together with a range of other studies of the same subject, may indicate that restrictions in availability of dangerous means for suicide can have a positive effect on suicide rates.

#### **Conclusion**

Restrictions on availability of carbon monoxide, barbiturates and dextropropoxyphen was associated with a decline in the number of deaths by self-poisoning with these compounds. Restricted access occurred concomitantly with a fiftyfive percent decrease in suicide rate.

Changes in availability of a suicide method are highly associated with changes of the rate of suicide by that specific method. The reduced availability of lethal methods is likely to have contributed to the general decline of the suicide rates in Denmark.

#### **SELECTIVE PREVENTION, INTRODUCTION TO PAPERS**

Important risk groups for suicide are the mentally ill, those with severe somatic illnesses, the socially disadvantaged, and those with recent loss especially to suicide.

I have chosen to describe the risk of suicide and identify risk factors in homeless persons as an example of an extremely socially disadvantaged group. Moreover, the suicide risk of patients with schizophrenia, affective disorder and alcohol and drug abuse is undertaken together with an analysis of high-risk periods and an analysis of time trends in suicide risk for patients with schizophrenia. Two papers from the OPUS trial are included, both describing the suicidal ideation and suicidal behaviour among patients with recent onset psychosis in schizophrenia spectrum and analysing the effect of integrated treatment on suicidal behaviour in a one- and two-year follow-up period. Risk factors for suicidal ideation and behaviour are analysed.

PAPER II: A 10-YEAR FOLLOW-UP STUDY OF MORTALITY AMONG HOMELESS USERS OF HOSTELS IN COPENHAGEN. [Nordentoft and Wandall-Holm, 2003]

#### **Objectives**

The aim of the study was to investigate mortality among users of hostels for homeless in Copenhagen, and to identify predictors of death such as conditions for upbringing, mental illness, and alcohol and drug abuse.

#### **Methods**

A total of 579 persons who visited a Copenhagen hostel for homeless in 1991 (called registration sample), and a representative sample of 185 persons (called interview sample), who visited two Copenhagen hostels for homeless. All participants were traced in the Danish Civil Registration System and in the Danish Cause of Death Register.

Cause-specific mortality rates were analyzed.

#### **Results**

Standard Mortality Rates for both sexes were 3.8 (95% C.I. 3.5-4.1); 2.8 (95% C.I. 2.6-3.1) for men and 5.6 (95% C.I. 4.3-6.9) for women. SMR for suicide in this cohort (both sexes) was 6.0 (C.I. 3.9-8.1). SMR for natural death was 2.6 (95% C.I. 2.3-2.9), for accidents 14.6 (95% C.I. 11.4-17.8) and for unknown cause of death 62.9 (52.7-73.2). Age-specific relative risk ratios for death revealed that

the mortality was relatively higher in the younger age groups. Mortality figures were significantly higher among homeless persons with more than two visits at the hostel and with less than a 10-day length of stay, compared to the rest of the study group. In univariate analysis, significant predictors for suicide were found to be associated with shortest stay in hostel less than 11 days with a relative risk of 5.32 (95% C.I. 1.07- 26.32) and more than one stay during 1991 with a relative risk of 4.70 (95% C.I. 1.18-18.82).

Among those interviewed, early death of the father, and alcohol and sedative abuse were risk factors for early death. As only one suicide occurred among the 185 persons interviewed, predictors for suicide in this sample were not analysed.

Among the homeless in two hostels in Copenhagen, there was a high proportion of mental illness, high proportion of persons with a criminal record, high proportion of alcohol and drug abusers, and high proportion of persons with a traumatic childhood.

## **Discussion**

### *Methodological considerations*

The registration sample included in the follow-up study consists of all persons who were registered with at least one stay at what was called first hostel during 1991. When planning the interview sample, we were well aware that we were unable to conduct an incidence study for practical reasons; and that a point prevalence study would be hampered by length bias, which would imply that young persons who are often very transient would be underrepresented. Using our knowledge about the age and sex composition of the population in the two hostels (based on information from the hostels about the age and sex composition of the population in 1991), we were able to conduct a stratified point prevalence study in which we decided how many persons of each sex in each age group we should interview in each hostel. This method is also likely to be hampered by length bias, as it is more likely that we would succeed in interviewing a person with a given age and sex who had a long stay at the hostel, than a person with the same age and sex who had a very short stay, as such a particular person would be more likely to have left before the interview. However, this way of sampling ensured that with regard to age and sex we included a population that resembled the incident population. The homeless persons were interviewed during a period of three months in 1992. First, we interviewed 100 homeless from one hostel, then 100 homeless from the other hostel. Selection of interviewees was planned pragmatically, dependent on who was available for interview in the hostel each day in the interviewing period.

Some of the persons in the registration sample were also included in the interview sample. We analysed the two samples separately, and the fact that some persons were participants in both samples was not surprising and did not bias the results.

The main finding of the study is a high mortality among the homeless users of hostels in Copenhagen. SMR was increased for all causes of death except homicide. Homicide is a rare cause of death in Denmark, and a no difference in homicide rates could be detected in the study, since the sample size is too small to do so.

The finding that those with only short duration of stay at the hostel and those with more than one stay during 1991 had the highest mortality indicates that the most transient population is the most vulnerable and has the highest risk. Analyses in the registration sample revealed no differences between mortality figures for men and women, which indicated a mortality rate especially among the young women that was much higher than expected.

### *Clinical implications*

Several studies show that it is possible to help especially mentally ill homeless persons by providing psychiatric care, food, and shelter. [Barrow et al., 1991; Shern et al., 1997; Shern et al., 2000; Tsemberis and Eisenberg, 2000]. With implementation of assertive outreach and case management techniques, it is possible to improve the standard of daily living in the homeless population. Young drug-

abusing delinquents are difficult to help, and special programmes should be developed to ensure psychiatric treatment, detoxification, medical treatment, social advice, and housing facilities for this group.

The findings concerning traumatic childhood experiences indicate that prevention of social exclusion should start early in life. The gender distribution among homeless raises the interesting question of which factors protected the girls who had the same traumatic childhood experiences, and who apparently in much lower numbers became homeless as adults.

## **Conclusion**

It is recommended to avoid or minimize social exclusion and to facilitate easy access to health services for those staying in hostels.

PAPER III: SUICIDE RISK IN RELATION TO FACTORS AROUND ADMISSION TO PSYCHIATRIC HOSPITAL [Qin and Nordentoft, 2005]

## **Objective**

Persons with history of admission to psychiatric hospital are at high risk for suicide, but little is known about how this is influenced by detailed factors around hospitalisation.

The objective of this study was to explore how risk for suicide differs according to time since admission, diagnosis, length of hospital treatment and number of prior hospitalisations.

## **Methods**

We obtained all personal data from various Danish longitudinal registers which included the Cause-of-Death Register, the Danish Psychiatric Central Register [Munk-Jorgensen and Mortensen, 1997], and the Integrated Database for Labour Market Research (so-called IDA Database) [Danmarks Statistik (The Danish National Bureau of Statistics), 1991]. We used the personal identifier (the so-called CPR-number) to retrieve and merge individual data from different databases [Malig, 1996]. From the Cause-of-Death Register [Sundhedsstyrelsen (Danish National Board of Health), 1982], we obtained all definite suicides coded as E950-959 in International Classification of Diseases, 8th version (ICD-8) and as X60-84 in International Classification of Diseases, 10th version (ICD-10) during 1981 to 1997. We restricted study cases to those residing in Denmark on January 1 of the year of suicide so that they had complete socio-economic information in the IDA Database. We finally gained 13,681 male and 7488 female suicides, which accounted for 99.64% of the total suicides in this period in Denmark.

We used a nested case-control design [Clayton and Hills, 1993] matching for sex, age and calendar time of suicide to randomly select up to 20 controls per case from a sub-sample of all individuals of the same age and gender who were alive and observed in the 5% sample of national population in the IDA Database at the date of the suicide. This procedure was followed for each suicide resulting in a sample of 273,371 male and 149,757 female controls matched for the cases. Suicides were compared to non-suicides in a nested case-control design. All 13,681 male and 7488 female suicides committed in Denmark during 1981-1997 and 423,128 population controls matched for sex, age and calendar time of suicide.

We analysed the data with conditional logistic regression model using the PhReg procedure in SAS version 8 [SAS Institute Inc., 1999] which yielded conditional odds ratio, 95% confidence intervals (95% CI) and corresponding p-value. Because of the method of sampling controls and the rarity of suicide, the estimated odds ratio in this study can be interpreted as risk ratio. We examined interaction between variables using the likelihood ratio test. We calculated population attributable risk based upon the risk ratio derived from the adjusted analysis and the distribution of exposure in the cases. Data are adjusted for socio-economic factors.

## Results

This study demonstrates that there are two sharp peaks of risk for suicide around psychiatric hospitalisation, one in the first week after admission while another in the first week after discharge; suicide risk is significantly higher in patients who had less than median duration of hospital treatment; affective disorders impact suicide at the strongest in terms of both its effect size and population attributable risk; and suicide risk associated with affective and schizophrenia spectrum disorders declines quickly after treatment and recovery while the risk associated with substance abuse disorders declines relatively slower. This study also indicates that an admission history increases suicide risk relatively more in women than in men; and suicide risk is substantial for substance disorders and for multiple admissions in women but not in men.

## Discussion

### *Methodological considerations*

With the focus on psychiatric admission, our data may represent a severe spectrum of psychiatric disorders. We are not able to control the influence of psychiatric illness treated only on outpatient basis, because such data were not available on the register before the year 1995. We are also unable to control for the influence of untreated psychiatric disorder. These limitations might lead to underestimation of our results because we placed outpatients, for example, and persons with untreated psychiatric disorders, who are generally assumed to be at a higher risk of suicide than people without psychiatric history, in the reference group.

We found patients with a length of admission shorter than the median length had a higher risk of suicide. This might indicate that these patients did not receive sufficient treatment and that they might have benefited from the treatment they could have had during a longer admission. On the other hand, we do have information from paper IV [Nordentoft et al., 2004] that the suicide risk for patients with schizophrenia was reduced at the same speed as for the general population during the period where the median length of admissions was dramatically reduced. Therefore, it cannot be concluded that psychiatric admissions of a certain length are necessary to prevent suicide. The finding that patients with short admissions have a higher risk of suicide might be a result of a common underlying factor determining both the short duration of admission and the increased risk of suicide. Such an underlying condition could be, for example, illness-related factors. Hawton and colleagues identified poor compliance as such a risk factor [Hawton et al., 2005], and comorbid substance abuse might be another example of such a factor. It could be argued that the finding of increased suicide risk the first week after discharge represents reversed causality, namely that inpatient stays were interrupted by patients' suicide, but only patients who were discharged for at least one day were included in analyses of suicide risk after discharge.

Because of the availability of high quality national registers, Denmark and Sweden are the only countries in the world where this type of research can be performed. It is therefore an important question whether the findings can be generalized to other countries. Compared to many European countries, the cost of psychiatric care and the number of psychiatric beds in Denmark is high [Knapp et al., 2002] and surely much higher than in developing countries. Therefore, it is uncertain to which degree the results can be generalised to other countries. Analyses were adjusted for marital status, income, place of residence, and number of psychiatric admissions, which were all variables identified as predictors of suicide in previous analyses [Qin et al., 2003].

### *Clinical implications*

With regard to population-attributable risk, this shows that hospitalised psychiatric disorders accounted for 33.2% male and 53.2% female attributed risk of suicide in the population. However, it provides further insight into what comprises attributable risk and how,

as to diagnosis and time since hospitalization, which is useful information for making prevention strategies in the population. For instance, we note that about 2.1% of male and 3.8% of female population attributable risk of suicides are accounted for by suicides among patients during the first week after discharge. This means that if substantial efforts in intensive care and supports could be made to, e.g., patients in the first week after the discharge, then up to 2.1% of male and 3.8% female suicides could be prevented.

Affective disorders were the single category responsible for most suicides. This finding was stronger among women than among men.

Combined results from this study suggest that intensive clinical care and maintaining care beyond the point of clinical recovery are important to reduce risk of suicide in patients with psychiatric disorders. These findings should lead to systematic evaluation of suicide risk among inpatients prior to discharge and corresponding outpatient treatment as well as family support should be initiated immediately after the discharge. There are some differences but also a substantial overlap in risk factors for suicide, suicide attempt and suicidal ideation in schizophrenia [Haw et al., 2005; Hawton et al., 2005; Nordentoft et al., 2002b]. The most striking difference is that males have a higher risk of suicide but not for suicidal ideation or suicide attempt. Even though the predictive value of suicidal ideation is likely to be low, it is, together with history of attempted suicide and comorbid depression, the most important risk factors that should be assessed before discharge. There are no high-quality intervention studies that can provide guidance as to which kind of service should actually be provided in order to reduce suicide mortality. As the base rate of suicide is low even in mental illness, and because suicide attempt is not an ideal proxy variable for suicide, since risk factors for suicide are not completely overlapping with risk factors for suicide attempt, very large randomised studies would be necessary to evaluate the effect on suicide rates of different treatments. A more pragmatic approach is to ensure that patients actually are taken care of and provided evidence-based treatment for the underlying psychiatric condition such as depression or schizophrenia.

## Conclusion

Suicide risk peaks in periods immediately after admission and discharge. The risk is particularly high in persons with affective disorders and in persons with short hospital treatment. Intensive clinical care and maintaining care beyond the point of clinical recovery are important for preventing suicide in patients with psychiatric disorders.

### PAPER IV: CHANGE IN SUICIDE RATES FOR PATIENTS WITH SCHIZOPHRENIA IN DENMARK, 1981-97: NESTED CASE-CONTROL STUDY

[Nordentoft et al., 2004]

### *Objective*

To study the change in risk of suicide among patients with schizophrenia and related disorders.

### *Methods*

Data for this study were based on four Danish longitudinal registers, including the Danish Civil Registration System, the Cause-of-Death Register, the Danish Psychiatric Central Register and the IDA Database. The Danish Civil Registration System [Malig, 1996] has been functioning since 1968 and contains a personal identifier for all individuals residing in Denmark and their birth information as well as links to parents. The personal identifier, the so-called CPR-number, is used as a key to retrieve and merge individual data from different databases. The Danish Civil Registration System also contains information about the vital status of each person; it is therefore possible to exclude persons who have disappeared or emigrated. The Cause-

of-Death Register [Sundhedsstyrelsen (Danish National Board of Health), 1982] contains computerized information about all deaths in Denmark, date of death, way of dying and cause of death.

The Danish Psychiatric Central Register [Munk-Jorgensen and Mortensen, 1997] covers all psychiatric inpatient facilities in Denmark and has been computerized since 1969.

The IDA Database [Danmarks Statistik (The Danish National Bureau of Statistics), 1991], a Danish acronym for Integrated Database for Labour Market Research, contains longitudinal information on labour market conditions, automatically extracted from official records for all persons in the population and their socio-demographic data.

From the cause of death register we extracted a list of all people aged less than 76 years who committed suicide in Denmark from 1981 to 1997. Suicide was determined as way of death when the causes of death were coded as E950-959 (ICD-8, international classification of diseases, eighth revision) for the period 1969-93 and as X60-84 (ICD-10, international classification of diseases, 10th revision) from 1994 and onwards. By using a nested case-control design matching for birth year, sex, and calendar time, we randomly selected 20 controls per case from a 5% random sample of the total population in the IDA database. We included 18.744 people who committed suicide and 374.880 population controls in the study.

### Results

Over the time studied the reduction in suicide rate among patients with schizophrenia and schizophrenia spectrum disorder was similar to that seen in the general population (incidence rate ratio 1.00, 95% confidence interval 0.98 to 1.03). The reduction among patients with other psychosis in the schizophrenia spectrum was faster than the reduction seen in the general population. Among people admitted to hospital with schizophrenia the risk of suicide was highest in the first year after first admission, and the excess risk was largest in the young age groups

### Discussion

#### Methodological considerations

Data in this study stemmed from comprehensive registers. However from the psychiatric case register, only information about in-patient treatment was used, as information about outpatient treatment was only reported since 1995. This might imply that our conclusions are based on a sample of patients with the most severe conditions, requiring inpatient treatment.

#### Clinical implications

It was previously assumed that de-institutionalization was associated with increased risk of suicide [Rossau and Mortensen, 1997; Osby et al., 2000b]. It was contrary to our expectation that suicide rates actually decreased. Therefore, we extracted information about the structural reorganization of psychiatric treatment. We can reject the hypothesis, previously put forward, that de-institutionalization would lead to increased suicide rate. The mechanism through which this positive time change occurred is unknown. It is possible that the suicide rate among patients with schizophrenia decreased due to better treatment facilities, or that they responded to the same factors as the general population. These factors that are only partly identified, but among them the change in the availability of several dangerous means for suicide is likely to play a role.

There are no studies that can guide us in reducing the high risk of suicide during the first month after discharge. A systematic evaluation of suicide risk among inpatients prior to discharge is relevant even though prediction of suicide is difficult. It might in some cases lead to identification of patients likely to commit suicide after discharge, as suicidal ideation and depression are known to be predictors. Introduction of outpatient treatment during inpatient stay and arranging the first outpatient contact shortly after discharge might also be helpful. Young first-episode patients are at high risk for sui-

cide, and more intensive treatment and support should be offered to this patient group.

### Conclusion

Throughout the period 1981-1997, suicide risk among patients with schizophrenia was much higher than among never-admitted persons in the general population. The suicide rate among patients with schizophrenia and related disorders has declined in the period 1981-1997, as has the suicide rate in the general population. It is unclear whether the reason for the reduction in suicide risk among patients with schizophrenia and related disorders is due to factors affecting the general population such as decreased availability of suicide means, or to factors that affect only patients with schizophrenia and related disorders such as changes in psychiatric services, or both. Priority must continuously be given to suicide preventive efforts directed towards the general population as well as towards psychiatric patients. The finding that the suicide risk is especially high during the first month after discharge should lead to systematic evaluation of suicide risk among inpatients prior to discharge and increased treatment and support immediately after discharge. Young first-episode patients are at high risk for suicide, and more intensive treatment and support should be offered to this patient group.

PAPER V: OPUS-STUDY: SUICIDAL BEHAVIOUR, SUICIDAL IDEATION AND HOPELESSNESS AMONG FIRST-EPIISODE PSYCHOTIC PATIENTS. A ONE-YEAR FOLLOW UP OF A RANDOMISED CONTROLLED TRIAL [Nordentoft et al., 2002b]

### Objective

To identify predictive factors for suicidal behaviour and to examine the effect of integrated treatment on suicidal behaviour and hopelessness.

### Method

341 patients with a first-episode schizophrenia spectrum disorder were randomised to integrated treatment or treatment as usual.

Patients aged between 18 and 45 were included if they met the criteria for ICD-10 diagnoses of schizophrenia, acute or transient psychotic disorder, schizotypal disorder, schizoaffective disorder or other delusional disorders in the F.2-spectrum. All patients should be able to speak and understand Danish, none of the patients had been treated with antipsychotic medication for more than 12 weeks.

Integrated treatment can be defined as an assertive community treatment model [Stein and Test, 1980] enhanced by better specific content via family involvement and social skills training. Two multidisciplinary teams in Copenhagen and one in Aarhus were established and trained to provide integrated treatment. Caseload reached a level of approximately 10. Each patient was offered integrated treatment for a period of two years. A primary team member was designated for each patient who was then responsible for maintaining contact and co-coordinating treatment within the team and across different treatment and support facilities. The patients were visited in their homes or other places in their community, or they were seen at the office according to the patient's preference. During hospitalization, treatment responsibility was transferred to the hospital, but a team member visited the patient once a week. The office hours were Monday to Friday, 8 a.m. to 5 p.m. All team members had a cell telephone with an answering function. Outside office hours, patients could leave a message and be sure that the team would respond the next morning. A crisis plan was developed for each patient. If the patient was reluctant about treatment, the team stayed in contact with the patient and tried to motivate the patient to continue treatment.

Psychoeducational family treatment was offered, and team members always tried to make contact with at least one family member

and motivate patients and families to participate in a psychoeducational group. Family treatment followed McFarlane's manual for Psychoeducational Multiple-Family Group Treatment [McFarlane et al., 1995] and included 18 months of treatment, 1.5 hours biweekly, in a multiple-family group with two therapists and 4-6 families, including the patients. The multiple-family group focused on problem solving and development of skills to cope with the illness.

Patients' social skills were assessed using the WHO Psychiatric Disability Assessment [World Health Organization, 1998]. Patients with impaired social skills were offered social skills training focusing on medication, coping with symptoms, conversation, and problem solving skills in a group of maximum six patients and two therapists [Liberman et al., 1986].

A more detailed description of the treatment provided by integrated treatment can be read in an ethnographic study of the project [Larsen, 2002] or in the Danish handbook written by staff members in integrated treatment [Nordentoft et al., 2002c].

Standard treatment usually offered the patient treatment at a community mental health centre. Each patient was usually in contact with a physician, a community mental health nurse, and in some cases also a social worker. Home visit was possible, but office visits were the general rule. A staff member's caseload in the community mental health centres varied between 1: 20 and 1: 30. Outside office hours, patients could refer themselves to the psychiatric emergency room. There are no detailed descriptions of how the community mental health centres in Copenhagen and Aarhus worked in the years when the trial was carried out, but a general description of the working methods in Danish community mental health centres can be found in a textbook about community psychiatry. [Blinkenberg and Iversen, 2002]

Patients were followed up after one year.

Outcome measures were attempted suicide during first year of follow-up and suicidal ideations during last week before one-year follow-up interview. The reporting of suicide attempt during first year of follow-up was based on patient's reports but supported by case-notes in medical records. In most cases, there was agreement between patient's reports and case notes; but in some cases, the patients had difficulty in reporting the time of the suicide attempt, which could possibly lead to misclassification so that a suicide attempt before the onset of treatment was classified as a suicide attempt during first year of follow-up. This risk of misclassification was known beforehand, and the researcher therefore paid special attention when asking about the time of the suicide attempt.

## Results

During the one-year follow-up period, 11 percent attempted suicide. This was associated with female gender, hopelessness, hallucinations and suicide attempt reported at baseline, with the two latter variables being the only significant ones in the final multivariate model.

There was an inverse association between thought disorder and suicidal ideation and suicide attempt.

The integrated treatment reduced hopelessness but there were no differences at one-year follow-up between treatment groups with regard to suicidal thoughts, suicidal plans or suicide attempt.

## Discussion

### Methodological considerations

The integrated treatment, though more intensive, was not especially focused on suicidal behaviour and ideation.

The sample size is too small to allow evaluation of suicide as an outcome measure. Reports of suicide attempts were based solely on patients' information.

In many studies hopelessness has been found to be an important predictor of suicide and suicide attempt, and it is promising that it was reduced significantly in the integrated treatment group. Hopelessness was significantly lower at the one-year follow-up in the

group receiving integrated psychiatric treatment than in the standard treatment group. Assessment of hopelessness was based on the answer to one specific item in SCAN, and although it might be representative, Hopelessness Scale [Bech et al., 1974] would most likely be a more valid measure of this variable.

The analyses of the psychotic and negative symptoms as predictors for suicidal thoughts were based on the Schedule for Assessment of Negative Symptoms and Schedule for Assessment of Positive Symptoms (SANS and SAPS) [Andreasen and Olsen, 1982; Andreasen et al., 1990] from one-year follow-up interviews. When analysing the same variables as predictors for attempted suicide during the first year of follow-up, the baseline values of SANS and SAPS were used. The reason for choosing different time periods for measuring outcome was that we considered reports of suicidal ideations during last week as more valid than report of suicidal ideation during last year. With regard to predictors, it seemed more reasonable to choose recent symptoms as predictors than symptoms one year earlier. However, these choices make the comparison between predictors difficult, as symptoms changed from baseline to one-year follow-up. Even with this caution in mind, it seems reasonable to conclude that hallucinations increase the likelihood of both suicidal ideations and suicide attempt, while negative symptoms and delusions might play a role as predictors of suicidal ideation but not as predictors for suicide attempt. It seems convincing that although overlapping, there are also differences between the population with suicidal ideations and the population with suicide attempt. In a recent review which included the present paper, Haw et al. did not identify hallucinations as predictors of deliberate self-harm [Haw et al., 2005].

The finding that thought disorder was inversely associated with suicidal ideation and suicide attempt could be hypothesised to be explained by the patients with thought disorder representing a group with long duration of untreated psychosis, and thus selected positively by surviving a long risk period (healthy worker effect). This hypothesis was tested with examining the association between suicidal behaviour and duration of untreated psychosis. No association with suicidal behaviour was found, nor in univariate analysis nor in the analysis of possible interactions between duration of untreated psychosis and the sub-scales of SAPS. There was no statistically significant difference between patients with and without thought disorder with regard to duration of untreated psychosis.

### Clinical implications

Suicidal ideation and suicidal behaviour were very common in the study group of young, first-episode psychotic patients.

Integrated psychiatric treatment was superior to standard treatment concerning hopelessness. There is a need for the development of special treatment programs focused on suicidal behaviour.

Being a female, having attempted suicide the year before the baseline interview, and hopelessness and hallucinations reported at the baseline interview were predictors of suicide attempts during the follow-up period. Hallucinations and attempted suicide were the most important predictors of suicidal attempts in the follow-up period.

The finding of thought disorder being inversely associated with suicidal thoughts, suicidal plans, and suicide attempt during follow up might suggest that the most disturbed patients were too impaired concerning cognitive function to form suicidal thoughts and suicidal plans, and to conduct an attempted suicide. This is in agreement with the observation of Fenton [Fenton, 2000] that patients with schizophrenia who are most likely to recover or experience a good outcome are those who also have the greatest risk for suicide.

Drake found that predictors of suicide and suicide attempt were different [Drake et al., 1985]. In our study, we found that correlates of suicide attempt and suicidal ideation were different, thus indicating that even though suicidal ideation and suicidal attempts are predictors of later suicide, prediction of suicide remains very complex.

There is a need for the development of special treatment programs focused on suicidal behaviour.

### Conclusion

Hallucinations and suicide attempt before inclusion in the study were the most significant predictors of suicide attempt in the follow-up period.

PAPER VI: THE OPUS TRIAL: A RANDOMISED MULTI-CENTRE TRIAL OF INTEGRATED VERSUS STANDARD TREATMENT FOR 547 FIRST-EPISODE PSYCHOTIC PATIENTS [Petersen et al., 2005]

### Objectives

To evaluate the effects of integrated treatment for first-episode psychotic patients.

### Methods

A randomised clinical trial of 547 first-episode patients with schizophrenia spectrum disorders, comparing integrated treatment and standard treatment. The integrated treatment lasted for two years and consisted of assertive community treatment with programmes for family-involvement and social skills training. A more detailed description of the methods used in integrated treatment is available in an ethnographic study of the integrated treatment and in a handbook written by the staff members in integrated treatment [Larsen, 2002; Nordentoft et al., 2002c]. The differences between the services provided in integrated treatment and standard treatment are presented, and it is evident that frequency of outpatient visits is much higher and families are much more involved in integrated treatment than in standard treatment, and that psychoeducational groups for relatives hardly existed in standard treatment. Standard treatment offered contact with a community mental health centre. Patients were assessed at entry and after one and two years by investigators that were not involved in treatment. The main outcome measures were psychotic and negative symptoms at one-year and two-year follow-up. These were assessed with Schedule for Assessment of Positive Symptoms in Schizophrenia (SAPS) and Schedule for Assessment of Negative Symptoms in Schizophrenia (SANS) [Andreasen and Olsen, 1982]. Suicidal ideation, suicidal behaviour

and depression were also investigated at one- and two-year follow-up.

### Results

At the one-year follow-up psychotic symptoms changed favourably to a mean of 1.09 (SD 1.27) with an estimated mean difference between groups of  $-0.31$  (95% confidence interval  $-0.55$  to  $-0.07$ ,  $P=0.02$ ) in favour of integrated treatment. Negative symptoms changed favourably with an estimated difference between groups of  $-0.36$  (95% confidence interval  $-0.54$  to  $-0.17$ ,  $P<0.001$ ) in favour of integrated treatment. At two year follow-up there was an estimated mean difference between groups in psychotic symptoms of  $-0.32$  (95% confidence interval  $-0.58$  to  $-0.06$ ,  $P=0.02$ ) and in negative symptoms of  $-0.45$  (95% confidence intervals  $-0.67$  to  $-0.22$ ,  $P<0.001$ ) both in favour of integrated treatment. Patients in integrated treatment had significantly less co-morbid substance abuse, better adherence to treatment, and more satisfaction with treatment. There were no differences between treatment group with regard to suicidal ideation, suicide attempts or depression at one-year or two-year follow-up. A graphic presentation of the effect of the integrated treatment on suicidal plans and attempts is shown in Figure 16.

### Discussion

#### Methodological considerations

Sample size was too small to allow suicide as an outcome measure. However as indicated in the flow chart there might be real differences in suicide mortality as only one suicide occurred in integrated treatment, while four definite and one probable suicide (a person who was found drowned, had gone into the sea from the shore) occurred in standard treatment. Information about suicide attempt relied solely on patient's reports. There was skewed attrition, and this might bias the analyses against the integrated treatment.

Disorganized symptoms were evaluated but seldom occurred in both treatment groups, and no significant differences were found at the baseline or follow-up interviews.

#### Clinical implications

Suicide and suicide attempts occurred frequently in the study sample. There is a need to develop interventions with special focus on suicidal behaviour.

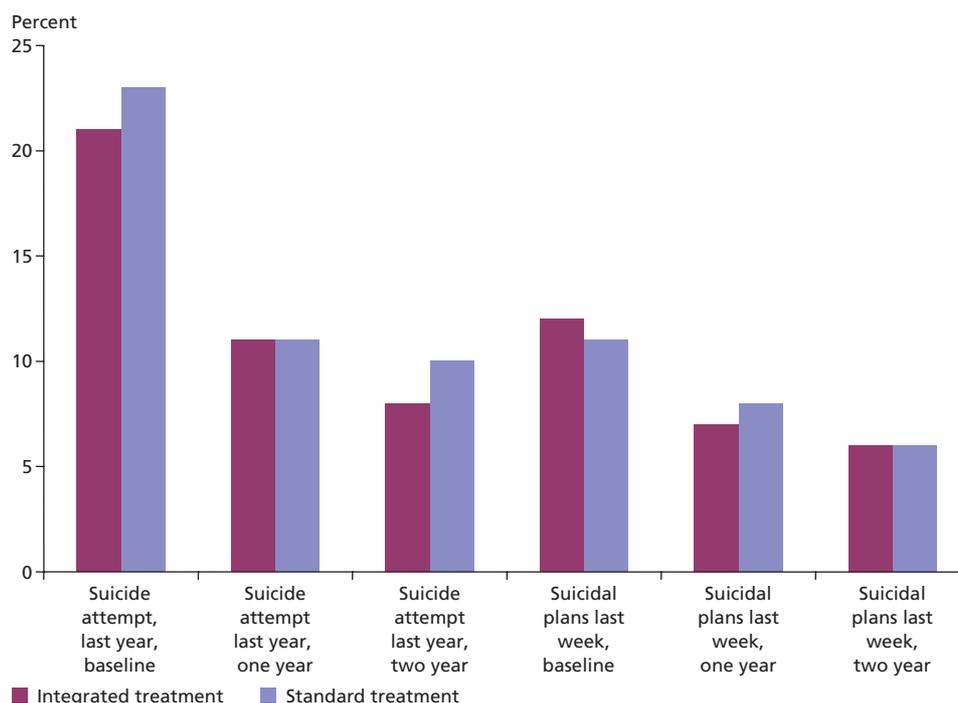


Figure 16. Suicidal plans and attempt at baseline, one-year and two-year follow-up.

## Conclusion

Integrated treatment improved clinical outcome and adherence to treatment. The improvement in clinical outcome was consistent in the one-year and two-year follow-ups. There were no differences between treatment groups with regard to suicidal ideation or behaviour.

## INDICATED PREVENTION, INTRODUCTION TO PAPERS

It is an issue of high priority to prevent suicidal acts among persons with suicidal ideation and to prevent repetition, fatal and non-fatal, among persons who have attempted suicide. In the following, four papers are summarized: One analyse the risk of suicide following attempted suicide; one paper describes the functioning of psychiatric emergency outreach, especially with focus on patients with suicidal ideations or behaviour; one paper analyses whether patients admitted to hospitals in Copenhagen Hospital Corporation are registered correctly in the registers and whether they are offered psychiatric evaluation and actually receive the treatment they have been referred to; and finally one paper describes the functioning and analyses the effect of the Copenhagen Suicide Prevention Clinic.

### PAPER VII: HIGH MORTALITY BY NATURAL AND UNNATURAL CAUSES: A 10-YEAR FOLLOW-UP STUDY OF PATIENTS ADMITTED TO A POISONING TREATMENT CENTRE AFTER SUICIDE ATTEMPTS

[Nordentoft et al., 1993a]

#### Objective

The purpose of the study was to describe mortality by suicide and other causes of death in a group of suicide attempters, and to extract social and diagnostic predictors for suicide and other causes of death in a group of suicide attempters.

#### Methods

All patients aged 15 and over referred to a general hospital with a poisoning treatment centre after deliberate self-poisoning and surviving the attempt (n=974 were followed up after 10 years in Danish Cause of Death Register. Since 1949, the poisoning treatment centre had a centralized function for the greater Copenhagen area (Copenhagen municipality, Frederiksberg municipality and Copenhagen County), and all unconscious self-poisoned patients were referred to the centre. The medical records were retrospectively assessed and information about sociodemographic features, psychiatric diagnosis (including drug abuse) and previous admissions, medication and information about toxicology was extracted and filled in a fixed form. Data were collected in records of all suicide attempters referred to the centre in 1980 [Bjaeldager et al., 1984].

The patients were included in the study from the index admission in 1980 to the end of 1990. Patients who died in the follow-up were followed to the registered date of death. The mean follow-up time was 8.48 years. The cause of death was divided in five groups: natural death, ICD-codes 000-799; accidents, ICD-codes 800-949; suicide, ICD-codes 950-959; homicide, ICD-codes 960-969; uncertain cause of death, ICD-codes 980-989.

Data were analyzed by use of Chi-squares, logrank test, Cox-proportional hazards model, age-specific mortality rates and standard mortality rates. Differences in Standard Mortality Rates were tested with Chi-squares. Standard mortality rates were calculated on basis of official statistics with information about causes of death in different gender and age groups in the total Danish population. The natural causes of death were divided in subgroups and observed/expected ratios were calculated using indirect standardizing methods.

#### Results

In 1980, the Poisoning Treatment Centre at Bispebjerg Hospital in Copenhagen successfully treated 974 patients after suicide attempt.

In a 10-year follow-up study of this patient group it was found that 306 patients had died; among them, 103 committed suicide, 131 died from natural causes, 31 died by accidents, five were murdered and in 36 cases the cause of death was uncertain. Standard Mortality Rate for all causes of death was 550. The cause specific Standard Mortality Rates were for suicide 2960, for natural causes 236, for accidents 1256 and for uncertain causes 5459.

In Cox-regression analysis high-risk factors for later suicide were several previous suicide attempts (relative risk 2.25), living alone (relative risk 2.28) and increasing age (relative risk 1.03 per year). Death by accident was predicted by drug abuse (relative risk 4.41) and more than two previous suicide attempts (relative risk 4.41). Being a pensioner (relative risk 2.05) or having drug abuse (relative risk 11.08) predicted death of uncertain causes. Natural causes of death also occurred more frequently than expected, due to all types of diseases except circulatory diseases. Being a pensioner (relative risk 1.69), having drug abuse (relative risk 2.72), having several previous suicide attempts (relative risk 2.25), being of increasing age (relative risk 1.06 per year) and being male (relative risk 2.49) were predictors of death by natural causes.

Patients fulfilling at least one of the high-risk criteria for later suicide were in a high risk-group, and though the high risk-group significantly differed from the rest of the patient group regarding frequency of suicide, both sensitivity and specificity remain low, 60 per cent and 61 per cent respectively.

## Discussion

### Methodological considerations

Baseline data in this study was extracted retrospectively from all medical records for patients referred to the centralized poisoning treatment centre in Copenhagen. Patients admitted to the poisoning treatment centre had a double affiliation. They were admitted at the medical department, and concomitantly at the psychiatric department. Therefore, all patients with self-poisoning were routinely referred to psychiatric consultation.

In a study of Danish psychiatric inpatients, it was described that drug abuse is often under-recognized [Hansen et al., 2000]. The diagnosis of drug abuse was a strong predictor of outcome, and it is therefore important to consider the validity of this diagnosis in the study. Psychiatrists diagnosed the patients, but the diagnoses were based on case notes from previous admissions and clinical assessment, which might be difficult when the patient has been recently unconscious. Information about toxicology, including blood concentration of alcohol, benzodiazepines and morphinotics, is assumed to be of high quality, as the centre served an expertise function. However, this procedure leaves a possibility for drug abuse to be undetected in some cases. This possible misclassification would most likely lead to an underestimation of mortality associated with drug abuse. The cause-specific Standard Mortality Rate (uncertain cause) was found to be almost 60 times higher than expected and twice as high as the cause-specific Standard Mortality Rate (suicide). Although it is a general assumption, that miscounting suicides is not so large that it would greatly affect the ranking of national suicide rates, it is unsatisfactory that death by uncertain cause of death is common.

In the general population, the suicide rate for men is much higher than for women. Among the patients included in the study, men and women did not have different suicide rates. Female suicide attempters have a more increased suicide rate as compared to male suicide attempters. An explanation for this finding might be that male suicide attempters more often use violent and lethal methods than female suicide attempters do. The group of suicide attempters surviving a suicide attempt might therefore represent a selected group of suicide attempters, namely those who initially chose the less lethal methods. Especially the surviving male suicide attempters might represent a group of male suicide attempters less prone to choose lethal method than the group of all men attempting suicide. This the-

ory is in accordance with the lack of association between male sex and violent method of suicide found in this study.

#### *Clinical implications*

Although high-risk factors can be identified, a high-risk strategy is not suitable for prevention of suicides. Only 8 out of 103 patients who died by suicide were previously diagnosed with from maniodepressive illness, 27 patients were not diagnosed with any mental illness, and 72 patients were not living alone. Although suicide occurred significantly more frequently among repeaters, for 46 of the 103 deaths by suicide, the index attempt was their first suicide attempt. Even when several different risk factors are combined, the sensitivity was found to be no more than 60 per cent, and specificity was 61 percent. A special high-risk group is difficult to identify.

Preventive efforts should be directed towards the whole group, and service directed especially towards this group of patients should be developed.

#### **Conclusion**

The high-risk group comprises the majority of the whole group of suicide attempters, because the risk factors though significant are not very specific. A strategy to prevent suicide after suicide attempts must be directed toward the majority of persons having attempted suicide.

PAPER VIII: PSYCHIATRIC EMERGENCY OUTREACH:  
A REPORT ON THE FIRST TWO YEARS OF FUNCTIONING  
IN COPENHAGEN  
[Nordentoft et al., 2002a]

#### **Objective**

The purpose of the study was to evaluate Psychiatric Emergency Outreach after functioning for a period of two years in Copenhagen, Denmark.

#### **Methods**

The design of the study is a register-based longitudinal study of all patients in contact with Psychiatric Emergency Outreach during the first two-years of its functioning period.

Emergency Outreach was staffed by a psychiatrist and an ambulance driver, and the target group was defined as mentally ill and persons in severe crisis. The target group was defined as mentally ill persons and persons in severe crisis whose problems cannot be solved by calling the general practitioner on duty or by visiting psychiatric emergency room. Psychiatric Emergency Outreach is available between the hours of 17:00 and 8:00 on weekdays and 24 hours a day in weekends and during holidays. Outreach calls are answered by ambulance with a psychiatrist driving out together with an ambulance driver, who is trained fireman. The psychiatric emergency outreach staff received two days of training in self-defence and management of potentially dangerous situations before the start of the service. General practitioners, the police, and the social security service can call Psychiatric Emergency Outreach. A secretary assists the Psychiatric Emergency Outreach during evening hours by finding records and looking the patient up in the case register in Copenhagen Hospital Corporation. The psychiatrist on duty decides whether a call shall result in emergency outreach or telephone consultation. For each of 935 calls covering 777 different patients, a registration form with social and clinically relevant data was filled out. The registration form contains information about the patient's identity, previous psychiatric contact, who called Psychiatric Emergency Outreach, abuse of alcohol, medicine or psychoactive drugs, psychosocial strain, income, civil-status, children, medication, reason for calling, and intervention. If a patient was in contact with Psychiatric Emergency Outreach more than once, registration forms were filled out at each call. Both telephone consultations and out-

reach were included in the investigation. Both in telephone consultations and in emergency outreach, each patient was diagnosed according to ICD 10. In some cases, contact with the patient was brief or the patient was so upset that a psychiatric diagnosis could not be determined. In these cases, the term "unspecified psychiatric disorder" was used. In each case it was evaluated whether the patient had alcohol or psychoactive drug abuse. Three different kinds of drugs was listed separately: alcohol, cannabis or benzodiazepines, street drugs (amphetamine, cocaine, morphinometrics, LSD ecstasy).

For each call, the reason for the call was registered. The reasons were placed into 8 predefined categories. Several reasons could be present at the same time. The level of psychosocial stress was assessed at each call and placed in a six-point scale where one referred to the mildest category and six to the worst possible (see Table 1 [American Psychiatric Association, 1987]).

Each person who had contact with Psychiatric Emergency Outreach by telephone or outreach was, at the end of the two-year experimental period, looked up in the National Person Register to find out whether the person was living or had died or disappeared. If the person had died the cause of death was extracted from the Cause of Death Register at the National Board of Health. Information about use of psychiatric services in Copenhagen Hospital Corporation was extracted from the Danish National Psychiatric Case Register.

Most data were analysed by chi-square test. Standard Mortality Rate (SMR) was calculated for all causes of death and for suicide separately. When calculating SMR, data from Copenhagen Statistical Bureau were the source regarding mortality in the general population in Copenhagen [Statistical Office, 2001].

#### **Results**

A total of 66 percent were previously registered as psychiatric patients, and in 37 percent of all calls, the patient had psychotic symptoms. In 25 percent of the calls, the patient was admitted to psychiatric hospital; 38 percent of the admissions were involuntary. Forty-eight percent of the calls were initiated by relatives, friends, or neighbours. The psychiatrist evaluated that danger to oneself or others occurred in 39 percent of all calls.

The frequency of calls was different in different parts of the city and varied during the two-year observation period from 0.89 per 1000 inhabitants to 2.33 per 1000 inhabitants. Referrals significantly co-variated with the rate of persons in the general population in the district who lived on early age pension or other social services.

Among the 756 patients with a legal personal code, 39 were dead before 1 August 1999. The Standard Mortality Rate (SMR) was 5.00. SMR for men was 6.29 and for women 3.82. The mean observation time was 374 days. SMR (suicide) was for all cases 31.98. For women, SMR (suicide) was 44.84, and for men SMR was 5.26.

#### **Discussion**

##### *Methodological considerations*

The design of the study is a longitudinal study of patients in contact with Psychiatric Emergency Outreach. There is no comparison group, neither a historical nor a parallel comparison group. The nature of the study makes it impossible to identify such a group since the patients included in the study were carefully selected by the general practitioners on duty, the police and the social security services who referred patients with severe mental illness in acute crises whose problems could not be solved by calling the general practitioner on duty or by advising the patients to visit the psychiatric emergency room. Such a sample of patients could not be identified as a comparison group without establishing a special offer for them. It would therefore not be possible to compare psychiatric emergency outreach with a system without this service, but different kinds of services – for instance, with different staffing – could have been developed and provided in different parts of the city. However, this was not feasible when planning the service. Therefore, the evaluation of the study has to rely on the reports of how problems were

solved and on the mortality figures that revealed that all patients who died from suicide or undetermined cause of death shortly after contact with Psychiatric Emergency Services were actually admitted between the time of contact and the time of death. This indicates that during this time period the service was able to identify serious risk of immediate suicide.

Another way of evaluating the service is to look at suicide mortality in Copenhagen before and after the start of the service. Since 1981, there has been a steady decline in suicide rates for both men and women in Copenhagen and Frederiksberg ([www.statistikbanken.dk/statbank5a/default.asp?w=1024](http://www.statistikbanken.dk/statbank5a/default.asp?w=1024)). It is likely that since this was caused by a long range of different factors, it is not possible to determine the role of Emergency Psychiatric Outreach in this time change.

The data in the study was registered by the psychiatrist working in the service during the first two years of its function. The nature of the service implies that the diagnostic procedure was not optimal. The registration forms used in this study were simple and with broad categories.

#### *Clinical implications*

It can be concluded that Psychiatric Emergency Outreach was aware of the risk of suicide and was able to select and admit suicidal patients. In 16 percent of all calls to Psychiatric Emergency Outreach, the reason for calling was that the patient was dangerous to himself or herself. It is therefore likely that a number of potential suicides and suicidal attempts were prevented because of the intervention by Psychiatric Emergency Outreach. If information about suicide attempts and suicide among patients who had been in contact with Psychiatric Emergency Outreach were available on a regular basis, this information could be used to improve the quality of the service.

It is important for the work of Psychiatric Emergency Outreach that it is carried out by specialists in psychiatry. The almost 20 percent involuntary admissions would not have been carried out, if outreach were carried out by a non-specialist without specific knowledge of the rules for involuntary admission. Furthermore, suicidal cases might not have been identified without an expert evaluation.

#### **Conclusion**

It can be concluded that Psychiatric Emergency Outreach can solve some of the problems of the severely mentally ill in the community and that the service described fulfils its purpose. However, the nature of the study does not allow comparison with other ways of improving the acute service for mentally ill and others in acute crisis.

#### PAPER IX: REGISTRATION, PSYCHIATRIC EVALUATION, AND ADHERENCE TO PSYCHIATRIC TREATMENT AFTER SUICIDE ATTEMPT

[Nordentoft and Sogaard, 2005]

#### **Objective**

For persons who are brought to hospital after a suicide attempt, the psychiatric evaluation is planned to play an important role in evaluating and referring patients to treatment [Sundhedsstyrelsen (Danish National Board of Health), 1998c]. The aim of the present study is to evaluate whether patients who were brought to the emergency room or the intensive care unit at general hospitals in Copenhagen were referred to and actually received a psychiatric evaluation, and to which extent they actually received treatment if they were referred to psychiatric treatment in one of the psychiatric services in the Copenhagen Hospital Corporation.

At an early stage in the planning of the study, it was evident that not all cases of suicide attempt were registered as such. Therefore,

the design of the study was changed so that it allowed evaluation of to which extent suicide attempts were registered as such in the official registers.

#### **Methods**

In the Copenhagen Hospital Corporation in four emergency rooms and six intensive care units we investigated all referrals in the period February 1, 2001 to May 1, 2001 with contact code 4 (self-harm) and selected diagnostic codes likely to be used in cases of self-poisoning, strangulation, drowning, wrist-cutting. We wanted to identify contacts with the following ICD 10 action diagnoses: T36-T65.9 (poisoning), T71.9 (strangulation), T75.1 (drowning), T90-T98.3 (complication to poisoning or other external factor), K71.1-K71.9 (toxic hepatic failure), S50-S51.9 and S54-S56.8 (lesions of elbow and lower and upper limb), S60-S61.9 and S64-S66.9 and S69-S69.9 (lesions of wrist and hand). At the Frederiksberg Hospital emergency room, it was not possible to perform an electronic search, because data only existed in a paper version. In this unit, all case records for the study period were read. This procedure resulted in 9,600 case records, of which 317 were identified as suicide attempts. To determine whether an incident was a suicide attempt, the WHO definition of suicide attempt was used [Platt et al., 1992]. For these 317 suicide attempts, we filled out a form with 29 items on the basis of information from case records. Information about social and economic factors, previous suicide attempts, alcohol and drug abuse, psychiatric consultation, and type of treatment recommended was extracted. In 142 cases, a form had been filled out because the patient had been admitted to an intensive care unit, and in 175 cases, the case was identified from the contact to the emergency room. In 95 cases, the same patient had two forms filled out for the same suicide attempt, because he or she was referred from the emergency room to the intensive care unit. In these cases, we only used the form from the intensive care unit in the analyses. This procedure identified 223 separate suicide attempts, 81 for persons who were treated only in the emergency room and not referred to further somatic treatment, and 142 for those who were admitted to intensive care units. A total of 16 were registered with more than one (two to six) suicide attempts during the study period. The number of different persons was therefore only 201.

Using the ten-digit personal identity code (the so-called CPR-number), all 201 persons were looked up in the Central Psychiatric Case Register [Munk-Jorgensen and Mortensen, 1997], and information about type and dates of psychiatric treatment was extracted. It was then investigated whether the person had been admitted to psychiatric department or had contact with outpatient facilities within one week after the suicide attempt. As we only had access to data about contact to psychiatric service in Copenhagen Hospital Corporation, patients with postal address outside the catchment area of Copenhagen Hospital Corporation were excluded from these analyses.

#### **Results**

We found that only 37 percent of the contacts to the emergency room (65 of 175) were correctly coded with Reason for Contact Code 4 in NomESCO's classification of external causes of injuries.

In 95 percent of the suicide attempts treated only in the emergency room, a psychiatric evaluation was arranged either by calling the psychiatrist to the emergency room or by referring the patient to psychiatric emergency. In the intensive care unit, psychiatric evaluation was arranged in 94 percent of the cases. Thus a psychiatric evaluation was planned for almost all patients, but 18 percent of the patients never reached the evaluation that had been planned to take place in psychiatric emergency. Only few patients were not referred to any treatment at all, but among the patients referred to psychiatric treatment, only those admitted involuntarily received treatment in 100 percent of the planned cases. For outpatient treatment in the suicide prevention clinic, the percentage that attended planned

treatment within the first week after the suicide attempt was especially low (57 percent).

## **Discussion**

### *Methodological considerations*

The present quality of coding does not allow the use of Reason for Contact as outcome in studies of repeated intentional self-harm.

The nature of the study does only allow evaluation of to which extent patients referred to hospital after a suicide attempt are evaluated by a psychiatrist, and to which extent patients referred to psychiatric treatment actually follow the treatment. The nature of the study does not allow evaluation of the effect or quality of the psychiatric evaluation or the treatment to which patients are referred. However, as the psychiatric evaluation is an important gateway to further treatment, it is important to determine whether this evaluation actually takes place, and if the psychiatrist's recommendations for treatment are adhered to.

It was decided to set an arbitrary limit of one week after discharge as the maximum time for first contact to follow-up treatment. A more thorough investigation of the data, however, showed that none of the patients who had no contact during the first week had any contact with that specific service later during the following two years, which was the period for which we had data from the Central Psychiatric Case Register.

An evaluation of the quality of the treatment to which the patients are referred is beyond the scope of the present study, but this issue is examined in another study [Nordentoft et al., 2005].

### *Clinical implications*

It had not previously been investigated to which extent patients who attempt suicide are registered with the correct contact code. Only a minority (37 percent) of the suicide attempts identified in this study were correctly coded with Reason for Contact Code 4. It is likely that when coded 4, the Reason for Contact actually reflects that the patient has inflicted self-harm, but it is not possible to conclude that the absence of the contact code 4 implies absence of intentional self-harm.

The present quality of coding does not allow the use of Reason for Contact as outcome in studies of repeated intentional self-harm. This finding makes it necessary to improve the quality of coding Reasons for Contact. If the Reason for Contact Code is correct, the National Patient Registry can become an important data-source in epidemiological studies of suicide attempts. The very low positive predictive value ( $317/9600 = 3.3$  percent) does indicate the procedure used in this study is far too time-demanding to use in other research projects.

Previous reports of referral to psychiatric evaluation have revealed that 20 percent had left the intensive care unit without psychiatric evaluation [Nordentoft et al., 1993b]. In the present study we found that psychiatric evaluation was planned in relation to almost all suicide attempts, but that it must be recommended to pay attention to escorting patients to psychiatric emergency in order to ensure that the patient actually attends the planned consultation. In many cases, attempting suicide also involves that the suicide attempter has made his or hers evaluation of the possibilities for getting help and judged them negatively. Therefore, to motivate patients to make an attempt to get help from psychiatric service might not be an easy task, and many patients may be ambivalent, hesitating, reluctant or even hostile toward psychiatric services. It can therefore be valuable to make an extra effort to make sure that the patient is actually evaluated by a psychiatrist.

Kapur et al. found that persons who did not get a psychosocial evaluation after suicide attempt had a higher risk of repeated suicide attempt during follow-up [Kapur et al., 2002]. In a previous study, Greer and Bagley found the same result [Greer and Bagley, 1971]. However, this finding could be explained by selection, as individuals who left without psychosocial evaluation might constitute a risk

group [Bennewith et al., 2005], or it might indicate that the evaluation was beneficial.

In some other Danish cities, the psychiatric evaluation is carried out by a psychiatrist affiliated with a suicide prevention clinic. This organization might better ensure that patients are evaluated by a psychiatrist with in-depth knowledge about existing treatment facilities for this particular patient group.

We found that patients who were referred after psychiatric evaluation to psychiatric treatment at outpatient facilities only received the planned treatment in approximately two thirds of the cases; therefore, we recommend that outpatient facilities adopt an assertive approach to patients who have attempted suicide.

## **Conclusion**

As hypothesized, we found that not all suicide attempts were registered as such in the National Patient Register – in fact, only 37 percent. It is recommended that patients who have attempted suicide should be approached assertively, and that the supportive and guiding principle be used in securing them treatment.

## PAPER X: EFFECT OF A SUICIDE PREVENTION CENTRE FOR YOUNG PEOPLE WITH SUICIDAL BEHAVIOUR IN COPENHAGEN

[Nordentoft et al., 2005]

### **Objective**

In 1992, a suicide prevention centre was opened in Copenhagen with a two-week programme of social and psychological treatment. The aim of the study was to investigate the referral pattern to the suicide prevention centre and to evaluate the effect of the treatment in the centre on hopelessness, depression, subjective well being, abuse of alcohol and repetition of suicide attempt.

### **Methods**

Patients included in the study were inhabitants in Copenhagen or Frederiksberg) municipality, aged between 16 and 40 years (after 1994, 16-45 years), had severe suicidal thoughts or incidents of attempted suicide and were able to understand and willing to give written informed consent. Patients with psychotic illness or intravenous drug abuse were excluded from the study.

Referred and non-referred patients fulfilling inclusion criteria were compared as a special part of the study. Factors that distinguished those who followed the treatment programme from those who were not referred or who did not follow the treatment programme were identified in a multivariate stepwise backward logistic regression analysis based on Wald test.

In a quasi-experimental study, 362 patients in the suicide prevention centre and a parallel comparison group of 39 patients were interviewed with European Parasuicide Study Interviewer Schedule I (EPSIS I) which is a comprehensive interview including several validated scales.

The 362 patients at the Suicide Prevention Centre were offered a two week 24 hour stay at the centre. The staff consisted of psychologists and social workers. The patients received psychological treatment on a daily basis with a focus on problem solving and coping strategies and individual consultation with a focus on planning the future. The treatment followed principles for cognitive behavioural treatment.

The 39 patients in the comparison group consisted of: (a) 20 patients who were brought to Bispebjerg Hospital after a suicide attempt and who fulfilled inclusion criteria, but were unwilling or unable to accept being treated in the suicide prevention centre as inpatients, and (b) 19 patients aged 18-45 years who fulfilled inclusion criteria and during the period from 1 October 1993 to 1 January 1994 were brought to Frederiksberg Hospital after a suicide attempt. During that period, patients residing in the catchment area of Fred-

eriksberg Hospital could not be referred to the Suicide Prevention Centre. The comparison group received treatment as usual, which could include admission to a psychiatric department, outpatient contact with a Community Mental Health Centre, contact with a general practitioner, individual psychotherapeutic session with a clinical psychologist or no contact with health professionals. None of the patients in the comparison group received cognitive behavioural treatment in groups.

All patients were invited to follow-up interviews with European Parasuicide Study Interviewer Schedule II (EPSIS II) and followed in the National Patients Register and the Cause of Death Register.

Qualitative data were analysed with Pearson's Chi-square and backwards multivariate logistic regression analysis based on Wald test. Continuous outcome measures were analysed with t-test and linear regression. Beta-values were calculated in linear regression analyses of treatment effect and adjusted for age, gender, baseline value of the outcome measure and the variables which were significant in the referral study: school education, diagnosis of stress and adjustment disorder, and planned suicide attempt. Each CAGE-question was categorised with the value one for positive answers and the values of the items were added to CAGE-score. Wilcoxon signed rank test was used for evaluating development of CAGE-score. CAGE-score at follow-up was dichotomised into zero versus other values. For evaluating the treatment effect on CAGE-score, a multivariate logistic regression analysis was performed with adjustment for age, gender, baseline values of the score and the variables that were significant in the referral study.

Cox-regression was used to test differences in mortality between the intervention and comparison groups. The two patients without valid personal codes were omitted from the analyses, and the patients who emigrated were included for the number of years before the date of emigration.

The comparison group consisted of 20 patients who did not accept referral to the suicide prevention centre and 19 patients from a catchment area from which there was no access to the centre. Due to the risk of "refusal bias", the analyses were also carried out with the comparison group split up into "refusal group" and the "no access group".

## Results

**Referral study:** Persons who followed treatment were more likely to have longer school education, to have prepared and planned the suicide attempt, and to be suffering from stress and adjustment disorders.

**Intervention study:** Thirteen persons died before 1 August 2002, eleven from the intervention group and two from the comparison group. During the first year of follow-up, three of the 362 patients in the intervention group committed suicide. Another four died by suicide before 1 August 2002. None of the 39 patients in the comparison group committed suicide during the first year of follow-up, but one died by suicide before 1 August 2002. Cox-regression revealed that the relative risk for death from all causes in the intervention group compared with comparison group was 0.67, C.I. 0.15-3.04 and for death from suicide 0.86, C.I. 0.11-7.03.

At the one-year follow-up, 59 percent of patients in the intervention group and 53 percent of patients in the comparison groups were interviewed with EPSIS II. The intervention group obtained a significantly greater improvement in Beck's Depression Inventory, Hopelessness Scale, Rosenberg Self-Esteem Scale and CAGE-score and a significantly lower repetition rate.

## Discussion

### Methodological considerations

The referral study indicates that the Centre receives a patient group with prominent suicidal ideation who might function better compared with the rest of the target group. Thus the results of the study cannot be generalized to the whole patient group. The positive effect

of treatment found in this study might be most prominent in the younger part of the target group characterised by planned suicide attempt and more often with a diagnosis of stress and adjustment disorder.

The randomised controlled trial is the best design for evaluating the effect of the treatment at the Suicide Prevention Centre. However, when that is not possible, the parallel comparison group is an appropriate solution. The baseline characteristics in the intervention group and the comparison group suggest that they are comparable, except for the intervention group having higher scores in General Health Questionnaire (less subjective well-being) and lower scores in Rosenberg Self-Esteem (lower self-esteem). This is a limitation that biases the study against the intervention group. In the multivariate linear regression analysis of all scales, the baseline value of the scale was included together with the variables that differed in the referred and non-referred group. This procedure adjusts for differences in baseline values of the scale between treatment groups and controls confounding introduced by detectable selection bias in intervention and comparison groups.

It was anticipated that suicide attempts would not always be reported as such to the National Patient Register; therefore, it was decided to investigate also reports of poisoning, wrist cutting and asphyxia. Information about suicide attempts the first year after inclusion in the study was extracted by selecting those with hospital contacts because of self-inflicted self-damage, poisoning (ICD 10 codes DT360- DT600, DT650-DT651, DT653- DT659 and DZ036), wrist cutting (ICD 10 codes DS619, DS640, DS641, DS642, DS649, DS651, DS659, DS660, DS661, DS669) or asphyxia (ICD 10 codes DT710 - DT719). However, it is possible that even though this procedure was used some hospital treated suicide attempts still could have been missed. Not all patients who attempted suicide in the follow-up period were treated in hospital, and for the hospital treated patients the relevant codes were not consequently used. Therefore the finding that 15.4 percent in the comparison group and 5.6 percent in the intervention group had a hospital contact during the first year of follow-up that could be identified as due to a suicide attempt must be interpreted with caution. Even though there were some methodological problems with the completeness of the register data and specificity of the chosen diagnostic codes, the result of the analysis of register data points to the same conclusion as the information obtained with interview, namely that the intervention lowered repetition rate.

Because of the risk of refusal bias, the comparison group was split up into "refusal group" and "no access group", and both suicide attempts appearing in the National Patient Register and reported suicide attempts occurred more often in the "no access group", thus indicating, that the inclusion of the "refusal group" did not introduce a selection bias against the control condition.

### Clinical implications

The core of the treatment presented in this study is problem-solving behavioural therapy; but also access to help from a social worker and non-specific benefits from staying two weeks in a protective environment during the suicidal crisis might be responsible for the improvement.

The study adds to the evidence of a positive effect of psychosocial treatment and problem solving on repetition rate, hopelessness, depression and abuse of alcohol among suicide attempters.

### Conclusion

Although the design cannot exclude selection bias, it seems sound to conclude that the intervention is responsible for a lower repetition rate and a larger improvement in Beck's Depression Inventory, CAGE-score, Rosenberg Self-Esteem Scale and Hopelessness Scale in the intervention group.

## DISCUSSION

### THE DECLINE IN DANISH SUICIDE RATES:

#### SOME POSSIBLE EXPLANATIONS

Even after cautious consideration of the possible influence of reduced autopsy rate and decline in the number of forensic toxicologic analyses, it seems sound to conclude that in recent decades, there have been declining rates of suicide in Denmark in all age groups except for the very young, who have had a stable rate, and the very old, who have had increasing rates. The overall picture is a large decline in suicide. The decline is relatively larger for women.

It is likely that the shift towards drugs with low case fatality used for self-poisoning played an important role in this time change. However, we also know that in 57 percent of all cases women who commit suicide have been admitted to a psychiatric ward sometime earlier in their lives, while only 37 percent of all men who commit suicide were admitted to a psychiatric ward before committing suicide [Qin and Nordentoft, 2005]. Restrictions in availability of lethal methods have played an important role in reducing suicide rates, and switch in method were temporary and did not counterbalance the overall tendency to dramatic fall in numbers of suicides. It is convincing that there is a relationship between reduced availability of methods and reduced suicide, given the significantly larger declines in suicides involving restricted methods than those involving unrestricted ones. However, reduced access to lethal means was not responsible for the whole reduction in suicides, since there has also been some reduction although to a less extent in suicide by means for which there has been no change in availability. "Proposal for a national programme for prevention of suicide and suicide attempt in Denmark" indicated four different areas that could be of importance in explaining the positive time change:

1. Introduction of new antidepressant drugs
2. More focus on suicide prevention and several preventive initiatives
3. Reduced availability of means for suicide and better medical treatment of suicide attempt
4. Better social integration

The papers and the reviews included in this thesis cannot tell us whether or not all the above-mentioned explanations are of importance.

Ad 1) It is not unlikely that the introduction of new antidepressant drugs had a positive influence on the suicide rate after being introduced in the 1990s, and it seems justified to conclude that they replaced to some extent the more dangerous tricyclic antidepressants [Nordentoft et al., 2006]. The association between rising sales figures for new antidepressant drugs and reduced suicide rates coincided with other changes in society. The meta-analyses of randomised clinical trials, comparing SSRI and placebo were inconclusive with regard to the effect on suicide rate and did not indicate any protective effect against suicide attempts. The results of individual-based naturalistic studies and ecologic studies suggest that use of SSRI might reduce suicide rates.

Ad 2) Increased focus on suicide prevention and preventive centres has not been evaluated in Denmark. The study of the Copenhagen Suicide Prevention Centre [Nordentoft et al., 2005] was only designed to examine effects on repetition rate among the patients treated at the centre compared to a control group, and therefore cannot provide answers to whether establishing the suicide prevention centre reduced suicide rates. The impact of other Danish suicide centres was not evaluated at all. The decline in suicide rate coincided with the establishment of suicide prevention centres in several large cities in Denmark.

Ad 3) On the basis of the study of time changes in availability of means for suicide [Nordentoft et al., 2006], it seems justified to conclude that restrictions in availability of barbiturates and the reduction of number of households with domestic gas with carbon mon-

oxide had a positive influence on the national suicide rate in Denmark, especially for women. Concomitantly with the changes in availability of means for suicide, improved medical treatment for self-poisoning has been consistently implemented in Denmark. This has especially influenced the case fatality rate for self-poisoning with paracetamol.

Ad 4) None of the studies in the thesis examined the effects of time changes in social integration. It is possible that increased social integration was partly responsible for reduction in suicide rates in Denmark. Investigations of changes in social integration in Denmark indicate that during the period 1981-1999, Danes placed increasing value on being a family [Gundelach, 2002]. Examples of other factors that could mirror the social integration in the society are unemployment rate and immigration. These factors were not analysed in the thesis.

The declining rates of suicide in Denmark occur concomitantly with a decline in rates in all Western European countries, but Denmark was the country with the most pronounced decline [Rihmer, 2004]. The declining rates can express changes within different groups, and a positive national time trend does not always reflect a positive development due to changes at the universal prevention level. The time trend can also be explained by changes at the selected or indicated prevention level. The national rates represent the combined result of changes at all three levels.

#### PRINCIPLES FOR INTERVENTIONS

##### IN DIFFERENT RISK GROUPS

Interventions targeted the three different intervention levels must reflect the suicide risk for persons at the different levels. The total population addressed at the universal preventive level can have a higher suicide risk compared with other countries, but compared to risk groups embraced by the selective prevention and the indicated prevention, the risk of suicide is lower. Therefore, interventions will have to be acceptable for the total population. This means that only interventions that do not interfere too deeply in individuals' daily life or wellbeing can be accepted. Seat belts, immunization and prohibition of the sale of soft drinks in schools are examples of interventions of that kind, whereas medication with severe side effects is unacceptable in the total population if only small groups are likely to benefit. Restriction in packet-size of weak analgesics could be another example of an intervention with only small and maybe even beneficial influence on the total population. Among patients admitted to psychiatric ward because of immediate risk of suicide, more radical interventions can be acceptable, such as detainment, personal guard, and removal of personal belongings such as belts, laces, and knives that could be used for suicide attempt. Medication with side effects and ECT can be accepted to hinder suicide in risk groups as part of the intervention at the selective level.

The groups targeted by the selective preventive level are only a minority in Danish society, but still they account for several hundred thousand individuals. The selective level includes all psychiatric patients, treated and untreated persons with alcohol or drug abuse, all who previously attempted suicide, all who have a newly diagnosed severe physical disorder, and groups of homeless, institutionalized, prisoners and other socially excluded persons. The increased risk of suicide ranges from an approximately relative risk of two in groups of patients with newly diagnosed cancer to a relative risk of more than 100 for patients in almost all diagnostic categories who have been discharged from psychiatric departments within seven days.

The size of the patient group at the indicated level is somewhat smaller but might include up to 50,000 persons; a large proportion of these persons are also included at the selective level.

Population attributable risk (PAR) for psychiatric patients expresses how large a proportion of all suicides in Denmark could be avoided if the suicide risk among psychiatric patients could be reduced to the same level as among the never admitted. The formula for calculating PAR is [Armitage and Berry, 1987]:

$$PAR = \frac{\text{proportion of the population with the risk factor (relative risk - 1)}}{1 + \text{proportion of the population with the risk factor (relative risk - 1)}}$$

Our knowledge of the size of the groups included at the different levels indicates that the group of psychiatric patients and the group of persons who attempted suicide recently are the two most important risk groups with regard to PAR. Both groups are large and have high relative risk of suicide, and these two facts together imply a large PAR. For psychiatric patients, the PAR is well-known in Denmark. It is 53 percent for women and 33 percent for men [Qin and Nordentoft, 2005]. The PAR is unknown for the group of persons who have recently attempted suicide, but it must be anticipated that this is also a high figure.

#### GENDER DIFFERENCES

As in other areas of medicine and social science, gender differences in suicidal behaviour can be used as an ideal window through which to look at the interplay of biological and psychosocial factors [Riecher-Rossler and Hafner, 2000].

Gender differences in suicide rates are to some extent explained by different case fatality in methods used by men and women. That case fatality is important does not mean that help seeking is not important. In Figure 11, it is possible that  $X_3$  (help-seeking women, not committing a suicidal act) are much larger than the corresponding  $Y_3$  (help-seeking men, not committing a suicidal act), which would explain the fact that 57 percent of women who die from suicide have a lifetime history of psychiatric admission and only 37 percent of men. The relative risk associated with psychiatric admissions is much larger for women than men. The overall effect of history of psychiatric admission on suicide differed significantly by sex; it increased the risk significantly more for women than for men [Qin and Nordentoft, 2005]. This finding could be explained if there were increased suicide risk for those diseases that more often affect women, which is true to some extent, since women are more often diagnosed with affective disorder. The finding could also be explained by other factors than that treated psychiatric disorder plays an important role in increasing the risk for suicide – for example by the fact that men are more susceptible than women to such untreated psychiatric conditions as alcohol and drug abuse and factors associated with the labour market (unemployment, sick leave, early age pension) [Qin et al., 2003]. The figures indicate that to reduce suicide rate among men (besides restrictions in availability of dangerous means), it is also important to invite and encourage men with suicidal impulses to get into contact with treatment facilities, and to develop programmes that can attract men with suicidal impulses and effectively reduce their risk of suicide.

#### CLINICAL IMPLICATIONS AND IMPLICATIONS FOR RESEARCH

Suicide represents an important public health problem, and suicide prevention and research must be given high priority.

##### **Reliability and validity of official registration of suicide and suicide attempt**

The Danish registers represent an invaluable source of data of importance in many fields, including suicide research, and give Denmark a special position with regard to being able to unravel complicated associations. Because of the unique registers in the Scandinavian countries, a range of studies within the field of suicide research can only be conducted in these countries.

An important priority with regard to the register-based research is to make sure that data in the registers are valid and updated. It is therefore important that the Cause of Death Register is updated, that classification of manner of death is based on high-quality investigation and that also more detailed information with regard to cause of death is valid and that classification of different types of self-poisoning is based on chemical forensic analyses, when necessary.

An effort should be made to make sure that the National Patient Register becomes valid with regard to registration of suicide attempts leading to hospital contacts [Nordentoft and Søgaard, 2005]. The Register for Suicide Attempt (Center for Selvmordsforskning) contains complete registrations of suicide attempts in the county of Funen. The National Patient Register should serve the same function for the whole country, but the proportion of suicide attempts that are registered is too low to allow that the register can be used for monitoring the number of suicide attempts in Denmark.

##### **The universal preventive level:**

##### **Clinical implications and implications for research**

On the universal level, it is important to reduce factors in society that are likely to produce the individual experience of desperation. However, this kind of intervention lies beyond the scope of this thesis and also lies outside the scope of most national suicide preventive strategies. However, the naturalistic experiments in Greenland and in the former Eastern European countries indicate that societal changes might have great influence on suicide rates. It is a very difficult task to unravel to which extent the changing rates are results of changed social roles and norms, changed registration procedures, change in access to alcohol, change in access to health care, or to lethal methods for suicide. However, it seems convincing that changes in social roles are of importance [Mäkinen, 1997], and that change in registration procedures and in access to lethal methods for suicide cannot explain the rapid shifting suicide rates (see Figure 9).

The relationship between suicide and a range of social factors such as unemployment, divorce, immigration, adoption, childhood upbringing, and crime need to be further analysed, and linkage studies of the Danish and Swedish nationwide population-based registers give excellent possibilities for this.

The epidemiological overview of time changes in suicide rate in different age and sex groups indicates that especially among the elderly there has not been the same positive development as in other groups. This may be because the elderly choose more fatal methods, or it may be because the elderly are not an important part of the risk groups addressed at the selective or indicated level. There is a special need for suicide prevention and research among the elderly.

The gender differences in suicidal behaviour indicate that help-seeking and choice of methods are both of importance. Also studies of suicides among doctors indicate that access and knowledge about dangerous means for suicide can be determining factors.

The review of availability of suicide methods with high case fatality indicates that there should be restrictions in access to dangerous methods such as guns, carbon monoxide and barbiturates. In a worldwide perspective, the concept of reducing access to lethal means for suicide can have paramount effect. As stated by World Health Organization, pesticide ingestion is the most common method for suicide on a worldwide basis with at least 300,000 suicides each year [Bertolote et al., 2006]. Efforts are being made to replace high case fatality pesticides with pesticides with lower case fatality and to secure safe storage and easy access to qualified medical treatment [Eddleston et al., 2002; Gunnell and Eddleston, 2003; Konradsen et al., 2003].

In Denmark, access to a range of the most of the dangerous compounds is restricted, but still it is possible that restricted access to guns and securing psychiatric wards against jumping, hanging and suffocation would have beneficial effects. Restrictions in packet-size of weak analgesics should be implemented. These compounds have become the most popular drugs for attempted suicide and restrictions in packet-size are therefore justified, even though the compounds are associated with a low fatality rate.

Our own study and the majority of other studies concerning restricted availability do not support the substitution theory. However, it is equally important to avoid introduction and marketing of new suicide methods with high case fatality. It is likely that knowledge about the fatality of a specific method can increase the use of

this method; therefore, it seems justified to prevent specific manuals for suicide from being published. On the other hand, it is not likely that the dangerousness of specific methods can be kept secret from the public.

The time changes in use of methods for suicide should be followed, and in order to be able to direct preventive measures more directly towards special groups, the method-specific suicide rate should be investigated for specific risk groups.

#### ***The selective preventive level:***

##### ***Clinical implications and implications for research***

It can be argued that the preventive focus in the USI model does not invite unravelling the causes of suicidal behaviour in risk groups, for instance, by identifying the genes that predispose to schizophrenia and affective disorders. However, prevention at the selective preventive level includes interventions that aim to prevent and treat the underlying condition in the involved risk groups and interventions with the specific target of reducing risk of suicidal behaviour. There is a need to continue to identify causes and pathogenesis of the diseases underlying suicidal behaviour in most risk groups. Within the social sciences, interventions likely to reduce social risk factors, such as homelessness, must be further explored [Tsemberis and Eisenberg, 2000].

Together with psychological autopsy studies from various countries, the Nordic register studies have highlighted how important it is for suicide prevention to give high priority to treatment of psychiatric disorders. With skilled use of analytical epidemiology, the Danish registers can be very helpful in identifying and estimating size and importance of risk groups, risk factors and protective factors, and in planning future interventions. However, the Danish Psychiatric Case Register does not include clinical data, and therefore the predictive value of clinical manifestations will have to be highlighted in studies involving clinical assessment of the patients [Haw et al., 2005; Hawton et al., 2005; Nordentoft et al., 2002b].

There are several high risk groups for suicide. Mental illness constitutes a very important risk factor, and affective disorder is the single disease entity with most suicides, closely followed by schizophrenia and substance abuse. The Standard Mortality Rates are increased for all mental illnesses to 20–40.

Other risk factors are old age, single status, unemployment, recent loss, somatic illness, and as shown in this thesis, marginalized homeless persons. The thesis has focused on suicide among patients with schizophrenia and among homeless persons.

The review of risk factors for suicide in schizophrenia indicated that the most important risk factors were: male gender, young age, short duration of illness, many admissions during last year, current inpatient, short time since discharge, co-morbid depression, previous suicide attempt, drug abuse, poor compliance with medication, poor adherence to treatment, high IQ, and suicidal ideations.

A review of risk factors for suicide attempt in schizophrenia identified past or recent suicidal ideation, previous deliberate self-harm, past depressive episode, drug abuse or dependence, and higher mean number of psychiatric admissions as predictors [Haw et al., 2005]. Our own study revealed that female gender, previous suicide attempt, hallucinations and hopelessness were predictors of suicide attempt during a one-year follow-up period.

Risk factors for suicide during psychiatric inpatient stay and after discharge have not yet been investigated in different diagnostic groups in Denmark. This should be done, using the possibilities for including socioeconomic risk factors from registers. The Danish Psychiatric Case Register contains data about outpatient treatment, but so far this information has not been included in the analyses of the association pattern between service use and suicide. This information must be used in the future.

The possibility of reversed causality must be considered in observational studies. An example of the confusion of cause and effect is that two of the studies in this thesis have shown that the persons

who spend short time in institutions have a higher risk of suicide than those who spend longer time [Qin and Nordentoft, 2005; Nordentoft and Wandall-Holm, 2003]. However, at least for the psychiatric patients, we also have data showing that the suicide risk was reduced for patients with affective disorders and schizophrenia and related disorders concomitantly with a reduction in psychiatric beds and reduction in the length of psychiatric hospitalization [Nordentoft et al., 2004] and (Eyd Høyer Hansen (personal communication, manuscript in preparation)). This makes it unlikely that there is a purely causal link between long length of hospitalization and increased suicide risk. It can be hypothesized that compliance with medication and planning of post-discharge follow-up can be improved in a longer hospitalization, but it is also very likely that short hospitalization is a proxy for factors in the person that are associated with higher risk of suicide. There is a risk of identifying a group of “healthy compliers” [Brodersen et al., 2000] and interchanging the effect of the treatment with the effect of the personal characteristics of the selected group of patients complying with treatment. Analyses should at least be corrected for sociodemographic risk factors, comorbidity, time since first hospitalization and other factors known to increase or reduce risk of suicide. It can be hypothesized that taking vitamin pills regularly is also associated with reduced risk of suicide. To be sure that there is a real effect of any kind of treatment, randomised clinical trials should be carried out.

To increase the basis of knowledge on which clinical practice is planned, there is a need for randomised clinical trials evaluating specific programmes aimed at reducing suicidal behaviour in risk groups. In designing such trials, it is necessary to be aware that the number of patients involved in the OPUS trial was too small to evaluate the risk of suicide [Nordentoft et al., 2002b; Petersen et al., 2005]. A large number of trial participants is necessary if suicide is chosen as outcome measure and even in trials investigating interventions aimed at reducing suicide attempts. It is always important through systematic reviews to secure updating of the evidence about psychosocial and pharmacological interventions likely to reduce risk of suicide in certain patient groups. At present, however, there are too few randomised trials concerning psychosocial interventions to necessitate a review.

Our study of high-risk situations indicates that increased attention should be paid to the periods immediately after admission and shortly after discharge [Nordentoft et al., 2004; Qin and Nordentoft, 2005]. The risk is especially increased for patients who have just come into contact with psychiatric services for the first time [Nordentoft et al., 2004]. Interventions should be targeted towards patients who have just come into contact with psychiatric services, and quality assurance projects should ensure that risk of suicide is skillfully evaluated shortly after admission and before discharge, and that outpatient treatment starts within one week after discharge. Risk factors for suicide should be evaluated at admission and discharge, and in cases where there is indication of increased risk, the clinical condition of the patient should be monitored closely. It is a common experience in medicine that assessments are very rarely subjected to randomised trials, and recommendations concerning diagnostic tests will often have to rely on a weaker level of evidence than treatment [Sekretariatet for referenceprogrammer, 2004]. Therefore, observational studies rather than randomised trials form the basis for recommending assessment of such risk factors for suicide as previous and present suicidal behaviour and ideation. There is a low base rate of suicide, and this implies that even in high risk groups the most likely outcome at a given time is that the patient survived or died from something rather than suicide. In this respect, suicide prevention resembles prevention of terror attacks, where it has been judged necessary to investigate many people who are not at that moment about to carry out a dangerous act.

It can be argued that the finding that suicide risk is elevated during inpatient stay indicates that the psychiatric services are able to identify which high-risk group should be carefully monitored.

However, this situation is not satisfactory and much more can be done to make sure suicide risk during inpatient stay is not overlooked. It must be welcomed that the Danish National Board of Health has recently published a report recommending that all psychiatric departments should carefully evaluate how to reduce the possibilities for hanging and suffocation in psychiatric wards [Sundhedsstyrelsen (Danish National Board of Health), 2006]. Approximately one-fourth of suicides among psychiatric patients in Denmark are committed during admission or during the first week after discharge.

Among patients with a diagnosis within the schizophrenia spectrum, time changes in the suicide rate have been positive during recent decades. Until now, analyses of time changes in risk of suicide in other risk groups in Denmark have not been published [Qin et al., 2006].

With regard to the possible effect of SSRI on suicidal ideation and behaviour, it seems likely that prescription of SSRIs are not associated with alarmingly increased suicide risk, but it is a cause for concern that two meta-analyses with a large number of participants reach the same conclusion, namely that a risk exists that SSRI can increase suicide attempts in adults [Fergusson et al., 2005; Gunnell et al., 2005b]. The relation between treatment with SSRI and suicidal behaviour and ideation needs to be further explored.

### ***The indicated preventive level:***

#### ***Clinical implications and implications for research***

Prevention of suicide at the indicated level aims to prevent persons with suicidal ideation from committing a suicidal act, to secure the immediate survival of persons who attempt suicide, and to prevent persons who attempted suicide from subsequently committing another fatal or non-fatal suicidal act.

The review of follow-up studies of hospital-treated persons, who attempted suicide, showed that there is a high risk of repeated fatal and non-fatal suicidal behaviour. The risk factors for suicide were male gender, increasing age, alcohol and substance abuse, somatic disease, mental illness, ongoing or previous psychiatric treatment, previous suicide attempt, high suicidal intent score, violent suicide attempt or suicide attempt with severe lethality. In our own study, we identified living alone, increasing age and previous suicide attempt as risk factors for suicide.

Risk factors for repeated non-fatal suicide act were previous suicide attempt, alcohol and drug abuse, depression, schizophrenia, previous inpatient treatment, sociopathy, unemployment, frequent change of address, hostility, hopelessness, living alone, low social class or unemployment, self-discharge before evaluation. Conflicting results were found with regard to whether suicidal intention predicted repetition.

The risk factors for repeated fatal and non-fatal acts are only partially overlapping, and this fact indicates that target groups are slightly different and that there are some differences in the preventive measures necessary for prevention of repeated attempt and completed suicide.

As pointed out in the "Proposal for a national programme for prevention of suicide and suicide attempt in Denmark" [Sundhedsstyrelsen (Danish National Board of Health), 1998c]: Suicidal persons are to be identified and irrespective of possible mental illness, abuse, age, gender and ethnic background offered relevant treatment. In other fields of Danish health care, the concept "treatment guarantee" has been implemented, and this concept should also be used in suicide prevention.

In the action plan it was stated: Suicidal persons should be quickly and correctly assessed by the necessary professional expertise. Establishing aid for suicidal persons should be according to a guiding principle so that the suicidal person is not left on his/her own before other relevant support is started. These recommendations are very central in the Danish action plan but they are still not implemented systematically, although our data indicates that in Copenhagen Hos-

pital Corporation, the assessment is most often carried out by a psychiatrist [Nordentoft and Sogaard, 2005].

Quality assurance programmes should be implemented to assure that the interventions decided upon actually take place. The study by Nordentoft and Sogaard [Nordentoft and Sogaard, 2005] is an example of how such quality assurance can be conducted. The study gives support to one of Hawton's conclusions in the Cochrane review of interventions after suicide attempt [Hawton et al., 1999], namely that an assertive approach can be necessary to ensure that the planned interventions are actually carried out. It does not seem feasible to make very great demands on the patient's motivation before engagement in treatment.

The study of the Copenhagen Suicide Preventive Centre indicates that a specific intervention with focus on problem solving might reduce the risk of repeated suicide attempt. The weakness of this study is its quasi-experimental design however, and therefore there is still a need for randomised clinical trials of interventions likely to reduce suicidal behaviour among suicide attempters. The results of the study are in concert with the meta-analysis of psychosocial interventions [Hawton et al., 1999] and a recent randomised clinical trial [Brown et al., 2005].

Help lines, interventions like psychiatric emergency and other crisis interventions can intervene in the suicidal process before the suicidal act, but the effect of such services are not evaluated in clinical trials. The study of psychiatric emergency outreach seems to indicate that immediate suicide risk can be reduced by establishing such interventions [Nordentoft et al., 2002a].

When the Copenhagen Centre for Suicide Prevention was established, it was discussed whether a randomised trial could be carried out. At that time, it was considered unethical. Such a consideration must be contrasted with the fact that suicide prevention centres are few in Denmark, and that the Copenhagen centre was closed recently.

Research that can guide interventions on the indicated preventive level are first of all randomised controlled trials. If there are no strong randomised clinical trials to provide evidence about effectiveness of treatment, it is not possible to plan effective treatment for this high-risk group. There is an pressing need for a large randomised trial examining the effect of some of the most promising interventions, and an assertive approach in combination with cognitive-behavioural-therapy seems most promising.

Quasi-experimental designs can be used when randomisation is not possible, but even with careful selection of the comparison group, there is a risk that the intervention group would have a better or worse prognosis than the comparison group due to factors not related to the treatment [Nordentoft et al., 2005].

There are numerous small projects that evaluate the risk of suicide after suicide attempt, and the outcome of these is very dependent on the setting and the sample. There is no reason for repeating predictor analyses in another selected sample. There is a need for splitting the analyses in first-ever attempters and repeaters. Small projects should not be carried out unless the purpose is to investigate variables that have not been studied in previous research. Nationwide register-based follow-up studies of patients who were admitted because of poisoning with antidepressants and weak analgesics can give information about risk factor for and timing of subsequent suicide in a large sample.

### **SUMMARY AND OVERALL CONCLUSION**

The suicide rates in Denmark have been declining during the last two decades. The decline was relatively larger among women than among men. All age groups experienced a decline except the very young with stable rates and the very old with increasing rates.

The Universal, Selective, Indicated (USI) model recommended by Institute of Medicine was used as a framework for the thesis. Universal preventive interventions are directed toward the entire population; selective interventions are directed toward individuals who are

at greater risk for suicidal behaviour; and indicated preventions are targeted at individuals who have already begun self-destructive behaviour.

At the universal level, a review was carried out to highlight the association between availability of methods for suicide and suicide rate. There were mostly studies of firearms, and the conclusion of the review was that there was clear indication of restricted access to lethal means was associated with decline in suicide with that specific method, and in many cases also with overall suicide mortality. Restricting access is especially important for methods with high case fatality rate. Our own study indicated a beneficial effect on suicide rates of restrictions in access to barbiturates, dextropropoxyphen, domestic gas and car exhaust with high content of carbon monoxide. Although a range of other factors in the society might also be of importance, it was concluded that restrictions in access to dangerous means for suicide were likely to play an important role in reducing suicide rates in Denmark, especially for women.

At the selective level, there are several important risk groups such as psychiatric patients, persons with alcohol and drug abuse, persons with newly diagnosed severe physical illness, all who previously attempted suicide, and groups of homeless, institutionalized, prisoners and other socially excluded persons. The thesis focused on homeless persons and psychiatric patients, especially patients with schizophrenia and related disorders.

The thesis contains a review of the risk of suicide in homeless. In all the studies included, increased suicide mortality was found, and in the studies that evaluated suicide risk in different age groups, the excess suicide mortality was most dominant in younger age groups. Our own study revealed an increased risk of suicide, and in univariate analysis, significant predictors for suicide were found to be associated with shortest stay in hostel less than 11 days and more than one stay during one year.

The thesis also contains a review of the risk of suicide in first-episode patients with schizophrenia, and it was concluded on the basis of the identified studies that long-term risk of suicide was not 10 percent as previously accepted, but lower. Risk factors for suicide among patients with schizophrenia were evaluated in case control studies, in nested case control studies, and in prospective studies. The following risk factors were the most important and frequently observed predictors: male gender, young age, short duration of illness, many admissions during last year, current inpatient, short time since discharge, previous and recent suicide attempt, co-morbid depression, drug abuse, poor compliance with medication, poor adherence to treatment, high IQ, and suicidal ideations. The results of analyses of psychotic symptoms as risk factor for suicide were contradictory, but a recent meta-analysis concluded that both hallucinations and delusions seemed to be protective; however, there was a non-significant tendency that command hallucinations were associated with higher suicide risk.

Prevention of suicide in schizophrenia must especially focus on improving assessment of risk of suicide during inpatient treatment and the first week after discharge, and special attention must be paid to patients with one or more of the identified risk factors.

There is a need for large randomised clinical trials evaluating the effect on suicide and suicide attempt of psychosocial and pharmacological treatment in schizophrenia. In our own study, we did not find any effect of integrated treatment on attempted suicide, but there was an effect on hopelessness and a trend toward lower prevalence of depression among patients in the integrated treatment. There were four suicides and one probable suicide (drowning) in standard treatment and one suicide in integrated treatment at two-year follow-up, but the study did not have sufficient power to detect these differences in proportion to who committed suicide; more than one thousand patients should have been in each treatment condition in order for these differences in proportion to be significant.

At the indicated prevention level, a literature review was carried

out regarding risk of suicide attempt and suicide in short-term, medium-term and long-term follow-up of persons who attempted suicide. It was concluded that the risk of repetition in short- and medium-term follow-up studies was approximately 16 percent, with lower risk among "first-ers" compared to repeaters. There was a large variation in repetition rate. The proportion who committed suicide in medium-term follow-up studies was 2.8 percent and in long-term follow-up studies was 3.5 percent (weighted mean) with clearly higher proportions in the Nordic studies than in the studies from UK. Risk factors for attempted suicide were previous suicide attempt, alcohol and drug abuse, depression, schizophrenia, previous inpatient treatment, self-discharge before evaluation, socio-pathology, unemployment, frequent change of address, hostility, and living alone. Several of the predictors are overlapping and most of them were already identified in early studies of factors predictive of repetition of suicide attempt. Predictors of suicide were male gender, increasing age, previous suicide attempt, serious suicide attempt, alcohol and substance abuse, somatic disease, mental illness, and planning of suicide attempt, high suicidal intent score, violent suicide attempt or suicide attempt with severe lethality, and ongoing or previous psychiatric treatment.

In our follow-up study from Bispebjerg Hospital, we found that the risk of suicide during a ten-year follow-up period among patients admitted in 1980 after self-poisoning was 30 times greater than in the general population. We also found increased mortality by all other causes of death. Predictors of suicide were several previous suicide attempts, living alone and increasing age.

There are not many randomised clinical trials of psychosocial interventions aiming to reduce risk of repetition among suicide attempters. A Cochrane review concluded that evidence was lacking to indicate the most effective forms of treatment for deliberate self-harm patients. A recent randomised controlled trial showed a positive influence of cognitive behavioural therapy on repetition rate. Our own quasi-experimental study of effectiveness of two weeks' inpatient treatment in a special unit of young persons who had severe suicidal thoughts or who had attempted suicide showed that risk of repetition was reduced in the intervention group, and that the intervention group obtained a significantly greater improvement in Beck's Depression Inventory, Hopelessness Scale, Rosenberg Self-Esteem Scale and CAGE-score.

The study of emergency outreach indicates that there are many persons in the community that experience a suicidal crisis, and that this group is an important target group for psychiatric emergency outreach.

In our study of registration and referral practice in Copenhagen Hospital Cooperation, we conclude that not all suicide attempts were registered as such in the National Patient Register – in fact, only 37 percent. It must be concluded that the quality of the Danish Patient Register must be improved with regard to registration of suicide attempt. We found that psychiatric evaluation was planned in relation to almost all suicide attempts, but that it must be recommended to pay attention to escorting patients to psychiatric emergency in order to ensure that the patient actually attends the planned consultation. We found that patients who were referred after psychiatric evaluation to psychiatric treatment at outpatient facilities only received the planned treatment in approximately two-thirds of the cases; therefore, like Hawton et al. [Hawton et al., 1998; Hawton et al., 1999], we recommend that outpatient facilities adopt an assertive approach to patients who have attempted suicide.

Danish suicide research is strong, primarily due to the possibilities for linking complete national registers providing detailed data and large sample sizes for suicide research, which is so far unique for the Nordic countries. This, combined with skilful use of epidemiological methods, had resulted in a remarkable series of papers highlighting risk of suicide in different risk groups, risk factors and protective factors. This activity must continue. In this work it is important to be aware of limitations in naturalistic studies such as the

risk of interchanging cause and effect and the necessity to carry out control for confounders.

Meta-analysis is a strong tool for summing up results of previous research. Meta-analyses can be used in reporting the evidence for effectiveness of interventions, but also for determining risk or identifying risk factors. A meta-analysis of risk factors of repetition of suicide attempt has not been carried out, and the quality of the identified studies did not allow a formal meta-analysis.

Large randomised clinical trials examining the effectiveness of interventions on reducing rate of suicide attempt and suicide should have high priority.

Suicide is a major public health problem and should be given high priority with regard to prevention and research.

The "Proposal for a National Programme for Prevention of Suicide and Suicide Attempt in Denmark" contained many recommendations, the most important are:

- Restriction in access to lethal methods for suicide.
- Suicidal persons are to be identified and irrespective of possible mental illness, abuse, age, gender and ethnic background offered relevant treatment.
- Increased knowledge of risk factors and groups at risk with a view to reinforcing the effort towards groups at risk.
- National registration of suicide attempts.

These recommendations are very central in the Danish action plan but they are still not implemented systematically.

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