Trends in Suicidality in Eastern Finland, 1988-1997

Doctoral dissertation

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Abstract

This study is based on local data derived from the region of the province of Kuopio, Finland. The work includes a follow-up study of general population in the area during 1998-1999 concerning suicidal ideation (Study I) and a retrospective study of suicide mortality in the province of Kuopio from 1988 to 1997 (Studies II-IV).

The specific aim was to investigate the incidence, prevalence, persistence of and recovery from suicidal ideation and associated factors. In addition, the aim was to investigate suicide mortality from specific viewpoints. The study included an investigation of male suicide victims (urban-rural differences in male suicide mortality) and a comparison study concerning both men and women (gender-related changes in suicide rates and methods). Later, the study included an investigation of female suicide victims (the associations between mean alcohol consumption and female suicide mortality with special reference to the manifestation of female suicides in relation to alcohol use).

The study of a sample of the Finnish general population was part of a depression study project of the Department of Psychiatry at the Kuopio University Hospital. The retrospective suicide mortality study was based on the medico-legal autopsy records of the Department of Social Affairs and Health (Provincial State Office of Eastern Finland, Kuopio). Data for the studies were derived from the province of Kuopio in the Eastern Finland.

Suicidal ideation was common in the Finnish general population of the study area and suicidal ideation tended to be persistent. Male suicide mortality displayed marked urban-rural differences. The overall male suicide mortality was generally lower in urban than in rural regions. In urban regions, the decline of age-specific suicide mortality was apparent among young and old male victims and was also seen in the group of victims aged 35-64 years. No corresponding decline was seen in the rural region. Violent suicide mortality in men was higher in rural than in urban regions. Gender-related differences in suicide mortality diminished. The difference of mean ages between male and female suicide victims decreased. Also the difference between genders in relation to chosen suicide method diminished during the study period, which was mostly due to changes among male victims. The proportion of self-poisoning suicides increased among male victims and at the same time, there was a downward trend in suicides by hanging as well as using firearms or explosives in this group. Female suicide victims under the influence of alcohol at death were younger than sober victims. The blood alcohol concentration of female suicide victims had a rising trend but it had no effect on the violence of the suicide method.

Violence and lethality of chosen suicide methods among male suicide victims showed declining trends. This may increase the number of suicide survivors in the future and thus provide possibilities for preventive interventions. However, major attention of general health care practitioners should be paid earlier to the signs of suicidal behavior in persons living in difficult life situations especially in less densely populated living areas with severe current risk factors. Changes in female alcohol consumption and its relationship to suicide mortality should not be ignored in suicide prevention efforts.

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Medical Subject Headings: suicide; suicide/prevention & control; suicide/trends; risk factors; prevalence; follow-up studies; retrospective studies; men; women; Finland
Tuotimellä


Prologue

“We cannot change the past, but together we can shape a different future.”

(David Satcher 1998)
To my family
Acknowledgements

This thesis has been carried out at the Department of Psychiatry, Kuopio University Hospital, and in the collaboration with the Department of Social Affairs and Health in the Provincial State Office of Eastern Finland.

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Kuopio, April 2006

Tuula Pesonen
**Abbreviations**

5-HIAA 5-hydroxyindoleacetic acid
5-HT serotonin
5-HTergic serotonergic
5-HTT serotonin transporter
5-HT$_{2A}$ serotonin receptor $2_{A}$
% per cent
‰ per mill
BAC Blood alcohol concentration
BDI-21 Beck Depression Inventory
CI Confidence interval
CSF cerebrospinal fluid
DBT dialectical behavior therapy
DSM-IV Diagnostic and Statistical Manual of Mental Disorders. Fourth edition
GAD generalized anxiety disorder
km$^{2}$ square kilometer
M-H Mantel Haenszel Test
MDD major depressive disorder
OCD obsessive-compulsive disorder
OR Odds ratio
PSD psychoactive substance dependence
SD standard deviation
SMRs standardized mortality ratios
SPSS Statistical Package for Social Sciences
SSRI serotonin selective reuptake inhibitor
TPII tryptophan hydroxylase
UAC urine alcohol concentration
WHO World Health Organization
List of original publications

Original publications are referred to in the text by Roman numerals I-V.


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1. Introduction

Every year approximately one million people worldwide commit suicide and 10-20 times as many attempt suicide. During recent years one major concern has been the increase in suicide mortality among young people (Bertolote 2001). Suicide is always an endpoint of several contributing factors. Suicidal individuals may suffer from different mental disturbances and life crises, which are often manifested in repeated non-lethal self-destructive behavior. This causes an increased work load in emergency departments (Malone at al. 1995; Lömöqvist et al. 2003).

Most suicide victims suffer from mental disturbance (Henriksson et al. 1993). Suffering from any mental disorder has been associated with a significant risk of premature death, with a relative risk of 1.6 in men and 1.4 in women. Particularly schizophrenia and depression have been connected with an elevated mortality rate concerning both natural and unnatural causes (Joukamaa et al. 2001). This underlines the importance of the detection and effective management of psychiatric disorders connected with self-destructive behavior. A considerable proportion of persons who attempt suicide are never reached by adequate help and management. Over half of those who attempt suicide may not seek professional help and three out of four attempters may not be admitted to a hospital or other facility (Crosby et al. 1999).

The highest risk of initial suicide ideation, plans and attempts occurs during the late teenage years and early 20s (Kessler et al. 1999). In the Finnish general population, during a 12-month period, suicidal ideation has been found to be most common in the age group between 25-44 years and least common in men and women older than 65 years (Hintikka et al. 1998). Studies on young and very old subjects have suggested that suicidal ideation may be a long-term mental state (Goldney et al. 1991; Buddeberg et al. 1996; Forsell 2000). Persistent suicidal ideation has been associated with a markedly increased probability of planned suicide attempts (Kessler et al. 1999). On the other hand, Szanto and coworkers (2003) and Bruce and coworkers (2004) investigated suicidal ideation in elderly patients suffering from late-life depression and found that
suicidal ideation resolved rapidly during treatment interventions. The treatment intervention's effect was apparent regardless of depression severity (Bruce et al. 2004). High- or moderate risk patients were less likely to be full responders and they needed a longer time to do so (Szanto et al. 2003).

Direct suicidal behavior is manifested in suicidal ideation, parasuicide or suicide. A person with indirect suicidal behavior does not have a conscious purpose of self-harm or death. Indirect suicidal behavior may be expressed by risky driving, high-risk hobbies, hazardous alcohol drinking, drug misuse or neglecting the management of physical illness. Generally, both direct and indirect suicidal behavior is seen in the same person (Lönnqvist et al. 2003).

Until recently, the suicide mortality in Finland has been among the highest in Europe (Lester 1997; Diekstra and Gulbinat 1993). When comparing internationally, high male suicide mortality, especially in young men, is typical for Finland. Suicide is the most common cause of death among 20-34 year old men. Although in elderly people the suicide mortality rates have been found to be highest, the overall increase in suicide mortality is above all due to the increase in suicides among young men (Lönnqvist et al. 2003). Since the 1980s, suicide prevention has been an important goal of Finnish health policy. During the research phase of the National Suicide Prevention Project of Finland in 1987, suicide mortality in the province of Kuopio in Eastern Finland was the highest in the country (Lönnqvist et al. 1995). As a result of this, preventive efforts were recommended, including alertness to the early signs of self-destructiveness as well as effective co-operation between different health authorities, social workers and the police (Itsemurhat Kuopion läänissä 1987, 1989).

The determination of national suicide rates is essential for understanding and comparing the general trends in suicide mortality between countries and larger regions of different sociodemographic cultures. Precise information on different suicide methods, suicide mortality in certain age-groups as well as regional divergence is important when investigating regional suicide mortality for the planning and assessment of local and regional suicide prevention strategies. Suicide mortality has to be analyzed according to age and gender with special reference to differences in risk factors (Canetto 1997).
Few studies have systematically compared suicide mortality between urban and rural regions (Isometsä et al. 1997a; Saunderson et al. 1998). Urban and rural suicides may differ with respect to the prevalence of mental disorders, their co-morbidity and physical disorders, as well as the preceding situation (Isometsä et al. 1997a).

Alcohol dependence, heavy drinking and alcohol intoxication enhance the risk of suicide and suicidal behavior (Hufford 2001; Poikolainen 1995; Powell et al. 2001). Negative life events and interpersonal stressors have been found to be notable risk factors for suicide among male alcoholics (Murphy et al. 1979; Heikkinen et al. 1994a). Alcohol dependence, associated comorbid psychopathology and negative life events have been regarded as distal risk factors for suicidal behavior while proximal risk factors determine the timing of when suicidal behavior turns into action (Hufford 2001). It has been shown that alcohol-positive suicides among women increased in Finland during 1987-1996 (Lunetta et al. 2001).
2. Review of literature

2.1. Concepts of suicidal behavior

Suicidality can be viewed as a continuum of different self-destructive elements, which may vary with respect to manifestation, permanence, seriousness and lethality.

2.1.1. Suicidal ideation

Suicidal ideation is defined as thoughts serving as the agent of one’s own death. The condition may vary in seriousness depending on the specificity of suicide plans and the degree of suicidal intent (APA 2003). For example, suicidal ideation can be manifested as fleeting thoughts that life is not worth living, through very concrete, well-thought-out plans for killing oneself, to an intense delusional preoccupation with self-destruction (Goldney et al. 1989). In fact, the objective of suicidal ideation may not be the death of oneself but rather a wish for momentary relief or escape from mental distress. Suicidal thoughts can also be seen as a universal human phenomenon with an abstract sense of searching for the meaning of life and death (Goldney et al. 1989).

2.1.2. Suicidal intent

Suicidal intent is regarded as a state with a subjective expectation and desire for a self-destructive act to end in death (APA 2003). Although some studies have revealed that suicidal men and women are equally determined to kill themselves (Canetto and Sakinofsky 1998; Denning et al. 2000), other study results have demonstrated an association between high suicidal intent and male gender (Haw et al. 2003). Suicidal intent and hopelessness have been reported to be marked predictors of suicide (Beck and Weishaar 1990; Brown et al. 2000; Suominen et al. 2004a) and the Suicide Intent Scale has been used in the clinical assessment of suicidal patients since the 1970s (Beck et al. 1973; Beck et al. 1974). It has been found that among suicide attempters, about 40% stated that the wish to die was strong and only luck prevented them from death, while thirteen percent stated that their intention to die was serious but they knew the method they had chosen was not foolproof and forty-seven percent stated that the
attempt was a cry for help and they did not want to die (Kessler et al. 1999). In a study by Polewka and coworkers (2005), 65% of suicide attempters had made an impulsive suicidal act without specific longstanding planning and had usually made it in the presence of another person, hence increasing the probability of being saved. In spite of this, these patients had made their act with the conviction that their purpose was to end their life. This opinion lasted through the examination, but they rarely expressed further suicidal intent. The remaining 35% of suicide attempters had a clear intention to die by the attempt, with full precautions against being saved and clear planning with minimum possibilities for any intervention. On the other hand, in a study based on the National Suicide Prevention Project in Finland (Isometsä and Lönqvist 1998), the majority (62%) of male and a considerable proportion (38%) of female suicide completers had died at their first attempt. Almost two-thirds of female suicide completers had previous attempts and more than one-third of these victims had made their last attempt during the final year.

2.1.3. Deliberate self-harm

Deliberate self-harm is defined as willful self-inflicting of painful, destructive or injurious acts without intent to die (APA 2003). This term is commonly used to describe a wide range of behaviors including attempted hanging, impulsive self-poisoning and superficial cutting in response to intolerable tension. In the United Kingdom this term is used for all episodes of survived self-harming behaviors regardless of intent. In North America this term refers to episodes of bodily harm without suicidal intent, especially if the behavior is repetitive. The use of this term in the North America does not include drug overdoses and methods of high lethality (Skegg 2005).

2.1.4. Suicide attempt

A suicide attempt is specified as self-injurious behavior with a nonfatal outcome accompanied by evidence (either explicit or implicit) that the person intended to die (APA 2003). Attempted suicide is the strongest known predictor of completed suicide (Harris and Barraclough 1997). Suicide attempts themselves are potentially lethal
events, which usually indicate other existing health problems like depression or substance abuse (Crosby et al. 1999).

An aborted suicide attempt is defined as potentially self-injurious behavior with evidence (either explicit or implicit) that the person intended to die but stopped the attempt before physical damage occurred (APA 2003).

The term parasuicide is commonly used in European literature and is descriptive of potentially self-destructive behavior without requiring the assessment of intention (O’Carroll et al. 1996). In this study the concept of attempted suicide is recommended.

2.1.5. Suicide

The words "suicide" and "suicidal" are used to refer to self-chosen behavior that is intended to bring about one's own death (Dijkstra and Gulbinat 1993). Based on the definition of the American Psychiatric Association, suicide is defined as self-inflicted death with evidence (either explicit or implicit) that the person intended to die (APA 2003). This term should be applied only in the case of death. In the literature, high risk behavior with a fatal outcome is defined as suicide, if the indirect causal sequence can be specified and understood as intentional. In addition, self-neglecting behavior such as a hunger strike or refusal to take life-preserving medication with a lethal outcome has also been considered as suicide (Dijkstra and Garnefski 1995).

2.1.6. Definitions of fatality, lethality and mortality

Fatality is regarded as a determination of life, usually as the result of an accident or disaster. The lethality of suicidal behavior is regarded as objective danger to life associated with a suicide method or action. Lethality is distinct from and may not always coincide with an individual's expectation of what is medically dangerous (APA 2003). In demography, lethality means the proportion of cases ending in death from the group of all cases of certain illness. Mortality is defined as the death rate or the number of people dying from a certain illness in a population during a given time period, usually the number of deaths / 100 000 inhabitants per year (New Thesaurus 2000).
2.2. Epidemiology of suicidal behavior

2.2.1. Suicidal ideation

The life-time prevalence of suicidal ideation ranges from 2 to 18% (Weissman et al. 1999, Kessler et al. 1999). Females are overrepresented among those who report suicidal ideation (Canetto and Sarkinofsky 1998). Nevertheless, in Finland there seems to be no difference in the frequency of suicidal ideation between men and women (2.3 versus 2.4%; Hintikka et al. 1998). According to a study by Kessler et al. (1999), about 90% of unplanned and 60% of planned first attempts had occurred within one year of the onset of ideation. Only a small proportion of persons with suicidal ideation receive psychiatric help (Buddeberg et al. 1996).

Among persons suffering from current major depressive disorder (MDD), 58% have been found to report suicidal ideation, men more often than women. The factors associated with suicidal ideation were a high level of hopelessness, alcohol dependence or abuse, low levels of social and occupational functioning and poor perceived social support (Sokero et al. 2003). In addition, among persons who had suffered from major depression and were admitted to a psychiatric hospital after a suicide attempt, suicidal ideation remained high after hospitalization (Malone et al. 1995).

2.2.2. Attempted suicide

A suicide attempt indicates a high risk of premature death. Among suicide attempters, all cause mortality has found to be 15 times higher than expected among men and nine times higher than expected among women. Deaths from suicide accounted for 37% of all excess deaths among men and 44% among women (Ostamo and Lönqvist 2001). The prevalence of attempted suicide varies internationally, based on different data-recording procedures, being 0.3-3.5% for males and 0.8-5.3% for females (Diekstra and Carnefsky 1995). The risk of a suicide attempt has been related to being female, being previously married and having a low educational level. Violent suicide attempters are more likely to be males (Malone et al. 1995).
The female to male ratio in clinically-treated nonfatal suicidal acts is about 1.5:1 (Canetto and Sarkinofsky 1998). However, the situation in Finland seems to be different. According to Ostamo and Lönnqvist (1994), more Finnish men than women show nonfatal suicidal behavior, the female to male-ratio being about 0.8:1. In a study by Hintikka and coworkers (1998), where a sample of people living in Finland were asked about suicide attempts during the previous year, the 12-month self-reported prevalence of parasuicide was found to be 0.9% in women and 1.1% in men. Connected to this, factors such as unfavorable socio-economic characteristics and their changes over time have been found to have a negative effect, especially among male suicide attempters (Ostamo et al. 2002).

The majority of suicide attempters have at least one psychiatric diagnosis, depressive syndromes being more common among females and alcohol dependence among males. A high proportion of suicide attempters have psychiatric comorbidity (Suominen et al. 1996). Suicide attempters with personality disorders have been found to more often have previous suicide attempts and lifetime psychiatric treatment than attempters without personality disorders. In spite of this, suicide attempters with personality disorders do not differ in terms of suicide intent, hopelessness or lethality from attempters without personality disorder (Suominen et al. 2000).

In Finland it is recommended that every patient who has attempted suicide should be referred to psychiatric evaluation (Arlnperä 1994). Suominen and coworkers (2004b) examined suicide attempters’ views of their psychiatric consultation and recorded a positive attitude to the evaluation among most patients, although those with a drug overdose felt that the consultation had taken place too soon (before they had recovered from the toxic effects of the overdose). Hopelessness and intense depression had made the attempters feel indifferent towards psychiatric consultation, which may influence attitudes towards the evaluation and recommended treatment.

In a Finnish study of attempted suicides, 8% of attempters had finally committed suicide during the twelve-year period after the index attempt (Suominen at al. 2004a) and suicides tended to accumulate during the whole 37-year follow-up period after the index attempt (Suominen et al. 2004c). Suicide attempters who survive a very serious attempt have been found to present similar clinical and psychosocial features to victims
of completed suicide (Mann 2002). In a case-control study in New Zealand, Beautrais (2001) found that suicides and medically serious suicide attempts are two overlapping populations with very similar risk factors (presence of current psychiatric disorder, history of previous suicide attempts, previous psychiatric care and contact, social disadvantage and recent stressful life events). However, these groups also display differences. For instance, those who are more likely to die by suicide are more often males with a non-affective psychosis and those with a high risk of attempting suicide are more often females with anxiety disorder and with poor social contact.

2.2.3. Suicide

Global suicide rates per 100,000 population have been estimated starting from the 1950s. There is a large variation between countries in death rates from suicide (Schmidtke 1997, Bertolote 2001). The highest suicide rates are found in Europe and especially in countries of Eastern Europe with similar historical, genetic and sociocultural characteristics to the Baltic countries, Finland, Hungary and also in the Russian Federation (Bertolote 2001, Table 1). Suicide rates are generally higher in men than in women for all age-groups, the male to female ratio for most countries being above 3:1 (Dicksta and Gulbinat 1993).

Between 1950 and 1995 there was an approximately 49% increase worldwide in suicide rates among men and a 33% increase among women. According to WHO estimates for the year 2020, about 1.5 million people will die from suicide, which represents on average one death every 20 second (Bertolote 2001).
Table 1. Suicide rates in European countries per 100 000 population; derived from Bertolote (2001).

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>1992</td>
<td>26.7</td>
<td>11.0</td>
</tr>
<tr>
<td>Denmark</td>
<td>1996</td>
<td>24.3</td>
<td>9.8</td>
</tr>
<tr>
<td>Estonia</td>
<td>1996</td>
<td>64.3</td>
<td>14.1</td>
</tr>
<tr>
<td>Finland</td>
<td>1995</td>
<td>43.4</td>
<td>11.8</td>
</tr>
<tr>
<td>France</td>
<td>1995</td>
<td>30.4</td>
<td>10.8</td>
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<tr>
<td>Germany</td>
<td>1997</td>
<td>22.1</td>
<td>8.1</td>
</tr>
<tr>
<td>Greece</td>
<td>1996</td>
<td>5.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Hungary</td>
<td>1997</td>
<td>49.2</td>
<td>15.6</td>
</tr>
<tr>
<td>Iceland</td>
<td>1995</td>
<td>16.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Ireland</td>
<td>1995</td>
<td>17.9</td>
<td>4.6</td>
</tr>
<tr>
<td>Italy</td>
<td>1993</td>
<td>12.7</td>
<td>4.0</td>
</tr>
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<td>Latvia</td>
<td>1996</td>
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<td>13.5</td>
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<td>Lithuania</td>
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<td>6.5</td>
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<td>6.2</td>
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<td>Poland</td>
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<td>24.1</td>
<td>4.6</td>
</tr>
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<td>Portugal</td>
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<td>10.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Spain</td>
<td>1995</td>
<td>12.5</td>
<td>3.7</td>
</tr>
<tr>
<td>Sweden</td>
<td>1996</td>
<td>20.0</td>
<td>8.5</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1994</td>
<td>30.9</td>
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<td>UK</td>
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Analysis of suicide rates among younger age groups is difficult due to the deficiencies in official suicide mortality statistics for late childhood or early adolescence (5-14 years old). The suicide rates are very low or the data is not reported (Diekstra and Garnefski 1995). According to WHO statistics, the latest mean worldwide annual rates of suicide among 5 to 14-year-olds are 0.5 / 100 000 for females and 0.9 / 100 000 for males,
while in the 15-24 age group they are 12.0 / 100 000 for females and 14.2 / 100 000 for males (Pelkonen and Marttunen 2003). Furthermore, in a study based on a Swiss age-period-cohort analysis of suicides, the age-specific risk for suicide seemed to increase steadily with age. Intermediate plateaus were recorded during the 20s and 50s and the effects of age were similar for both genders (Ajdacic-Gross et al. 2005). This is in accordance with the findings of Bertolote, who stated that the number of suicides is highest in the age group of 35-44 years (Bertolote 2001).

There has been evidence of a real increase in suicide rates among adolescents and young adults in many European countries as well as in industrialized countries in other parts of the world. This is especially true among young men (Diekstra and Garnefski 1995; Eisenberg et al. 2005; Pritchard and Hansen 2005). In addition, the association between attempted suicides and committed suicides has been shown to be connected with age. Among younger suicide victims the number of preceding suicide attempts before death is higher than among old suicide victims (Renaud et al. 2005; De Leo et al. 2005).

Statistical records of suicides have been kept in Finland since the 19th century. They are generally thought to be very reliable. The incidence of suicides in Finland has been growing steadily since the 19th century with a temporary period of suicide rate decline after World War II. After that, suicide mortality increased again until the end of the 1980s, when mortality from suicide started to decline. The decrease in suicide mortality was more rapid at the end of the 1990s. During ten years, suicide mortality declined by about one-third. In 1995, suicide rates in Finland for men and women, respectively, were 43 and 12 / 100 000 inhabitants per year, while in 2003 the respective figures were 31 and 9 / 100 000 inhabitants per year (Pirkola and Sohlman 2005).

In Finland, in every case of death by unnatural causes, the Finnish law for determining the cause of death demands a medico-legal autopsy. Finnish death certificates are based on the clinical cause of death determined by a forensic pathologist. Thus, suicide estimation in Finland is based on the clinical balance of probability rather than on beyond reasonable doubt, as in countries where the determination of the causes of death are made by coronial practice (Öhberg and Lönnqvist 1998). In both methods of determination there may be committed suicides that have been defined as undetermined
deaths. As a result of this, the suicide mortality in Finland may be underestimated by about 10% (Öhberg and Lönnqvist 1998) and in countries with a coroners' inquest by over 20% (Sampson and Rutty 1999).

2.3. Theoretical background of suicidal behavior

When exploring the theoretical background of suicide, the classification of contributing factors for suicidal behavior as separate risk factors may be problematic, because factors influencing an individual's suicidal behavior may not be connected to each other in a simple reason-consequence-relation (Balazic and Marusic 2005). For example, mental disorders may enhance unemployment and psychosocial problems, which may provoke family difficulties, divorce and social isolation, and vice versa. Recently, the risk factors behind suicidal behavior have been categorized into three main groups: genetic and environmental factors and interaction between the two. It has been assumed that an individual's response to environmental insults is moderated by his or her genetic make-up (Marusic and Farmer 2001; Balazic and Marusic 2005).

2.3.1. Neurobiology

Three neurobiological systems together have the main role in regulating the pathophysiology of suicidal behavior: hyperactivity of the hypothalamo-pituitary-adrenal axis, dysfunction of the serotonergic (5-HTergic) system and excessive activity of the noradrenergic system (van Heeringen 2003). Dysregulation of the hypothalamo-pituitary-adrenal axis and high activity of the noradrenergic system were found to be connected to responses to stressful events. Dysfunction of the serotonergic system is associated with anxiety, impulsivity, aggression and alcoholism (van Heeringen 2003; Mann 2002). In particular, low concentrations of 5-hydroxyindoleacetic acid (5-HIAA), a metabolite of serotonin (5-HT), in cerebrospinal fluid have been found in suicide attempters and especially in those with violent attempts. This group of patients with CSF-HIAA levels below the median had a 20% rate of mortality by suicide during a one-year follow-up after the lumbar puncture (Träskman et al. 1981).
2.3.2. Genetic factors

It has been stated that suicidal behavior is influenced by familial and genetic factors. Genetic risk factors may account for approximately 43% of the variance in suicidal thoughts and behavior (Statham et al. 1998; Balazic and Marusic 2005). In several controlled family studies, a nearly 5-fold greater relative risk of a suicidal act has been found among relatives of index cases with suicidal behavior when compared to relatives of non-suicidal controls. The relative risk was greater for completed suicide than for attempts (Baldessarini and Hennen 2004). Monozygotic twins have a higher rate of concordance for suicide than fraternal dizygotic twins (Baldessarini and Hennen 2004, Balazic and Marusic 2005).

In Europe, countries with suicide rates above 20 / 100,000 per year form a J-shape region from Finland to Austria and Hungary. Based on this geographical area, earlier studies introduced the thesis of a connection between the Finnish genetic roots and high suicide rates among Finno-Ugrians, which could be due to the fixation in the gene pool of certain behavioral traits predisposing to individuals to suicide during the early states of ethnogenesis (Marusic and Farmer 2001). For example, both Finns and Hungarians share the same proportion of European (90%) and Uralic (10%) genes (Cavalli-Sforza et al. 1994).

Recent studies have supported the theory that the genetic roots of Finnish people are mostly of West-European origin (Norio 2003). The results of studies on mitochondrial DNA and on genetic distances support this idea. Hardly any genetic distinction can be made between Finns and other Europeans (Lahermo et al. 1996). For example, Basques, Finns and Saami people share the same mitochondrial haplogroup V (Torroni et al. 1998, 2001). Studies on genetic distances, which refer to the differences in gene frequencies between populations, show that the genetic distance of the Finns is shortest to the Belgians, Austrians, Germans, and Swedes. Further apart are, for example, the Hungarians and Russians, and very remote are the Saami people, who have been regarded as forming a group that migrates to Northern Finland rather than branch with close interaction with the local population (Norio 2003). The European origin of the Finnish genetic pool has also been supported by the classical studies of Harri
Nevanlinna, who stated that, based on genetic polymorphisms, three quarters of the genes of the Finns are European and one quarter are Eastern (Nevanlinna 1972, 1984).

Genes coding for proteins that involve serotonergic neurotransmission have been found to be important in suicidal behavior (Balazic and Marusic 2005). Candidate genes linked to suicidal behavior by affecting the serotonergic system have been identified (Arango et al. 2003). These include the tryptophan hydroxylase 2 gene (TPH2), which encodes the rate-limiting enzyme for brain serotonin biosynthesis (Zhou et al. 2005), the serotonin transporter gene (5-HTT; Courtet et al. 2005), and the gene encoding the serotonin 5-HT2A receptor (Mann 2002).

Not all findings concerning these candidate genes have been replicated in other studies. The explanation may be the statistical power of individual studies not being high enough to detect small differences between the cases and controls and thus offer conclusive results (Lalovic and Turecki 2002). However, there is extensive scientific evidence that reduced serotonergic activity may be linked to impulsive-aggressive traits, which may increase susceptibility to suicide (Turecki 2005). In addition, Caspi and coworkers (2003) have investigated in their birth cohort study the gene-environment linkage between polymorphism in the serotonin transporter gene (5-HTT) and depression as a psychopathological reaction to stressful situations. The researchers found that the 5-HTT gene interacts with life events to predict, for instance, depressive symptoms, depression diagnoses and suicidality.

It has been assumed that the candidate genes interact with each other and also with early environmental factors with different phenotypic consequences (impulsivity, inability to control anger etc.; Courtet et al. 2005). It has been emphasized that the effects of genetic-based serotonin dysfunction are assumed to always be connected to several environmental stressors (Virkkunen 2005).

2.3.3. Social and psychological aspects

In his studies on suicide, the French sociologist Emile Durkheim introduced the term of anomic suicide. An anomic suicide was defined as the result of a breakdown of social regulators that people need to control their behavior. A society with a lack of common values and meanings may develop in its members psychological states with a sense of
futility and lack of purpose, which may lead to emotional emptiness and suicide (Durkheim 1951).

Suicidal behavior may serve in the communication of both personal and social needs (Hendin 1982) and is strongly connected to the expression of the suicidal act. Different social role expectations may vary between men and women, which may have an effect on the kind of behavior expected or approved for men and women. This may include both facilitating and reducing elements with respect to self-harming behavior (Canetto and Sakinofsky 1998). For example, the method chosen by female suicide victims may include a message for those left behind. It may be an expression of how the individual has lived and tried to solve the burdensome conflicts of her life (Hendin 1982). In addition, women are found to commit suicide less often than men, because in doing so they would “abandon and destroy all relatedness” (Kaplan and Klein 1989). Women are more socialized to emphasize external attractiveness, which may play a role when choosing a less self-harming method. Less violent methods would traumatize people finding the victim less than more violent methods (Denning et al. 2000).

2.3.4. The stress-diathesis theory and the stress-vulnerability model

Wasserman has characterized suicide as an act stemming from the interplay between cognitive, affective and communicative aspects (Wasserman 2001a). Mann and coworkers have proposed a stress-diathesis model for suicidal behavior, which emphasizes that the risk of suicide is not only determined by psychiatric illness but also by the present situation. In their model, diathesis reflects tendencies for suicidal behavior according to sex, religion, genetic and familial factors, effects of childhood, psychosocial support and state-dependent factors (Mann et al. 1999). Diathesis for suicidal behavior is an important determinant for the manifestation of suicidal behavior and is influenced by several contributing factors. This can be represented in the stress-vulnerability model (Wasserman 2001a), which includes:

- the suicidal person’s cognitive style and personality
- the role of environmental factors
- the way in which stress contributes to the diathesis being manifested
• how other people’s reactions and psychosocial and cultural support can contribute to the outcome
• the circumstances in which a person’s vulnerability is diminished (protective factors) and those in which it is expressed in suicide or attempted suicide (risk factors).

2.4. Factors contributing to suicidal behavior

Certain factors may increase the suicide risk of an individual either as a prolonged background effect (distal or trait-dependent risk factors) or by influencing the individual's prevailing behavior (proximal or state-dependent risk factors). Distal risk factors are considered to span a range of risk factors involving relatively stable characteristics as well as events occurring during weeks, months or years prior to suicidal behavior. Proximal risk factors are considered to play a role in determining the timing of suicidal behavior. These factors increase suicide risk in moments immediately before the suicidal act (Hufford 2001).

2.4.1. Effects of childhood experiences

Non-genetic familial factors that may have an influence on suicidal traits include the effects of parenting and physical and sexual abuse (Mann 2002). Early parental loss has been shown to be connected to depression and suicidal behavior later in life (Malone et al. 1995). The association between childhood abuse history and the development of future suicidal behavior may be mediated by a causal relationship between childhood abuse experiences and the development of particular personality traits, such as impulsivity and anger dysregulation. However, a clear relationship is difficult to determine. Alternatively, children who already have excessive impulsivity and aggressive traits may be at greater risk of abuse (Brodsky et al. 1997). The long-term impact of childhood abuse may have effects on the victims’ future rate of depression and anxiety, varying degrees of dissociation, identity confusion and impaired self-esteem regulation as well as somatic complaints and self-destructive behavior (Farber et al. 1996).
2.4.2. Psychiatric disorders

A clear relationship has been found between suicidal behavior and current mental and psychosomatic disorders as well as alcohol and drug abuse (Buddeberg et al. 1996, Arsenault-Lapierre et al. 2004). While psychiatric problems may enhance unemployment and problems in personal relationships, negative effects concerning social isolation and psychiatric morbidity may be overlapping and thus difficult to differentiate as separate risk factors (Mann 2002). In persons with mental disorders the risk of suicide is 10 to 20 times higher than in the general population (Harris and Barraclough 1997). Suicide accounts for about 10% of deaths among psychiatric patients (Souery et al. 2003).

Based on the results of the nationwide psychological autopsy study of suicides in Finland during 1987-1988, 93% of suicide victims had suffered from at least one mental disorder. The most frequent mental disorders in suicides were depressive disorders (59%), followed by alcohol dependence (43%), personality disorders (31%), psychotic disorders (25%) and anxiety disorders (11%). Psychiatric comorbidity was found in 44% of suicide victims (Henriksson et al. 1993). This result is in accordance with the systematic review of 76 psychological autopsy studies made by Cavanagh and coworkers (2003), where the median proportion of suicide cases suffering from mental disorder was 91%.

In an Irish case-control psychological autopsy study, the prevalence of at least one current DSM-III-R mental disorder (Axis I and/or Axis II) was much higher among the suicides than among the controls (90% versus 25%, respectively). The increased risk of suicide was associated with Axis I disorders such as depressive disorders, psychoactive substance use disorders and primary non-affective psychoses, as well as Axis II disorders, especially antisocial, avoidant and dependent disorders (Foster et al. 1999).

Arsenault-Lapierre and coworkers (2004) reviewed twenty-seven psychological autopsy studies comprising 3275 suicides. The results showed that the mean percentage of suicides with mental disorders was 87% and that 43% of suicide cases were diagnosed with affective disorder, depressive disorders being the most frequent disorder. Furthermore, 26% of suicide victims had suffered from substance problems,
most frequently including problems connected with alcohol. Personality disorders represented 16% and psychotic disorders, including schizophrenia, 9% of the suicide diagnoses.

Lifetime mortality from suicide among patients with a psychiatric hospital treatment history is approximately 20% in persons with bipolar disorder, 15% in persons with unipolar depression, 10% in persons with schizophrenia, 18% in persons with alcoholism and 5% and 10%, respectively, in persons with borderline personality and antisocial personality disorders (Mann 2002). The suicide risk is highest during the first four weeks after discharge from psychiatric hospital (Geddes and Juszczak 1995).

In a population-based Swedish study of hospital patients by Ösby and coworkers (2001), patients suffering from bipolar disorders had increased standardized mortality ratios (SMRs) for suicide (SMRs 15.0 and 22.4 for males and females, respectively) and this was also the cases with unipolar disorders (SMRs 20.9 and 27.0). The SMR for all natural causes of death was also increased in these groups, causing approximately half of the excess deaths.

The mortality rate in suicide was also found to be high among hospital-treated patients suffering from schizophrenia (Mortensen and Juel 1993). In a Swedish study the standardized mortality ratios for suicide in patients with schizophrenia were 15.7 for males and 19.7 for females (Ösby et al. 2000). Among patients with schizophrenia who had been treated in hospital, the suicide risk was shown to be highest during the first year after the first admission. The suicide risk was highest in the young age-group and decreased for every additional year of age (Nordentoft et al. 2004). In addition to this, there was found to be a general reduction in the suicide rates among patients suffering from schizophrenia, which may be connected to better psychiatric treatment, reduced access to means of suicide or improvements in treatment after suicide attempts (Nordentoft et al. 2004).

2.4.2.1. Affective disorders

2.4.2.1.1. Depressive disorders

Based on the National Epidemiologic Survey in the U.S.A, the lifetime and the 12-month prevalence of major depression disorder (MDD) was 13% and 5%, respectively.
The age at onset of MDD was 30 years in both genders. In this group, 8% of males and 9% of females had attempted suicide, 38% of males and 36% of females had thought a lot about suicide and 43% of males and 47% of females had felt that they wanted to die (Hasin et al. 2005). In a Finnish time-trend study from 1989 to 2001 among psychiatric outpatients with MDD, 56-76% had suffered from thoughts of death, suicidal ideation or suicide plans or had attempted suicide (Sorvari et al. 2005).

Persons with a pre-adult onset (before age 18) of major depressive disorder have a higher risk of suicidality than those with adult onset MDD (Zisook et al. 2004). Suicide attempts among patients suffering from major depressive disorder have been shown to be associated with the presence and severity of depressive symptoms, the lack of a partner, previous suicide attempts and time spent in depression (Sokero et al. 2005). On the other hand, the severity of depression does not seem to unsubtly separate suicide attempters from non-attempters, but depression contributed to the lethality of the method used as a statedepending risk factor once the threshold of suicidal behavior had been reached (Malone et al. 1995). The severity of depression as a risk factor may be difficult to verify due to the high homogeneity of the patient groups. The patients under study suffering from depression are usually treated in hospital.

The severity of the affective disorder determines the size of the suicide risk. The lifetime suicide risk for patients ever hospitalized for suicidality was 8.6% and for patients hospitalized without specification of suicidality 4.0%. For the mixed outpatient/inpatient group of affective disorders the lifetime suicide mortality risk was 2.2% and for the nonaffectively ill population less than 0.5% (Bostwick and Pankratz 2000).

### 2.4.2.1.2. Bipolar disorders

Bipolar disorder is a potentially fatal psychiatric disease. It shows a strong association with comorbid substance abuse, medical illnesses and suicide risk. The suicide risk for bipolar disorder has been estimated to be 0.4% per year among men and women, being over 20-fold higher than in the general population. Suicidal behavior is often associated with the early stage of the illness, severe depression and affective states mixed with
dysphoria and agitation (Tondo et al. 2003). Recurrent episodes are general and, if untreated, the risk of suicide may rise to 15% (Shastry 2005).

Suicidal acts have been associated with the depression phase of bipolar I disorder and in this group with male victims suffering from comorbid alcohol use disorder (Isometsä 2005). In another Finnish study (Valtonen et al. 2005), 80% of patients suffering from bipolar affective disorder reported serious suicidal ideation or suicidal ideation and attempts during their lifetime. The prevalence of suicidal behavior did not differ between bipolar I and II disorders. In particular, hopelessness, comorbid personality disorder, severe depression and previous suicide attempts were found to be independent risk factors of suicidal behavior.

In the Zurich cohort study by Angst (1998) the prevalence of hypomania/mania among persons aged up to 35 years was 6% and that for brief hypomania (recurrent and lasting 1-3 days) was 3%. Two-thirds of the hypomanic persons also received a separate diagnosis of depression, which placed them in the category of bipolar, and half received a diagnosis of major depression. The lifetime history of suicide attempts was 3- to 5-fold higher among all hypomanic groups as compared to the controls, whose rate was 3%. The suicide attempt rate was highest among depressives (20%) but was also elevated in persons suffering from brief hypomania (14-17%), hypomania (10%) and hypomanic symptoms (7%).

In individuals suffering from bipolar affective disorder the comorbidity with cluster B personality disorder increased the lifetime suicide risk (Garno et al. 2005). In bipolar patients, substance use disorder doubled and substance use disorder combined with substance-induced symptoms tripled the suicidal risk (Comtois et al. 2004).

2.4.2.2. Substance abuse

Next to depression, substance abuse represents the most important psychiatric comorbidity in connection with suicidality. There is a strong connection between acute alcohol inebriation, alcohol addiction and both attempted and committed suicides (Da Silveira and Jorge 2004; Bilban and Skibin 2005). Among suicide victims with alcohol or other substance dependence, female victims were found to be more frequently dependent on prescribed drugs alone or in addition to alcohol use than men were.
addition, female victims with prescription drug use disorder had more Axis I psychiatric morbidity than those with alcohol dependence disorder only (Pirkola et al. 1999a).

In a model presented by Conner and Duberstein (2004), suicides among alcoholics were related to major depressive episodes and stressful life events and especially to interpersonal difficulties. The suicidal act in this group was viewed as an act of reactive aggression against distress over relationship problems. Partner-relationship problems are regarded as an important focus in suicide prevention among suicidal alcoholics (Murphy et al. 1979; Heikkinen et al. 1994a; Conner et al. 2003; Conner and Duberstein 2004). Among drug users, women were found to be twice as likely to report depression as men, and men were nearly twice as likely to report antisocial personality disorder as women (Cottler et al. 2005). In addition, among patients suffering from a major depression episode with a history of comorbid alcoholism, the high frequency of suicidal behavior and severity of suicidal ideation have been connected to aggressive traits (Sher et al. 2005).

2.4.2.3. Schizophrenia and other psychoses

As many as 5% of patients suffering from schizophrenia commit suicide during their lifetime, usually soon after the onset of the illness (Palmer et al. 2005). On the other hand, the long duration of schizophrenia does not seem to lead to adaptation to the illness or elimination of suicidal tendencies, and suicide may thus occur at any point during the course of schizophrenia (Heilä et al. 1997; Saarinen et al. 1999). Paranoid symptoms as well as vulnerability and withdrawal connected to the loss of professional concern about the patient are found to be dominant clinical features in schizophrenic illness before death by suicide (Saarinen et al. 1999). Paranoid symptoms are also connected to intense self-destructive aggression among schizophrenic patients (Meissner 1978). In addition, depressive syndromes in the residual phase of the disorder and higher suicide intensity (more suicide attempts and more violent methods in attempts than controls) have been associated with completed suicide in schizophrenia (Kuo et al. 2005).

During the 12-month period of the National Suicide Prevention Project in Finland, 7% of suicide victims had suffered from schizophrenia, and both an active course of the
illness and depressive symptoms were highly prevalent among this group. Alcohol problems were common in middle-aged male suicide victims suffering from schizophrenia, while depressive symptoms were common in the corresponding female group (Heilä et al. 1997).

2.4.2.4. Personality disorders

About one in ten psychiatric outpatients and one in five to six hospital-treated patients suffer from borderline personality disorder, and 75% of patients are females (Koivisto and Isometsä 2005). Retrospective studies have shown that almost 10% of patients with border-line personality disorder commit suicide. Suicide usually occurred after the age of 30 years in a state of withdrawal and hopelessness and after several attempts at treatment (Koivisto and Isometsä 2005). Persons suffering from personality disorders may be especially vulnerable to adverse recent life events. Interpersonal difficulties and job-related and financial problems, in particular, may precede suicide among persons with personality disorder (Heikkinen et al. 1997).

The extent of suicidal behavior, i.e. age at the first attempt and number of lifetime attempts, correlates with personality traits and especially with cluster B personality disorders (Malone et al. 1995; Brodsky et al. 1997). In a Finnish study by Isometsä and associates (1996), 64% of suicide victims suffering from personality disorder had cluster B personality disorder and 34% had cluster C personality disorder. The personality disorder has almost always been found to be associated with current depressive syndromes, substance use disorder or both (Isometsä et al. 1996; Cheng et al. 2000). Furthermore, Schneider and coworkers (2006) recently performed a psychological autopsy study of 163 completed suicides, which revealed that cluster B personality disorder was related to female victims and cluster C personality disorder to male victims. People with cluster B personality disorder have difficulties with impulsive behavior and they tend to violate social norms or act out, which may manifest in self-abusiveness or hostility towards other people. Cluster C personality is manifested in anxiousness, fearfulness, being afraid of social relations and feeling out of control (American Psychiatric Association DSM-IV 1994).
2.4.2.5. Anxiety disorders

Anxiety and nervousness are associated with adverse health outcomes such as hospital admissions for deliberate self-harm and medically-serious suicide attempts (Beautrais 2001). Persons perceiving severe anxiety have a relative risk for suicide attempt of 9.2 for men and 3.1 for women (Ringback Weitoft and Rosen 2005). However, suicides connected to pure anxiety disorders without contemporary comorbidity are rare. The long-term course of anxiety disorders has a major effect on the everyday lives of the sufferers and the comorbidity of depression significantly increases the risk of suicide (Keller 2002). In the large Netherlands Mental Health Survey and Incidence Study (NEMESIS), comorbidity with any anxiety disorder in combination with mood disorder increased the likelihood of suicide attempts. In addition, panic disorder, agoraphobia without panic and simple phobia (not obsessive-compulsive disorder, general anxiety or social phobia) were significantly associated with lifetime suicide attempts, even after adjusting for other mental disorders and sociodemographic variables (Sareen et al. 2005).

In the National Suicide Prevention project in Finland, 1% of all suicide victims had suffered from current panic disorder and the prevalence of this disorder was higher in female than in male suicide victims. All victims with panic disorder had a comorbid psychiatric disorder (Henriksson et al. 1996). In addition, anxiety related to impulsivity (Apter et al. 1993) and post traumatic stress disorder (Oquendo et al. 2005) has a strong association with suicide risk.

2.4.3. Previous suicide attempts

The number of previous suicide attempts has been found to be the strongest predictor of suicide and future suicidal behavior in all psychiatric populations (Brooksky et al. 1997; Harris and Barraclough 1997; Mann et al. 1999). Most male suicide victims die in their first suicide attempt, while 20% of men and 40% of women were found to have made a non-fatal attempt during the previous year (Isometsä and Lönnqvist 1998). Based on a large general population study among adults and mortality data in the US, it was estimated that during the preceding 12 months there had been 36 suicide attempts for every completed suicide (Crosby et al. 1999). Among personality traits indicating
borderline personality disorder, impulsivity and aggression showed a particularly strong association with previous parasuicides (Brodsky et al. 1997; Mann et al. 1999).

2.4.4. Model behavior

In 1774 a German writer, Johann Wolfgang von Goethe, described the suicide of a young man suffering from unresponded love in the novel Die Leiden des jungen Werther (The Sorrows of Young Werther; von Goethe 1989). The portrayal of morbid sentimentalism and the tragedy of sensibility was followed by a suicide epidemic in Europe, and the sales of the novel increased in several countries (Phillips et al. 1992). Werther’s effect can be defined as the occurrence of imitative suicides following media stories (Gould 2000; Stack 2003). In particular, a glamorous depiction of suicides in the media carries the risk of imitation (Mann 2002). In an opportune situation an individual’s suicidal behavior may lead to suicide clusters or pacts, where several suicides or suicide attempts occur close together or at the same time (Krysinska 2003). Suicide clusters are regarded as a group of suicides or suicide attempts, or both, that occur closer together in time and space than could normally be expected in a given community (Hawton 1978; CDC 1988). Teenagers are the most vulnerable group in this respect (Mann 2002). Among adolescents, suicide clusters account for about 1–5% of all suicides in this age-group (CDC 1988; Gould 2000). Suicide pacts are defined as mutual agreements, which are usually seen between two people who promise to kill themselves at the same time and often in the same place. In United States and England, 0.3–1% of all suicides fall in this category and are usually found among couples older than 50 years (Nock and Marzuk 2000).

2.4.5. Suicide method

Suicide methods have typical characteristics that are related to differences in the availability and acceptability of the methods (Pirkola et al. 2003). Women who commit suicide use less violent methods, such as drugs and carbon monoxide poisoning. Men tend to more often use methods with a higher probability of a lethal outcome, such as guns and hanging (Canetto and Sakinofsky 1998; Denning et al. 2000; Schapira et al.
An exception to this is the United States, where having a gun at home raises the risk of gunshot suicide among men as well as among women (Conner and Zhong 2003; Wiebe 2003).

Based on the results of a nationwide psychological autopsy study of suicides in Finland during 1987-1988, the most frequent suicide method chosen by men was hanging, followed by firearms, inhaling carbon monoxide from motor cars and drugs. Among women the most frequent method was drugs, followed by hanging, drowning and inhaling carbon monoxide (Henriksson et al. 1993). Elderly suicide victims were found to have used more violent suicide methods than the young (Pitkälä et al. 2000).

Although suicide attempters tend to choose the same method in a continuum of repeated suicide attempts, individuals who do change the suicide method in subsequent attempts commonly switch to a more lethal method (Isometsä and Lönnqvist 1998; Nishimura et al. 1999). Changes in suicide rates are connected with changes in the pattern of exposure and the method (Schapira et al. 2001). For example, hunting guns in homes may increase the risk of death as a result of an impulsive suicidal act, especially among men (Hintikka et al. 1997). In England and Wales, coal gas was replaced by less toxic domestic gas in 1974, which was followed by a 7% decrease of suicide rates in men and 58% decrease in women (Schapira et al. 2001). In China and Sri Lanka, suicide rates of more than 100 / 100 000 per year were partly a result of the availability of highly lethal suicide methods such as pesticides (Mann 2002).

2.4.6. Social isolation and economic difficulties

Social isolation is related to a high risk of suicide (Durkheim 1951). Living alone and being single or divorced may increase the suicide risk in vulnerable persons (Schapira et al. 2001). In a Finnish study, male suicide victims were more commonly never been married, were divorced, widowed and were less likely to be presently married than males in the general population (Heikkinen et al. 1995). High social fragmentation (e.g. high rates of population turnover and unmarried or single households) may negatively affect the social support network and may be connected with other factors that enhance suicidal behavior. Both men and women from regions of high social fragmentation who have shown self-harming behavior are more likely to be
unemployed or living alone than those from less fragmented regions (Hawton et al. 2001).

Income inequality has been more strongly associated with higher suicide rates in men than in women (Fernquist 2003). People having a life situation that is less common in society (e.g., continuance of unemployment or early retirement) are more likely to be associated with suicide when compared to socially more common or expected situations (Schapira et al. 2001).

2.4.7. Negative life events

Negative life events and stress can worsen both physical and mental health (Barnett et al. 2005; Steptoe and Marmot 2005; Hanssen et al. 2005; Honkalampi et al. 2004). The antecedents of suicide play a major role in the motives for action and the timing of the suicidal act. In a Finnish study, 80% of suicide victims had reported negative life events before dying (Heikkinen et al. 1994b). The most common life events were job problems, family discord, somatic illness, financial troubles, unemployment, separation, death and illness in the family. Among male suicide victims living alone, separation, financial difficulties and unemployment during the three months before death were more common than among other men.

The suicidal process is usually affected by several contributing factors, including present mental disorder, relationship problems and recent negative life events. The number of negative life events has found to be positively associated with depression, hopelessness, anger and a lack of self-esteem. Relationship problems and physical or mental abuse have been found to be the main indicators of severe mental problems in the family of suicide attempters (Ösvath et al. 2004). Among negative life events, a considerable loss has been associated with suicide risk and can be viewed through existential issues. Loss may include the threat to a significant interpersonal relationship, bereavement, deterioration in mental or physical health, financial problems and the threat of unemployment (Krysinska 2003).

It has been hypothesized that previous suicidal experiences connected to negative events would be more clearly related to the intensity of suicidal crises among never- and first-attempters than among multiple attempters. Furthermore, negative events may be
related to the duration of suicidal crises among multiple attempters, but not so clearly among never- or first-attempters (Joiner and Rudd 2000).

2.4.8. Suicides in family

According to the American Association of Suicidology, death by suicide affects the lives of approximately six other people related to the deceased and is followed by grief within the next 12 months (Krysinska 2003). Family studies have showed that the risk of suicide is increased when there is a suicide in the family (Buddeberg et al. 1996) and particularly when an aggressive method has been used (Balazic and Marusic 2005). Bereavement by suicide has characteristics of complicated grief, which can be a risk factor for physical or mental health problems, including suicidal ideation (Krysinska 2003; Mitchell et al. 2005). Mental symptoms in relatives or significant others of suicide victims have been detected up to three years after the suicide. After that, mental well being is usually restored and in the following years amelioration generally occurs. Nevertheless, widows of suicide victims may have depressive and anxious symptoms even ten years after the suicide (Saarinen et al. 2000).

2.4.9. Protective factors

In general, an individual’s life and health situation often includes factors that strengthen the person’s coping strategies and have powerful protective effects against suicide. Protective factors include ties with family and other close rewarding contacts, interesting occupations and sources of pleasure as well as employment. In men, living with a partner reduces the risk of suicidal behavior. In women, adequate social support and having children were found to be protective factors against self-destructive behavior (Hintikka et al. 1998). Having an own child is generally protective against suicide and the effect is especially strong if the child is young. Parenthood may also include negative effects and increase the suicide risk by having children with a hospitalized psychiatric disorder or by losing the child at an early age (Qin and Mortensen 2003).

In addition, finding a person who is prepared to listen and having possibilities to obtain help as well as medication and therapy represent protective factors for suicide (Heikkinen et al. 1994b; Wasserman 2001b). For example, despite the high lifetime rate
of suicide, most people with mood disorders (the depression phase of bipolar mood disorder or unipolar or major depression) never attempt suicide (Mann and Arango 2001).

2.4.10. Gender-related differences

As described earlier (2.3.5), men and women differ in terms of committed suicides and nonfatal suicidal behavior. This may be the result of gender-specific factors that protect the individual from suicide or enhance its risk (Lester 1995; Qin et al. 2000). Women favor the use of less immediately lethal suicide methods, which may protect them from a fatal outcome. In men, killing oneself by a method related to masculine behavior may facilitate death. Vice versa, the high prevalence of nonfatal self-harming behavior in women may reduce such behavior in men (Canetto and Sakinofsky 1998). Cultural expectations concerning gender and suicidal behavior are strong. Gender-related differences may be more expressed in regions where different suicidal behaviors are regarded as feminine or masculine (Canetto and Sakinofsky 1998).

According to recent studies, the difference between men and women concerning nonfatal suicidal behavior may be narrowing. In Denmark, relatively more men engaged in nonfatal suicidal behavior and relatively more women killed themselves in the late 1980s and early 1990s than was the case in the 1970s (Bille-Brahe 1993). In an English study from 1981-2000, rates of suicidal behavior were higher in females, but the difference between the genders narrowed in the second half of the 1990s (O’Loughlin and Sherwood 2005). In a German study, women were only slightly overrepresented in a medical intensive care sample of acute self-harming poisoning (Furst and Habscheid 1993). As far as committed suicides are concerned, the difference in methods chosen is becoming smaller (Salander Rehnberg and Jacobsson 1999).

2.4.11. Effect of residential environment (urban-rural)

Studies of suicide behavior in relation to the residential environment are only partly comparable due to differences in the urban-rural definition (Middleton et al. 2003; Qin 2005). In spite of this, there may be special adverse characteristics of the living area of individuals that affect mental health and thus increase the risk of suicidal behavior. For
example, in the Finnish Health 2000 study, regional differences were detected in mental disorders and their comorbidities. Prevalences of alcohol use and comorbid disorders were higher in the metropolitan area of Helsinki and depressive disorders in northern Finland. This may be partly explained by the metropolitan area of Helsinki having the highest population density, highest annual per capita alcohol consumption and highest frequency of unmarried, younger and employed people, and by the higher proportion of seasonal affective disorder at latitudes with the greatest annual variation in daily light, i.e., in northern Finland (Pirkola et al. 2005). In addition, psychosocial disadvantages (larger proportions of unemployed, lower housing space per person and higher level of social assistance) have been connected with higher attempted-suicide rates (Ostamo et al. 2001).

Furthermore, suicides in urban and rural regions may differ with respect to the prevalence of mental disorders, their co-morbidity and physical disorders as well as the preceding situation (Isometsä et al. 1997a; Qin 2005). For example, the highest male suicide rates have been found in the most rural regions (Saunderson et al. 1998) and suicides among young men living in rural environments have shown an increase (Dudley 1992). This is in accordance with the study of Levin and Leyland from the UK (2005), who found that rurality has a smaller effect on female than on male suicides. This difference is due to the higher susceptibility to rural deprivation among males. On the other hand, this result is not in accordance with another study from the UK (Middleton et al. 2003), where higher suicide rates were detected among rural female victims and were not associated with changes in unemployment, socio-economic deprivation and social fragmentation but, on the contrary, were explained by a higher deterioration in mental health in rural than urban regions. Additionally, firearms are the most lethal means for both homicide and suicide (Branas et al. 2004). Firearms are more common in rural regions, and suicide victims from rural regions are more likely to have used firearms in committing suicide (Hintikka et al. 1997; Saunderson et al. 1998; Yip et al. 2000; Branas et al. 2004).

In addition, worsening of the rural life situation and economy may increase the migration of healthier individuals away from sparsely populated areas, leaving behind individuals with a higher susceptibility to adverse effects (Dudley et al. 1997; Qin
2005). On the other hand, migration to cities and suburban environments may enhance social isolation in victims living in densely populated regions (see 2.3.6), where social fragmentation is high (Saunderson et al. 1998). Urban living may especially increase the suicide risk among women aged 24-35 or older than 65 years. However, living in an urban area seems to even be a protective factor against suicide among young men. The increased risk in urban areas can largely be explained by the adverse effects of marital status, poverty and psychiatric status (Qin 2005).

2.4.12. Alcohol

The average alcohol consumption of the Finnish population has changed considerably during recent decades. Further changes are presently occurring due to changes in alcohol taxation in relation to the harmonization of EU legislation. In the late 1960s, alcohol consumption by women represented slightly over 10% of the total annual consumption (Simpura et al. 1995). It peaked at the beginning of 1990, being about 20% of the total annual alcohol consumption (Mustonen et al. 1999). From 1984 to 1998 the prevalence of Finnish female abstainers (persons consuming no alcohol during the previous year) decreased significantly and the temperance in alcohol consumption decreased in all female age-groups. Furthermore, the frequency of weekly drinking among women rose from 4% in the 1960s to 15% in the 1990s. In Finland, the heaviest drinking among women occurs between the ages of 20 and 29 (Intoxicants Statistical Yearbook 1998, 1999, 2000). During the first decades after World War II, the suicide mortality in Finnish men increased by 10% for every increase of one liter in the total annual alcohol consumption (Mäkelä 1996).

One example of the influence of alcohol consumption comes from the former USSR during the perestroika, when the restrictive anti-alcohol campaign initiated by Gorbachev in 1985 was followed by a decline in suicide rates of 32% for males and 19% for females (Wasserman et al. 1994; Wasserman et al. 1998). Results were interpreted as showing a possible correlation between suicide and alcohol as well as violent death and alcohol. The explanatory value of alcohol was lower for female suicides (27%) than for male suicides (50%).
Women have a greater sensitivity to alcohol than men. They become more rapidly intoxicated and are at a higher risk of chronic harmful effects (Mumenthaler et al. 1999). The same amount of alcohol creates higher BAC (blood alcohol concentration) levels among women than men. The reason for this is the smaller volume of distribution as well as the smaller first-pass metabolism of alcohol due to lower gastric alcohol-dehydrogenase activity in women (Baraona et al. 2001). Besides biological differences, gender differences in patterns of alcohol use have been connected to women’s and men’s differing needs, reasons and motivations for drinking as well as to different gender-specific roles and to ways in which societies regulate peoples’ behavior (Holmila and Raitasalo 2005). In addition, it has been found that women have a higher risk of suicide associated with alcohol use disorder than men (Harris and Barraclough 1997).

A strong association has previously been found between suicide attempts and the time of alcohol consumption during the preceding hours (Powell et al. 2001; Borges et al. 2004). The acute effects of alcohol intoxication may increase the risk of suicide by four mechanisms (Hufford 2001): it may a) enhance psychological distress, b) increase aggressiveness, c) propel the suicidal ideation into action through suicide-specific alcohol expectancies and d) constrict cognition with impairment in the generation and use of alternative coping strategies. On the other hand, alcohol at low doses can reduce anxiety (Hufford 2001), which is a part of the addictive element of alcohol usage (Carrigan and Randell 2003; Thomas et al. 2003). However, high doses of alcohol may enhance psychopathological features of the personality, such as susceptibility to distress or aggressiveness. In this situation an alcohol-induced reduction of impulse control in the presence of some other proximal risk factors (e.g. psychological distress, hopelessness or depression) may lead to active suicidal behavior (Hufford, 2001).

The alcohol myopia theory introduced by Steele and Josephs (1990) addressed the influence of alcohol in potentiating suicidality in the short term by two separate pathways. Firstly, they stated that alcohol enhances the risk of suicide by narrowing the cognitive focus and leading to an obsessive immersion in one's troubles and worsening of anxiety and depressive symptomatology. Secondly, the same narrowing of cognitive focus may increase the attractiveness of suicide by impairing the perception of
alternative solutions. Furthermore, due to its disinhibiting effect, alcohol may increase the susceptibility to suggestion and imitation (e.g. after exposure to media reports of other suicides) and to destructive effects on social relationships. Alcohol makes social behavior more extreme by inflating self-evaluations and pronouncing omnipotence. Social relationships may change into more destructive patterns and the social network lacks its preventive elements against suicide. In this context, an alcohol-intoxicated individual with suicidal ideation affected by other simultaneous risk factors may have a risk of going too far (Skog 1991). This association between alcohol and suicidal ideation in the psychosocial context has also been verified by Vilhjalmsson and coworkers (1998), whose study results showed that people who drink alcohol three times a week or more have a higher prevalence of suicidal ideation than people who drink smaller amounts of alcohol.

Acute alcohol consumption may increase the risk of injury (Watt et al. 2004; Paljärvi et al. 2005), which was found to be higher in women than in men (Stockwell et al. 2002). Alcohol impairment of inhibitory control has also been investigated by Fillmore and Weaver (2004). Results from this study indicated that disinhibited and aggressive behaviors under the influence of alcohol are more pronounced in men than in women.

In Finland, alcohol has been found in autopsy samples in about 30-40% of male and 13-20% of female suicide victims (Öhberg et al. 1996; Lunetta et al. 2001). The average blood alcohol concentration (BAC) for alcohol-positive suicide victims has been 1.2% for men and 0.8% for women (Hayward et al. 1992). The BAC has been found to be ≥ 0.5% in 12-20% of female suicide victims (Hayward et al. 1992; Öhberg et al. 1996; Lunetta et al. 2001). Lunetta and coworkers (2001) have previously found that alcohol-positive suicides among women increased in Finland during 1987-1996.

2.5. Suicide prevention

2.5.1. The levels of prevention

Suicide prevention in society can be seen as a part of general prevention in psychiatry, with three levels of aims (Taylor et al. 1997; Lehtonen and Lönnqvist 2003):
1) The aim of primary prevention in psychiatry is to reduce the manifestation of mental disorders and diminish the incidence of new cases of mental illness in the general population. Primary prevention of suicides is focused on finding and acting upon those changes in society that have an influence on suicide rates. This includes a) improving resources and circumstances that can enhance an individual’s coping resources, b) restricting the means for suicide and c) reducing alcohol sales through legislation.

2) Secondary prevention in psychiatry is focused on the early detection and management of existing psychiatric disorders, which in suicide prevention is aimed at detecting the risk groups for suicidal behavior and developing the management of depressive disorders. It attempts to eliminate and reduce problems that under unfavorable circumstances can lead to suicide.

3) In tertiary prevention of psychiatry the measures of management and rehabilitation are aimed at relieving suffering from mental illnesses. In clinical suicidology this includes a) preventive efforts to eliminate or alleviate the factors directly increasing the possibility of suicide and b) postventive measures for the survivors of completed suicide.

Suicide prevention strategies should include preventive interventions with outcomes that are mostly associated with the development of suicide mortality. These domains include:

- education and awareness for the general public and for professionals about suicidal behavior and suicide risks
- screening tools for at-risk individuals
- treatment of psychiatric disorders
- restricting access to lethal means for suicide
- responsible media reporting of suicide (Mann et al. 2005).

Based on the results of a large meta-analysis of specific suicide prevention strategies, education of physicians in detecting depression and the restriction of access to means for suicide were found to be particularly effective interventions (Mann et al. 2005). Suicide prevention can also be seen as a risk-group-oriented and three-pronged strategy, which facilitates successful population-oriented suicide prevention. The strategy
consists of identifying risk groups, improving the diagnosis and treatment of suicidal patients (including attempted suicides) and offering better rehabilitation for suicide attempters (Wasserman 2001b).

There is also an important group of community and organizational ‘gatekeepers’, whose contact with potentially vulnerable populations offers an opportunity for suicide prevention. This group includes clergy, first responders, pharmacists, geriatric caregivers, and personnel or staff at schools, prisons and in the military. The education of these caregivers in the identification of persons at risk is also an effective preventive intervention (Mann et al. 2005).

2.5.2. The National Suicide Prevention Project of Finland

In 1999 WHO specified as a global task the reduction of suicide rates by at least one-third by the year 2020 (WHO 1999). The Finnish Department of Mental Health of the National Health Institute has been active in both suicide research and the development of preventive strategies in Finland since the 1980s (Lönnqvist et al. 1995) In 1985 the Finnish National Board of Health formulated the first four directive goals for prevention (Åsberg et al. 1997):

- to draw attention to this theme as a complex problem
- to launch a development process in the entire country
- to integrate the project into the public service system
- to bring about activities that would specifically affect health services.

The National Board of Health established a 20% reduction in national suicide mortality as an effect goal of the project (Lönnqvist 1988). The National Suicide Prevention Project in Finland was carried out from 1986-1996 and consisted of a research phase (1986-1991), an implementation phase (1992-1996) and an internal evaluation phase (1997-1998).

This project has been externally evaluated by an international peer group (Beskow et al. 1999). The national psychological autopsy study was regarded to be a remarkable piece of work with a broad international presentation of the results. These confirmed earlier findings and produced new insights. During the Prevention Project, suicide
mortality in 1996 was 9% lower than at the beginning of the project (30 versus 33 / 100 000), but in 1990, before the start of the implementation phase, the rate increased to 38 / 100 000. During the implementation phase there was a gradual decrease in 1995 and a substantial drop in 1996 to 30% (~20% compared to 1990; Beskow et al. 1999). It was seen as satisfactory that Finland had seriously challenged the problem of suicide and the trend in suicide rates was in the right direction. In addition, the project had produced several suicide preventive activities for professionals, developed functioning participating methods and nearly 40 subprojects. The production of practical guidebooks for different situations where the “front-line helpers” may face persons with suicidal behavior was also evaluated as an effective outcome. In addition, concerning professionals who work with patients at risk of suicide, the development of preventive measures among psychologists has also been internally evaluated during the national prevention project in Finland. The overall structure of prevention ideology remained comprehensive and multifactorial, stressing multistage influence. Suicide prevention was assessed as a difficult challenge, with feelings of powerlessness (Upanne 2000).

In 1987 the research of the National Suicide Prevention Project in Finland revealed that the suicide mortality in the province of Kuopio in Eastern Finland was the highest in the country (Lönnqvist 1988). Consequently, preventive efforts were recommended, including alertness to the early signs of self-destructiveness as well as effective cooperation between different health authorities, social workers and the police (Itsemurhat Kuopion läänissä 1987 1989).

2.5.3. Suicide prevention programs in other countries

During 1996 a survey of 15 countries was carried out to examine national suicide prevention programs (Taylor et al. 1997). The countries were divided into three groups: countries with comprehensive strategies and those setting them up (Finland, New Zealand, Norway, Australia and Sweden), those with national preventive programs (the Netherlands, England, U.S.A, France and Estonia) and countries without national action (Japan, Denmark, Austria, Canada and Germany). Interventions in different countries shared many common themes, such as public education, school-based programs, the
detection and treatment of depression and other mental disorders, alcohol and drugs, enhanced access to mental health services and reduced access to lethal methods. Although there is widespread interest in the development of suicide prevention strategies, only a few countries have engaged all the levels of preventive efforts (Jenkins and Singh 1999). The best results can be expected from suicide prevention programs that are evidence-based, guided by specific testable hypotheses and implemented among populations with a sufficient size, thus producing generalizable and reliable results. In addition, the programs should include outcome measures (Mann et al. 2005).

2.5.4. Educational aspects

A few decades ago, suicide was still like a taboo, and general discussion of the problem was avoided (Buddeberg et al. 1996). In addition, the detection and management of depression has been shown to be insufficient (Laukkala et al. 2001). Scientific investigation and professional training for health providers in detecting and managing mental disorders and self-destructive behavior have enhanced the awareness of these questions, which represent common public health problems.

An educational program for suicide prevention was investigated on the Swedish island of Gotland in the early 1980s. Evaluation continued until the early 1990s and was followed by maintenance training until 1998 (Rutz 2001). The education program offered training in the detection and monitoring of depression as well as suicidal symptoms and information about psychotherapy and pharmacotherapy to all general practitioners on the island. During the three-year educational program, referrals for depression to the local psychiatric institution as well as days of sick leave due to depressive symptoms decreased by 50%. The amount of in-patient treatment for depressive disorders dropped by 70% and the number of suicides decreased by two-thirds. The decrease in suicide mortality occurred predominantly among women. However, the effects of the educational program were only temporary. By the end of the decade, suicide rates returned to the baseline values and the need for updating the training was apparent.

Thompson and coworkers later assessed the effectiveness of an education program for clinicians in improving the recognition and outcome of primary-care depression in
England (Thompson et al. 2000). The education was delivered to practice teams and was well received, while 80% of the participants thought that their management of depressive patients would change. In spite of this, the results showed similar sensitivity of physicians to depressive symptoms in the intervention group and in the control group after the education program, with no improvements in recognition or recovery from depression. On the other hand, Ziervogel and coworkers (2005) carried out an education program for geriatric caregivers in Germany concerning depression and suicidality in old age. In the three-month follow-up design the short-term effects of the education was seen in the topic concerning depression in old age and significant long-term effects in the increased knowledge of pharmacotherapy and antidepressants.

In addition, the effects of an information campaign on public attitudes towards the treatment of depression were studied in two German cities, Nuremberg and Wurzburg, in 2000 and 2001 (Hegerl et al. 2003). The aim was improvement of the condition of people suffering from depression. After ten months, slight to moderate positive effects were detected concerning the causes and treatment of depression, but no effects were found with respect to the misconceptions about pharmacotherapy.

2.5.5. Restriction of means for suicide

Differences in the lethality of the method used in suicide (the risk of the method causing death) make preventive efforts possible. Restriction of highly lethal methods for suicide may have a marked influence in decreasing suicide rates in the population (Marusic and Farmer 2001; Mann 2002; Pirkola et al. 2003). This includes gun control (Hintikka et al. 1997, Mann 2002), restricted availability of ingestible toxic agents such as pesticides (Mann 2002) and information given to physicians about the risk of prescribing medication of high toxicity to suicidal patients (paracetamol, tricyclic antidepressants and dextropropoxyphene) (Pirkola et al. 2003). The effectiveness of the restriction of means for suicide was seen in England by a change in legislation in 1998. The legislation limited the size of packs of analgesics such as paracetamol, salisylates and their compounds. Suicidal deaths from these drugs decreased by 22% during the first year after the restriction was implemented and the result persisted for the next two years. In addition, large overdoses were reduced by 20% for paracetamol and by 39%
for salisylates. The liver unit admissions and liver transplants for paracetamol induced hepatotoxicity were reduced by 30% in four years after the change in legislation (Hawton et al. 2004).

The restriction of a particular suicide method reduces its use as a means of suicide, but other methods tend to replace it. This was the case in Finland in the 1950s concerning parathion, a new pesticide, which accounted for a great proportion of the increase in the total suicide rate until its availability was restricted. The restriction was followed by a decline in parathion suicides, but the use of highly lethal and violent methods subsequently increased (Öhberg et al. 1995). Persons committing suicide by switching from one self-destructing method to another may weaken but not negate the effect of restriction of the availability of lethal suicide methods as a preventive measure (Isometsä and Lönnqvist 1998).

2.5.6. Evaluation and management of suicidal patients

Persistent suicidal behavior is a sign of severe mental problems and should lead to proper assessment. It has been found that the recording of suicidality is lacking in up to one-third of outpatients with MDD seen in Finnish specialized psychiatric services (Sorvaniemi 2005). The best predictors of suicidal behavior are a previous history of one or more suicide attempts and current suicidal ideation. The first three months after the onset of depressive symptoms have been found to be the period with the highest risk of suicide attempts (Malone et al. 1995). Clinical vigilance is generally important in major depression, although the presence of other psychiatric morbidity connected to suicide risk must be considered (Bertolote et al. 2004).

The primary evaluation of patients who have attempted suicide but whose life has been saved, offered by psychiatric consultations in emergency rooms as well as crisis management, are clinically significant interventions that may reduce further suicide risk. The treatment in a crisis situation may provide the patient with valuable experience of the fact that meaningful personal interactions and psychic renewal in a relationship with another person are still possible (Lehtonen 1978).

Qin and Nordentoft (2005) investigated the suicide risk in relation to psychiatric hospitalization and found two main peaks immediately (one week) after admission and
on discharge. The risk was high among patients with affective disorders and before a short period of hospital treatment.

The management of suicidal person includes three main components (Mann 2002):

1. diagnosis and treatment of an existing psychiatric disorder
2. assessment of suicide risk
3. removal of the means for suicide and specific treatment to reduce the likelihood of a suicide attempt.

Effective evaluation and treatment of depressive symptoms is essential. However, only a small minority (13%) of persons suffering from a depressive episode have been found to receive adequate doses of antidepressant medication during the preceding year. This occurred despite a generally increasing trend in antidepressant medical treatment (Laukkala et al. 2001).

Lithium has been shown to produce antisuicidal effects among bipolar patients and patients with recurrent unipolar depression (Baldessarini et al. 2001; Tondo et al. 2003; Cipriani et al. 2005; Kessing et al. 2005). However, when investigating the antisuicidal effects of lithium, selectivity may be a problem, because many studies are conducted in severely depressed inpatients (Dunner 2004) or because patients who are already at high risk of suicide are not normally recruited to randomized trials (Cipriani et al. 2005). A similar effect has been seen for clozapine, which has been shown to be effective in reducing suicide risk independent of its antipsychotic effects (Meltzer et al. 1995). The favorable risk-diminishing effect of clozapine on suicide attempts of patients with psychotic disorders has been confirmed by the meta-analysis of Hennen and Baldessarini (2005), although the effect of clozapine in reducing the risk of completed suicides was not as convincing.

The possible effects of the selective serotonin reuptake inhibitors (SSRIs) on the risk of suicidal behavior have been widely discussed by researchers. The possibility of an SSRI (fluoxetine) inducing suicidal ideation was first introduced by Teicher and coworkers in 1990 (Teicher et al. 1990). Since then, studies both for and against have been published indicating either positive treatment effects of SSRIs in reducing suicides (Hall et al. 2003) or an increased risk of suicidal behavior during SSRI treatment (Khan et al. 2003; Gunnel et al. 2005). On the other hand, there has been evidence based on the
recent reports of British Medicine and Healthcare Products Regulatory Agency (MHRA) that any increases in the risk of suicidal behavior are likely to be common to all antidepressants, rather than being specific to SSRIs (Gunnell et al. 2005). Isaesson and coworkers (2005) have recently reported a controlled forensic database study of 14,857 suicides, where the hypothesis that the treatment of depressed individuals with SSRIs leads to an increased risk of suicides was not supported.

Moreover, major depression is the main risk factor for suicide and it is reasonable to presume that the treatment of depression reduces the risk of suicide. This evidence is supported by large epidemiologic studies (Isaesson 2000; Hall et al. 2003), which show that the introduction of new antidepressants has increased the prescription of SSRIs in primary care and the presence of fewer side effects has improved the compliance (Hall et al. 2003). Nevertheless, close monitoring of the patient’s wellbeing is important in the treatment of major depression, especially in the early stages of drug treatment, not forgetting other management designs.

As far as therapeutic interventions are concerned, cognitive therapy has shown its efficacy in patients with repeated suicide attempts (Brown et al. 2005) and focusing on impulsivity during psychotherapy may reduce suicidal behavior (Brodsky et al. 1997). In addition, patients suffering from borderline personality disorder with suicidal tendencies were shown to benefit from psychosocial intervention such as dialectical behavior therapy (DBT), which improves interpersonal functioning (Linehan et al. 1994).

2.5.7. Postvention

Although not all individuals who experience loss by suicide need psychological help and support, the situation may be overwhelming for persons with inadequate coping mechanisms (Krysinska 2003). Since the 1990s, formal postvention programs have been established in several countries, especially in North America, Western Europe and Australia (Barlow and Morrison 2002; De Fauw and Andriessen 2003; Campbell et al. 2004). In some countries political, cultural or religious issues and a lack of recognition of the importance of this issue have hampered the systematic development of postvention (Krysinska 2003).
2.5.8. Consideration of subgroups

It has been argued that women may receive greater benefit from suicide prevention efforts than men (Lester 1995). Women are more willing to seek help in distressing life situations or in mental crisis, such as by contacting crisis hotlines (Lester 1995). Stressors precipitating suicidal behavior may differ between genders and this should be taken into account when trying to identify suicidal indicators in men and women (Lester 1995). The incidence of certain suicide methods clusters according to seasonality. For example, hanging is more common during the spring in both genders, and drowning and jumping from high places is seen more often during summer among males. On the other hand, drowning is more common among females during the autumn, as is poisoning. Appreciation of these differences may enable the suicide risk to be reduced in certain subgroups (Pirkola et al. 2003).

People with a serious somatic illness have shown only slightly increased suicide risk, even in spite of possible comorbid psychiatric disorder (Henriksson et al. 1995). In a Finnish study, 88% of patients who had committed suicide during treatment in a general hospital setting suffered from one or more psychiatric disorders, the most prevalent being major depression (62% of victims). Only a few had received psychiatric assessment during their general hospital in-patient treatment (Suominen et al. 2002). This can be regarded as a serious challenge for consultation-liaison psychiatry.
3. Aims of the study

The aim of the study was to investigate suicidal ideation at the population level with a 12-month follow-up and to analyze all committed suicide cases during a ten-year period (1988-1997) in the province of Kuopio in Eastern Finland. The specific aims of the separate studies were:

I. Firstly, to investigate the incidence, prevalence, persistence of and recovery from suicidal ideation, and associated factors, in a sample of a Finnish general population. Secondly, to determine the proportion of those with suicidal ideation who were in contact with health services for psychological distress during the 12-month follow-up period.

II. To examine urban-rural differences in male suicide mortality between 1988 and 1997.

III. To analyze the changes in regional (urban-rural) suicide rates for the province of Kuopio and compare the finding with those for the whole country.

IV. To investigate gender-related changes in suicide rates and methods.

V. To examine the associations between mean alcohol consumption and female suicide mortality, the manifestation of suicides in relation to alcohol use and the development of ‘alcohol related’ deaths among women.
4. Subjects and methods

4.1. Data collection

4.1.1. Study 1

4.1.1.1. Postal questionnaires

This study of suicide ideation in the general population was a part of a project on depression project by the Department of Psychiatry at the Kuopio University Hospital. In April and May 1998, 3004 postal questionnaires including the 21-item Beck Depression Inventory (BDI-21) (Beck et al. 1961, 1988) were mailed to subjects from a stratified general population sample (residents of the province of Kuopio, Finland, aged 25-64 years). The sample was selected from the National Population Register. The same questionnaires were mailed again 12 months later on follow-up. The study was described in detail in a letter, which, among other things, stated the voluntary basis of participation. Non-respondents received the same letter and questionnaire again 4-5 weeks after the first contact. By returning one of these questionnaires the respondents expressed their informed consent to participate in the study. The study protocol was approved by the Research Ethics Committee of the Kuopio University Hospital and the University of Kuopio.

At baseline, 2050 study questionnaires (68%) were returned. More men than women did not respond (39 vs. 25%, p < 0.001). The non-responding men were slightly younger than the responding men (mean age 42.3 years, SD 10.1 vs. 44.8 years, SD 10.5, p < 0.001), but no difference was found among women (mean age 43.1 years, SD 11.0 vs. 43.9 years, SD 10.8, respectively). On follow-up, men more often than women did not respond (26 vs. 19%, p < 0.001). Both the non-responding men and women were younger than the respective respondents (in men: mean age 41.7 years, SD 10.8 vs. 45.9 years, SD 10.3, p < 0.001, and in women: 41.7 years, SD 11.0 vs. 44.5 years, SD 10.7, p < 0.001). Nevertheless, there were no statistically significant differences in the prevalence of suicidal ideation at baseline between non-responding and responding men (15 vs. 14%) or women (13 vs. 9%).
A total of 1593 subjects responded to both inquiries (53% of the initial sample and 78% of the baseline respondents). The final sample included 668 men and 925 women. The mean age was 45.9 years (SD 10.3) for the men and 44.5 years (SD 10.7) for the women.

4.1.1.2. The Beck Depression Inventory item for suicidal ideation

Respondents completed the 21-item Beck Depression Inventory (BDI-21) both at baseline and on follow-up (Beck et al. 1961; 1988). The Finnish version of the BI-21 was validated in 1977 (Raitasalo 1977). One of the BDI items relates to self-destructiveness. The responses “I have definite plans to commit suicide” and “I would kill myself if I had the chance” were selected to indicate the presence of active suicidal ideation. The response “I feel I would be better off dead” indicated death wishes that also belong to the wide spectrum of suicidal ideation (Dikestra and Garnefski 1995). The response “I don’t have any thoughts of harming myself” was selected to indicate the absence of suicidal ideation. In calculating the BDI mean scores the suicidality item was excluded (range 0-60).

4.1.1.3. Other variables

In addition to basic sociodemographic variables, the subjects were also asked about their marital status (unmarried, co-habiting or married, separated or divorced, widowed, other), employment status (employed, unemployed, student, disabled or retired, other) and their financial situation during the previous 12 months (“How is your current financial situation?” was classified as 1-2 for a good financial situation and 3-4 for financial hardship). At baseline, participants were asked about their smoking habits and frequency of alcohol intake. Those who reported drinking alcohol two times or more a week were recorded as frequent alcohol drinkers. Subjects were divided into two groups according their smoking habits (daily smokers/ others). At follow-up the respondents were asked whether they had sought professional help for psychological distress during the previous 12 months (general practitioners, other primary care settings, psychiatrists
and clinical psychologists, other outpatient mental health clinics, inpatient services, none).

4.1.2. Studies II-IV

4.1.2.1. Medico-legal autopsy reports

Data from 1988 to 1997 (Studies II-IV) were collected from forensic medical autopsy records of the Department of Social Affairs and Health (Provincial State Office of Eastern Finland, Kuopio), where all suicide cases were autopsied. In Finland, every death with a possibly unnatural cause must be reported to the police. This includes all cases with a suspicion of trauma, poisoning or self-inflicted injury. In these cases the Finnish law for determining causes of death demands a medico-legal autopsy. A specialist in forensic pathology determines the mode of death based on medical history, the police report and autopsy findings. The final medico-legal autopsy report includes the police report, previous medical history, autopsy report, toxicological analysis and a summary.

A total of 823 suicide cases were autopsied in this way between 1988 and 1997. Based on age-grouping of official statistics, cases under 15 years of age were excluded (n = 3; including one boy and two girls). During the ten-year period under study (from 1988 to 1997), 37 children from 5 to 14 years of age had committed suicide in the whole country (Statistical Yearbooks of Finland 1987-1999). Persons without a permanent resident status in the province of Kuopio were also excluded (n = 43; including 36 men and 7 women). The final number of cases was 777. In Study II the total number of male victims was 609, including 293 male suicide victims in urban and 316 in rural regions. In Study III the number of cases was 777 (608 male and 169 female victims) and data for Study IV was obtained from 169 female victims.

Data from the medico-legal autopsy reports were analyzed using the SPSS package (version 11.5, for Windows).

4.1.2.2. Data derived from official statistics

The age-specific suicide rates for the whole country and the province of Kuopio were derived from the annual national statistical reports of Finland (Statistical Yearbook of

In comparing the national and regional data, the age-adjusted suicide mortality (≥ 15 years of age) and alcohol-related deaths for Eastern Finland were calculated as the number of suicides per 100,000 inhabitants per year. When calculating the age-adjusted suicide mortality, the data for the reference population were derived from the Finnish Statistics (Statistical Yearbook of Finland 1997. Causes of Death 1997, Appendix 5). In order to account for annual fluctuations, suicide mortality rates were calculated by using moving averages with a three-year interval.

4.1.2.3. Variables

4.1.2.3.1. Gender, age and marital status

In Study II suicide mortality was investigated in men, while Study III focused on differences in suicide mortality between men and women. In Study IV, suicides in women were analyzed in relation to the post mortem alcohol concentration in blood and urine and the findings of suicide mortality in women were put in perspective by using mean alcohol consumption in the general population.

The age grouping of subjects differed between Studies II-IV. In Study II, subjects were divided into three age classes: 15-34 years, 35-64 years and 65 years of age or older. In Study III, suicide cases were divided into six age-groups: 15-24, 25-34, 35-44, 45-54, 55-64 and 65 years or older. In Study IV, suicide victims were divided into three groups: 15-44 years, 45-64 years and 65 years or older. Marital status was classified as unmarried, married, widowed, divorced or lack of data.

4.1.2.3.2. Regional division of the province

The province was divided into urban and rural regions. The urban regions included the four largest municipalities with a population of over 15,000 inhabitants and a population density of over 25 inhabitants per km² (the mean population density was 59 inhabitants
per km$^2$). The rural regions included 20 municipalities with a population of under 15,000 inhabitants. The rural annual population density was under 12 inhabitants per km$^2$ and the mean population density was 6 per km$^2$. Only victims permanently resident in the province were included in the data analysis.

### 4.1.2.3.3. Suicide methods

During the study period, from 1988-1997, the diagnoses were based on the International Classification of Diseases (ICD). The ICD-9 (Classification of Diseases 1987, 1986) was used in Finland during 1979-1995 and the ICD-10 (Classification of Diseases 1995, 1995) since 1995. In the study of suicides the diagnoses indicating the cause of death by suicide have been classified to be equivalent concerning both the ICD-9 and the ICD-10 (Table 2).

**Table 2.** Suicide methods according to the ICD-9 and ICD-10 classification of diseases.

<table>
<thead>
<tr>
<th>Suicide method</th>
<th>ICD-9</th>
<th>ICD-10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Violent methods:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firearms / explosives</td>
<td>E955A</td>
<td>X72-X75</td>
</tr>
<tr>
<td>Cutting / piercing</td>
<td>E956A</td>
<td>X78</td>
</tr>
<tr>
<td>Hanging</td>
<td>E953A</td>
<td>X70</td>
</tr>
<tr>
<td>Drowning</td>
<td>E954A</td>
<td>X71</td>
</tr>
<tr>
<td>Jumping from a height</td>
<td>E957A</td>
<td>X80</td>
</tr>
<tr>
<td>Suicides in traffic</td>
<td>E959A, E959B</td>
<td>X81, X82</td>
</tr>
<tr>
<td>Other determined</td>
<td>E959X</td>
<td>X76, X77, X79, X83</td>
</tr>
<tr>
<td><strong>Non-violent methods:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas poisoning</td>
<td>E951A, E952A</td>
<td>X67</td>
</tr>
<tr>
<td>Intoxication by solids / liquids</td>
<td>E950A</td>
<td>X60-X66, X68, X69</td>
</tr>
<tr>
<td>Undetermined</td>
<td>E959X</td>
<td>X84</td>
</tr>
</tbody>
</table>
Suicide methods included intoxication by solids or liquids, gas poisoning, hanging, drowning, firearms, cutting / piercing, jumping from a height, under a moving vehicle and suicide by driving a vehicle and other / undetermined method. For further investigation, suicide methods were divided into violent methods (firearms / explosives, cutting / piercing, hanging, drowning, jumping from a height and suicides in traffic), non-violent methods (gas poisoning and intoxication by solids or liquids), and suicide by an undetermined cause.

4.1.2.3.4. Samples for BAC and UAC determination

Data on alcohol concentrations in the blood and urine of suicide victims were analyzed in Study IV. Screening for ethyl alcohol was performed routinely from the urine or the vitreous humor of the victim by the QED Saliva Alcohol Test (OraSure Technologies, Inc.). The accuracy of the postmortem screening protocol using the vitreous humor has earlier been confirmed (Engelhart and Jenkins 2001). In the case of positive results, blood samples were obtained from the femoral vein and quantitative analysis of the blood alcohol concentration (BAC) was performed. Samples for determination of the urine alcohol concentration (UAC) were gathered from the victims’ urinary bladder. Alcohol determinations were performed by gas chromatography. The BAC and UAC were reported in per mill (‰) as equivalent to 1g/1 liter. The presence of alcohol was determined as a blood concentration of 0.01‰ or over. Blood concentrations of ≥ 0.5‰ were considered as having a potential influence on the suicidal act, because blood alcohol concentrations below 0.5‰ may be due to endogenous post-mortem alcohol production (Nordrum et al. 2000). A BAC over 1.5‰ was considered as indicating a state of heavy alcohol intoxication (Crombie et al. 1998).

The state of inebriation in alcohol-positive suicide victims was determined according to the relative values of BAC and UAC (Gordon et al. 1988; Raekallio et al. 1981). The alcoholic state was divided into five groups: an early increasing state (UAC < BAC), late increasing state (UAC less than 20% greater than BAC), early decreasing state (UAC 20-50% greater than BAC), late decreasing state (UAC over 50% greater than BAC) and the final decreasing state of alcohol inebriation (UAC > 0‰ and BAC = 0‰). For the investigation of the state of inebriation, a total of 143 cases were available.
for which BAC as well as UAC were known (the basic group). In 26 cases only the BAC was known and hence the state of inebriation could not be determined (the missing group). There were relatively more alcohol-positive cases in the missing group than in the basic group (65% vs. 29%; $\chi^2 = 13.15$, df = 1, p < 0.001). However, there were no statistically significant differences between the basic group and the missing group concerning other variables (age, area of residence, suicide methods or BAC; data not shown).

### 4.2. Data analysis

When investigating time trends of regional suicide rates and specific variables, the ten-year study period was divided into 5 two-year periods (1988-89, 1990-91, 1992-93, 1994-95 and 1996-97). This was done to avoid annual fluctuation and based on the divergence of the number of suicide cases between men and women. When comparing the suicide mortality between the province of Kuopio and the whole country, local suicide rates were calculated as a moving average of three adjacent years.

The age-adjusted suicide mortality and ‘alcohol-related’ deaths for Eastern Finland were calculated as the number of suicides per 100,000 inhabitants (aged 15 years or older) per year (Statistical Yearbook of Finland 1997 and 1998; Wasswertheil-Smoller, 1995).

#### 4.2.1. Statistical analysis

Percentages and graphical presentation were used as descriptive statistics. Significant differences in proportions were assessed with the chi-squared test for independence and 95% confidence intervals (95% CI). Differences in means were assessed using the T-test for independent samples and the non-parametric Mann-Whitney U-test or Wilcoxon Signed Ranks test for dependent samples. The distribution for the compared groups was tested by the Kolmogorov-Smirnov test. Crude and adjusted odds ratios for the risk of suicidal ideation were calculated using logistic regression analyses. Multivariate models were also used to identify those factors that were independently associated with the occurrence of suicidal ideation and recovery. Temporal changes in suicide mortality
were examined with the Mantel-Haenszel test (M-H) for linearity. When investigating whether mean alcohol consumption correlated with suicide mortality or ‘alcohol-related’ deaths, bivariate correlations were first calculated and then the univariate and multivariate regression analyses were performed by using the Cochrane-Orcutt correction for serial autocorrelation, where the consumption of alcohol, the number of suicides and the number of ‘alcohol-related’ deaths were the covariates (Brockwell and Davis, 1996).
5. Results

5.1. Suicidal ideation at the population level (Study 1)

Both the 12-month incidence and prevalence of suicidal ideation were higher in men than women (4.6% and 14.7% in men vs. 3.1% and 9.2% in women). On follow-up, 69% of those men and 59% of those women who had suicidal ideation at baseline continued to have suicidal thoughts during the following year. There were no statistically significant differences in the prevalence of suicidal ideation at baseline between non-responding and responding men (15 vs. 14%) or women (13 vs. 9%).

Table 3. Suicidal ideation in high-risk groups in a sample of the Finnish general population (n = 1,593)\(^a\).

<table>
<thead>
<tr>
<th>Risk factors at baseline</th>
<th>At baseline</th>
<th>On 12-month follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p-value(^b)</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>Living alone vs. others</td>
<td>21 vs. 9 &lt; 0.001 2.8 2.0–3.8</td>
<td>18 vs. 9 &lt; 0.001 2.1 1.8–2.0</td>
</tr>
<tr>
<td>Unemployed vs. others</td>
<td>21 vs. 10 &lt; 0.001 2.3 1.5–3.5</td>
<td>19 vs. 10 &lt; 0.001 2.3 1.5–3.6</td>
</tr>
<tr>
<td>Financial hardship vs. others</td>
<td>21 vs. 9 &lt; 0.001 3.0 2.1–4.1</td>
<td>22 vs. 8 &lt; 0.001 4.9 3.5–6.7</td>
</tr>
<tr>
<td>Frequent alcohol drinking vs. others</td>
<td>21 vs. 10 &lt; 0.001 2.5 1.7–3.6</td>
<td>21 vs. 10 &lt; 0.001 2.4 1.7–3.5</td>
</tr>
<tr>
<td>Daily smoking vs. others</td>
<td>20 vs. 10 &lt; 0.001 2.4 1.7–3.4</td>
<td>22 vs. 9 &lt; 0.001 2.6 2.0–4.0</td>
</tr>
</tbody>
</table>

* In statistical analyses the risk group has been compared with the rest of the sample. \(^b\) \(\chi^2\) test.

At baseline as well as on follow-up suicidal ideation was more common among subjects living alone, being unemployed, having subjective financial problems and being frequent alcohol drinkers or daily smokers (Table 3). Suicidal ideation and the severity of depression were strongly related (Table 4).

Table 4. Beck Depression Inventory scores\(^a\) and suicidal ideation during the 12-month follow-up.

<table>
<thead>
<tr>
<th></th>
<th>At baseline</th>
<th>On 12-month follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>95% CI</td>
</tr>
<tr>
<td>No suicidal ideation</td>
<td>4.6</td>
<td>4.3–4.9</td>
</tr>
<tr>
<td>Occurrence of suicidal ideation(^b)</td>
<td>11.0</td>
<td>8.7–13.4</td>
</tr>
<tr>
<td>Recovery from suicidal ideation(^b)</td>
<td>11.0</td>
<td>9.6–14.1</td>
</tr>
<tr>
<td>Persistent suicidal ideation</td>
<td>14.5</td>
<td>12.7–16.4</td>
</tr>
</tbody>
</table>

\(^a\) Suicidality item not included, range: 0–60. \(^b\) Wilcoxon Signed Ranks test: difference between means, \(p < 0.001\)
The prevalence of suicidal ideation was 51% if the BDI score was 19-28 and 75% if the score was 29 or more. In men, but not in women, unemployment was strongly associated with the occurrence of suicidal ideation (OR 14.13, 95% CI 4.67 - 42.80). In women, age was inversely associated with the risk of suicidal ideation (OR 0.94, 95% CI 0.90 - 0.98). One-third of the men (31%) and women (35%) who had suicidal ideation at baseline contacted a general practitioner or other primary care facilities due to psychological distress during the follow-up. Over half of the men (59%) and women (54%) with suicidal ideation at baseline did not visit any health services because of psychiatric symptoms during the subsequent 12 months and the proportions were the same among men and women with persistent suicidal ideation (56% and 50%, respectively). Less than one-sixth of those who had suicidal ideation at baseline or had persistent suicidal thoughts had received antidepressive medication during the follow-up.

5.2. Regional differences (urban-rural) in suicide mortality among men
(Study II)

The age-adjusted suicide mortality in men remained constant from 67 / 100 000 per year in 1988 to 65 / 100 000 per year in 1997, but the overall male suicide mortality was generally lower in urban than in rural regions. At the beginning of the study period the urban and rural suicide mortality rates in men were quite different (53 in urban and 84 / 100 000 in rural regions in 1988). The difference decreased in the middle of the study period, but increased again towards the end of the study period (Figure 1).

In urban regions, the decline of age-specific suicide mortality was apparent among young and old men and was also seen in the group of individuals aged 35-64 years after 1992-1993. No decline was seen in the rural region (Figure 2).
Violent suicide mortality in men was higher in rural than in urban regions (47 / 100 000 in rural and 30 / 100 000 in urban regions, p < 0.001). The proportion of violent suicides declined from 90% in 1988-1989 to 74% in 1996-97 (p < 0.05). Men from rural
regions used violent methods more often than men living in urban surroundings \((p = 0.04)\). In urban regions, the mean age of suicide victims was lower \((p = 0.02)\) and more individuals were divorced \((p < 0.001)\) and living alone \((p = 0.01)\) than in rural regions. In rural regions suicide victims were more likely to have no partner and to be living in their primary family \((p = 0.01); \text{Table 5}\).

**Table 5.** Urban-rural differences among male suicide victims in mean age, marital status, household type and violence of suicide method.

<table>
<thead>
<tr>
<th></th>
<th>Urban</th>
<th>Rural</th>
<th>(\chi^2)</th>
<th>df</th>
<th>(p)-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>40.8 yrs</td>
<td>44.2 yrs</td>
<td>22.4</td>
<td>4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(95% CI)</td>
<td>(38.1-42.5)</td>
<td>(42.3-46.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital statusa:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>single</td>
<td>119 (40.8)</td>
<td>156 (49.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>married</td>
<td>109 (37.3)</td>
<td>113 (35.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>divorced</td>
<td>53 (18.1)</td>
<td>23 (7.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>widower</td>
<td>9 (3.1)</td>
<td>14 (4.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>data missing</td>
<td>2 (0.7)</td>
<td>10 (3.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>292 (100.0)</td>
<td>316 (100.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household typeb:</td>
<td></td>
<td></td>
<td>14.6</td>
<td>5</td>
<td>0.01</td>
</tr>
<tr>
<td>living alone</td>
<td>112 (38.4)</td>
<td>85 (26.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>living with primary family</td>
<td>36 (12.3)</td>
<td>66 (20.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>living with family</td>
<td>108 (37.0)</td>
<td>122 (38.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>living with children</td>
<td>2 (0.7)</td>
<td>6 (1.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>living in institution</td>
<td>13 (4.4)</td>
<td>14 (4.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>data missing</td>
<td>21 (7.2)</td>
<td>23 (7.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>292 (100.0)</td>
<td>316 (100.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place of deathb:</td>
<td></td>
<td></td>
<td>6.4</td>
<td>5</td>
<td>0.05</td>
</tr>
<tr>
<td>home</td>
<td>159 (54.3)</td>
<td>166 (52.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>room of building</td>
<td>42 (14.3)</td>
<td>64 (20.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>countryside/mature</td>
<td>36 (12.3)</td>
<td>33 (10.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>other building</td>
<td>26 (8.9)</td>
<td>20 (6.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>public place</td>
<td>23 (7.8)</td>
<td>20 (6.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>institution</td>
<td>7 (2.4)</td>
<td>12 (3.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>293 (100.0)</td>
<td>315 (100.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suicide methodc:</td>
<td></td>
<td></td>
<td>4.2</td>
<td>1</td>
<td>0.04</td>
</tr>
<tr>
<td>violent</td>
<td>216 (73.7)</td>
<td>255 (80.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>non-violent</td>
<td>77 (26.3)</td>
<td>61 (19.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>293 (100.0)</td>
<td>316 (100.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a One case missing in urban area.

*b One case missing in rural area.

**5.3. Gender-related differences in suicide mortality (Study III)**

Male suicide rates in the province declined rapidly during 1988-1992 from 71 to 53 / 100 000 per year followed by a subsequent increase during 1993-1997 from 55 to 58 / 100 000 per year. Moreover, the rates for the whole country declined continuously during the entire study period. Female suicide rates in the province varied and remained
at a higher level than the national average (Figure 3). The male to female ratio remained unchanged and was similar in the province to that in the whole country (3.6:1 in the province vs. 3.7:1 in the whole country).

![Figure 3](image.png)

**Figure 3.** Suicide mortality in the province of Kuopio and the whole of Finland from 1988 to 1997.

Men committed suicide at a younger age than women (42.6 years; 95% CI 41.4–43.9 vs. 47.5 years, 95% CI 45.1–49.8, respectively; Mann-Whitney U-test, p < 0.001). When investigating the temporal changes in mean age, in 1988-1989 male suicide victims were younger than female victims (41.8 years, 95% CI 39.2–44.5 vs. 49.5 years, 95% CI 45.1–53.9; Mann-Whitney U-test, p = 0.003). However, after 1989 the mean age of male victims increased, while it decreased in women. In 1996-1997 the difference disappeared (mean age in men 45.2 years, 95% CI 42.3–48.1 and women 47.0 years, 95% CI 41.1–53.0; Mann-Whitney U-test, p = 0.4). The decline in the mean age in women was mostly due to female victims from urban regions, whereas the
increase in men age of men was caused by an increase in the number of older male suicide victims from rural regions (Figure 4).

**Figure 4.** Mean ages of suicide victims (urban-rural) in the province of Kuopio, Eastern Finland, from 1988 to 1997.

When analyzing both genders combined in relation to age, there was a clear peak in suicide cases in the age group of 35-44 years. However, when examining the genders separately, there was a clear peak in suicide cases in this group among men, whereas among women none of the age groups showed a clear accumulation of cases ($p = 0.008$; Table 6).

**Table 6.** Suicide cases ($n = 777$) according to age group.

<table>
<thead>
<tr>
<th>Age group* (years)</th>
<th>Men n (%)</th>
<th>Women n (%)</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–24</td>
<td>77 (12.7)</td>
<td>10 (5.9)</td>
<td>87 (11.2)</td>
</tr>
<tr>
<td>25–34</td>
<td>119 (19.6)</td>
<td>36 (17.8)</td>
<td>155 (19.2)</td>
</tr>
<tr>
<td>35–44</td>
<td>168 (27.6)</td>
<td>35 (20.7)</td>
<td>203 (26.1)</td>
</tr>
<tr>
<td>45–54</td>
<td>103 (16.9)</td>
<td>37 (21.9)</td>
<td>140 (18.0)</td>
</tr>
<tr>
<td>55–64</td>
<td>74 (12.2)</td>
<td>34 (18.8)</td>
<td>108 (13.5)</td>
</tr>
<tr>
<td>65 or older</td>
<td>87 (11.8)</td>
<td>26 (15.4)</td>
<td>113 (14.2)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>608 (100.0)</td>
<td>169 (100.0)</td>
<td>777 (100.0)</td>
</tr>
</tbody>
</table>

* Differences in the proportions between men and women: $\chi^2 = 15.66$, df = 5, $p = 0.008$. 
As far as suicide methods were concerned, hanging was the only method for which the mean age of men and women differed significantly (47.3 years, 95% CI 45.0-49.7 for men vs. 52.6 years, 95% CI 48.0-57.1 for women; Mann-Whitney U-test, p = 0.04). Hanging was the most frequent suicide method among men and self-poisoning (solids / liquids) among women (Table 7).

Table 7. Suicide methods in the province of Kuopio, Eastern Finland, from 1988 to 1997.

<table>
<thead>
<tr>
<th>Suicide method*</th>
<th>Men, n (%) (95% CI)</th>
<th>Mean age, years (95% CI)</th>
<th>Women, n (%) (95% CI)</th>
<th>Mean age, years (95% CI)</th>
<th>Total, n (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanging</td>
<td>205 (33.7) (20.0-37.0)</td>
<td>47.3 (45.0-49.7)</td>
<td>31 (29.6) (27.0-37.9)</td>
<td>52.6 (48.0-57.1)</td>
<td>255 (32.8)</td>
</tr>
<tr>
<td>Firearms and explosives</td>
<td>203 (33.2) (29.0-37.0)</td>
<td>38.5 (36.3-40.7)</td>
<td>0 (0.0) (0.0-6.7)</td>
<td>43.0 (42.5-43.5)</td>
<td>208 (26.8)</td>
</tr>
<tr>
<td>Poisoning</td>
<td>109 (17.9) (15.0-21.0)</td>
<td>43.3 (41.2-45.6)</td>
<td>74 (65.1) (56.0-83.0)</td>
<td>45.0 (42.1-48.0)</td>
<td>183 (23.6)</td>
</tr>
<tr>
<td>Gas poisoning</td>
<td>27 (4.5) (2.8-6.1)</td>
<td>36.0 (32.9-39.1)</td>
<td>1 (0.6) (0.0-1.8)</td>
<td>22.0 (16.3-28.6)</td>
<td>28 (3.6)</td>
</tr>
<tr>
<td>Drowning</td>
<td>19 (3.1) (1.7-4.5)</td>
<td>46.0 (38.1-53.9)</td>
<td>16 (9.5) (5.0-14.9)</td>
<td>58.0 (46.0-62.0)</td>
<td>35 (4.5)</td>
</tr>
<tr>
<td>Traffic suicides</td>
<td>10 (1.7) (0.6-3.7)</td>
<td>56.6 (28.4-43.3)</td>
<td>9 (5.3) (1.9-8.8)</td>
<td>58.0 (37.6-69.0)</td>
<td>28 (3.7)</td>
</tr>
<tr>
<td>Jumping from a high place</td>
<td>10 (1.7) (0.6-2.7)</td>
<td>33.4 (26.8-40.0)</td>
<td>10 (5.9) (7.2-9.5)</td>
<td>37.9 (21.3-54.5)</td>
<td>20 (2.6)</td>
</tr>
<tr>
<td>Sharp object</td>
<td>9 (1.5) (0.5-2.4)</td>
<td>52.2 (48.1-64.4)</td>
<td>2 (1.2) (0.0-2.8)</td>
<td>62.5 (56.2-68.9)</td>
<td>11 (1.4)</td>
</tr>
<tr>
<td>Other methods</td>
<td>11 (1.8) (0.7-3.7)</td>
<td>40.5 (32.1-48.6)</td>
<td>1 (0.6) (0.0-1.8)</td>
<td>40.0 (34.0-46.0)</td>
<td>12 (1.5)</td>
</tr>
<tr>
<td>Total</td>
<td>688 (100.0)</td>
<td>42.4 (41.4-43.9)</td>
<td>169 (100.0)</td>
<td>47.5 (45.1-49.8)</td>
<td>777 (100.0)</td>
</tr>
</tbody>
</table>

* Differences in the proportions between men and women: χ²=112.69, df=8, p < 0.001.
† Mann-Whitney U test, p = 0.04.
‡ Only one case.
§ Mann-Whitney U test, p = 0.001.

When investigating temporal changes in the relative proportions of suicide methods in men and women, the proportion of self-poisoning suicides showed a rising trend between 1988-89 and 1996-97, which reached significance among men (from 12% to 22%; M-H = 5.36, df = 1, p = 0.02) but not among women (from 33% to 42%; M-H = 0.003, df = 1, p = 0.96). At the same time, there was a downward trend for men in suicides by hanging as well as using firearms or explosives. There were no changes in the relative proportions of suicide methods among women during the study period (Table 8).
## Table 8. Temporal changes in suicide methods in the province of Kuopio, Eastern Finland, from 1988 to 1997.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanging</td>
<td>56/13 (40.6/3.0)</td>
<td>46/17 (28.2/3.5)</td>
<td>35/9 (22.6/2.5)</td>
<td>40/13 (23.4/3.5)</td>
<td>34/8 (29.3/2.5)</td>
<td>205/50 (33.7/2.6)</td>
</tr>
<tr>
<td>Firearms and explosives</td>
<td>58/96 (32.9/2.4)</td>
<td>41/11 (33.8/3.3)</td>
<td>35/9 (23.1/3.3)</td>
<td>41/10 (23.1/3.3)</td>
<td>37/8 (27.6/2.5)</td>
<td>202/50 (33.2/2.5)</td>
</tr>
<tr>
<td>Poisioning (solid/liquids)</td>
<td>16/74 (11.0/3.3)</td>
<td>22/20 (10.0/2.5)</td>
<td>16/13 (7.6/4.1)</td>
<td>26/12 (21.4/0.0)</td>
<td>26/13 (22.4/1.9)</td>
<td>109/74 (17.9/4.8)</td>
</tr>
<tr>
<td>Gas poisoning</td>
<td>6/12 (4.2/0.6)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>2/1 (0.6/0.0)</td>
</tr>
<tr>
<td>Drowning</td>
<td>4/8 (5.0/0.5)</td>
<td>6/3 (5.0/0.4)</td>
<td>5/1 (4.9/0.2)</td>
<td>5/1 (4.9/0.2)</td>
<td>5/1 (4.9/0.3)</td>
<td>19/16 (13.9/1.5)</td>
</tr>
<tr>
<td>Traffic suicides</td>
<td>2/2 (1.1/0.0)</td>
<td>2/1 (1.1/0.0)</td>
<td>2/1 (1.1/0.0)</td>
<td>2/1 (1.1/0.0)</td>
<td>2/1 (1.1/0.0)</td>
<td>6/2 (1.4/0.0)</td>
</tr>
<tr>
<td>Jumping from heights</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>3/2 (0.9/0.0)</td>
</tr>
<tr>
<td>Sharp object</td>
<td>2/1 (1.5/0.2)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>1/1 (0.3/0.0)</td>
<td>4/2 (1.5/0.0)</td>
</tr>
<tr>
<td>Other/undetermined</td>
<td>5/1 (1.5/0.0)</td>
<td>5/1 (1.5/0.0)</td>
<td>5/1 (1.5/0.0)</td>
<td>5/1 (1.5/0.0)</td>
<td>5/1 (1.5/0.0)</td>
<td>11/1 (1.5/0.0)</td>
</tr>
<tr>
<td>Total</td>
<td>138/94 (30.6/5.6)</td>
<td>122/35 (29.9/4.9)</td>
<td>108/34 (26.9/4.1)</td>
<td>128/30 (24.0/4.1)</td>
<td>116/31 (25.9/4.0)</td>
<td>608/165 (37.0/5.0)</td>
</tr>
</tbody>
</table>

MW, M/m/women.

### 5.4. Associations between mean alcohol consumption and suicide mortality in women. Associations between mean alcohol consumption and alcohol-related deaths (Study IV)

From 1988 to 1997, the suicide mortality in women declined in two sequences. In 1988 the suicide mortality was 20.0 / 100 000 inhabitants, which was higher than the national figure. During 1988-1991 suicide mortality declined to 14.2 and, after a slight intermediate increase, declined again during 1993-1996 from 17.3 to 12.6 / 100 000. At the end of the study in 1997 the annual suicide mortality in women was 14.9 / 100 000 (Figure 5).
Figure 5. Suicide mortality and ‘alcohol-related’ deaths among women in the province of Kuopio and in the whole of Finland from 1988 to 1997.

The suicide rates in women from 15-44 years and 45-64 years of age remained higher than the national average. From 1988 to 1994, suicide rates for women aged over 65 years were the same as the national average, but thereafter started to decrease, while national rates remained essentially unchanged (Figure 6). The three most frequent suicide methods among women were intoxication by solids or liquids (74 cases; 44%), hanging (50 cases; 30%) and drowning (16 cases; 10%). There was no change in this respect during the study period (data not shown).
Figure 6. The age-specific suicide mortality of women in the province of Kuopio and in the whole of Finland from 1988 to 1997.

At the beginning of the study period, the annual alcohol consumption in the province was 9.00 liters (calculated as 100% alcohol / inhabitant), which was less than the national average. Alcohol consumption in the province increased from 1988 to 1990, but then decreased during the years from 1991 to 1994. During the last three years of the study period (1994-1997), alcohol consumption started to rise again (Figure 7).
Figure 7. The consumption of alcohol beverages as liters of 100% alcohol per inhabitant aged 18 years or more in the province of Kuopio and in the whole of Finland from 1988 to 1997.

‘Alcohol-related’ deaths among women in the province of Kuopio followed a rising trend during 1988-1990 (from 8.1 to 9.6 / 100,000), followed by a slight decline from 9.6 to 8.6 / 100,000 during 1991-1993. Thereafter, ‘alcohol-related’ deaths among women increased during 1993-1997 from 8.6 to 12.9 / 100,000. For the entire period under study, ‘alcohol-related’ deaths among women in the province were above the national average (Figure 5).

No association could be found between the mean annual alcohol consumption of the general population in the province of Kuopio and suicide mortality among women in this region, when investigating both the whole ten-year study period and subperiods. Furthermore, although the trend lines for regional mean alcohol consumption and ‘alcohol-related’ deaths in women in the province were similar, there was no association for the whole study period or the subperiods.
The blood alcohol concentration (BAC) was available for all female suicide victims except one (n = 168). Of the suicide victims, 66% were alcohol-negative, 6% had a BAC between 0.01-0.49%\(\text{v/v}\), 10% had a BAC \(\geq 0.50%\text{v/v}\) but lower than 1.5%\(\text{v/v}\) and 18% had a BAC \(\geq 1.5%\text{v/v}\). These findings remained unchanged throughout the study period.

The mean BAC among the female suicide victims who were under the influence of alcohol during the suicidal act (BAC \(\geq 0.5%\text{v/v}\); n = 47) was 1.7%\(\text{v/v}\) (95% CI 1.5-1.8). At the beginning of the study period the mean BAC remained relatively constant (1988-1989: mean BAC = 1.5%\(\text{v/v}\); 95% CI 1.1-1.9%\(\text{v/v}\); 1990-1991: mean BAC = 1.4%\(\text{v/v}\); 95% CI 1.0-1.8%\(\text{v/v}\)). After 1992 the mean BAC showed a rising trend up to a mean BAC of 2.0%\(\text{v/v}\) for 1996-1997 (95% CI 1.5-2.5%\(\text{v/v}\); Figure 8).

![Mean BAC](image)

**Figure 8.** The mean BAC (± SD) in female suicide victims under the influence of alcohol (BAC \(\geq 0.5%\text{v/v}\); n = 47) in the province of Kuopio, Eastern Finland, from 1988 to 1997.

The comparative statistics for the groups with BAC \(\geq 0.5%\text{v/v}\) and BAC \(< 0.5%\text{v/v}\) or \(0%\text{v/v}\) are presented in Table 9.
Cases from urban regions were more likely to be under the influence of alcohol (BAC ≥ 0.5%\textsubscript{\text{alcohol}}). Suicide cases from urban regions were also more often heavily intoxicated than cases from rural regions (23% with BAC ≥ 1.5%\textsubscript{\text{alcohol}} in urban regions versus 9% in rural regions; $\chi^2 = 5.15$, df = 1, $p = 0.02$; Table 9). The blood alcohol concentration had no effect on the violence of the suicide method (data not shown).

The mean age of all cases was 47.5 years (95% CI 45.1-49.8), which remained statistically unchanged during the period under study (data not shown). However, suicide victims with a BAC ≥ 0.5%\textsubscript{\text{alcohol}} were younger than those with a BAC < 0.5%\textsubscript{\text{alcohol}} or 0%\textsubscript{\text{alcohol}} (mean age 39.4 years, 95% CI 35.6-43.2 versus mean age 50.8 years, 95% CI 48.1-53.6; the Mann-Whitney U-test $p < 0.001$). This difference could be seen during the entire 10-year study period. In the first half of the study period (1988-1992) the mean age of suicide victims with a BAC ≥0.5%\textsubscript{\text{alcohol}} was 40.2 years (95% CI 34.2-46.2) compared to 52.2 years for a BAC <0.5%\textsubscript{\text{alcohol}} or 0%\textsubscript{\text{alcohol}} (95% CI 48.7-55.8; Mann-Whitney U-test, $p = 0.002$). During the latter half of the study period (1993-1997) the corresponding mean ages were 38.5 (95% CI 33.4-43.6) and 49.3 years (95% CI 45.00-53.6), respectively (T-test, $p = 0.005$).

<table>
<thead>
<tr>
<th>Variable</th>
<th>BAC &lt; 0.5% or 0%</th>
<th>BAC ≥ 0.5%</th>
<th>All cases</th>
<th>z2</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Age groups</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-44 years</td>
<td>43 (75.5)</td>
<td>31 (66.0)</td>
<td>74 (44.0)</td>
<td>14.26</td>
<td>2</td>
<td>0.001</td>
</tr>
<tr>
<td>45-64 years</td>
<td>54 (94.6)</td>
<td>14 (29.8)</td>
<td>68 (40.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65 years or older</td>
<td>24 (19.9)</td>
<td>2 (4.2)</td>
<td>26 (15.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>121 (100.0)</td>
<td>47 (100.0)</td>
<td>168 (100.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Area of living</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rural</td>
<td>37 (60.3)</td>
<td>37 (78.7)</td>
<td>130 (55.8)</td>
<td>5.07</td>
<td>1</td>
<td>0.02</td>
</tr>
<tr>
<td>total</td>
<td>121 (100.0)</td>
<td>47 (100.0)</td>
<td>168 (100.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>single</td>
<td>30 (72.8)</td>
<td>16 (37.2)</td>
<td>46 (34.0)</td>
<td>6.25</td>
<td>3</td>
<td>n.s</td>
</tr>
<tr>
<td>married</td>
<td>31 (94.0)</td>
<td>14 (32.6)</td>
<td>45 (40.9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>widower</td>
<td>14 (11.2)</td>
<td>2 (4.6)</td>
<td>16 (9.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>divorced</td>
<td>14 (12.0)</td>
<td>11 (25.6)</td>
<td>25 (15.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>116 (100.0)</td>
<td>42 (100.0)</td>
<td>158 (100.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\*4 cases missing (no alcohol data)
\*5 10 cases missing (9 cases: no marital status data; 1 case: no alcohol data)
Both the BAC and the UAC were available in 143 female suicide cases (85%), allowing us to investigate the state of inebriation. In 68% (97/143) of these cases, both the BAC and the UAC were 0%. Of the remaining cases available to assess the state of alcohol inebriation, most (85%; 39/46) were in different phases of a decreasing state of alcohol inebriation during the suicidal act (Table 10).

**Table 10.** The state of inebriation according to urine and blood alcohol concentrations (UAC, BAC) in the female suicide cases from 1998 to 1997.

<table>
<thead>
<tr>
<th></th>
<th>n (%)</th>
<th>groups (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No influence of alcohol</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UAC = 0% and BAC = 0%</td>
<td>97 (57.4)</td>
<td>97 (57.4)</td>
</tr>
<tr>
<td><strong>Increasing state of inebriation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early: UAC &lt; BAC</td>
<td>3 (1.8)</td>
<td>7 (4.1)</td>
</tr>
<tr>
<td>Late: UAC less than 20% &gt; BAC</td>
<td>4 (2.4)</td>
<td></td>
</tr>
<tr>
<td><strong>Decreasing state of inebriation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early: UAC 20-50% more than BAC</td>
<td>16 (9.5)</td>
<td>39 (23.1)</td>
</tr>
<tr>
<td>Late: UAC over 50% more than BAC</td>
<td>18 (10.7)</td>
<td></td>
</tr>
<tr>
<td>Last: UAC &gt; 0%, BAC = 0%</td>
<td>5 (3.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Missing cases</strong></td>
<td>26 (15.4)</td>
<td>26 (15.4)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>169 (100.0)</td>
<td>169 (100.0)</td>
</tr>
</tbody>
</table>
6. Discussion

6.1. Main findings

Suicidal ideation is common in the Finnish general population, depression being the most important causative factor in both sexes. Suicidal ideation seems to be a chronic symptom. Only a minority of suicidal individuals seek professional help. Hence, depression associated with suicidal ideation often remains undetected and untreated.

Male suicide mortality differed depending on the living environment (urban or rural), and in this respect results were consistent during the whole ten-year study period.

Gender-related differences in suicide mortality diminished over the period under study. At the beginning, men committed suicide at a younger age than women. However, this difference disappeared towards the end of the study period. The difference between genders in the chosen suicide method also diminished.

In women, suicide victims under the influence of alcohol at time of death were on average younger than sober victims. The blood alcohol concentration (BAC) of female suicide victims displayed a rising trend. However, the BAC had no effect on the violence of the suicide method.

6.2. Suicidal ideation

The 12-month prevalence of suicidal ideation recorded in Study I was approximately the same as that found in the Greek general population (Madianos et al. 1993) and somewhat higher than values reported from the US (Crosby et al. 1999), Australia (Goldney et al. 2000) and some other countries (Weissman et al. 1999). Nevertheless, comparison of these studies is difficult because of three methodological differences. First, the methods of surveys may vary between studies, i.e. suicidal ideation may be evaluated by telephone interviews, postal questionnaires or face-to-face interviews. Second, the time periods of the follow-up studies can be different. The longer the follow-up period, the more likely people are to forget their suicidal ideation and thus the prevalence of suicidal ideation may be lower than expected. Third, the phrasing and the way questions are formulated may influence the answer. If suicidal ideation is inquired
by a strict question, the prevalence may my lower than when the suicidal ideation is asked about in a more common way. However, this is the first study to prospectively assess the incidence of suicidal ideation and associated factors in a general population.

A noteworthy finding of the study was the higher suicidal ideation in men than in women and the high persistence of suicidal thoughts in both genders during the follow up. Based on the persistent nature of suicidal ideation, it can be assumed that despite the one year follow-up period the incidence of suicidal ideation can be observed with a sufficiently high validity. In addition, the sample of the general population in the current study was large enough and thus the representativeness of the sample reduces the average variation.

In addition, more than 50% of the persons suffering from suicidal ideation either at baseline or during the follow-up period did not contact health care providers. Less than one-sixth of those who had persistent suicidal ideation had received antidepressant medication. For example, in a British cohort study by Gunnell and coworkers (2004) the incidence of suicidal thoughts in the general population was lower than in the current study (2.0% in men and 2.3% in women) and 43% had persistent suicidal thoughts (Gunnell et al. 2004).

People with suicidal ideation may not be aware of the availability of professional help. This stresses the importance of general information to increase public awareness about the possible consequences of mental distress in stressful life situations and the necessity of outreach services for distributing preventive and clinical recommendations.

Although young and elderly people are the groups with a high incidence of suicidal ideation, old age may protect people from depression and associated self-destructiveness, because older people may have had a full life and developed an ability to survive the challenges of life, which can be regarded as a protective factor (Henderson 1994).

### 6.3. Suicide mortality

During previous decades there was a slight (but constant) increase in suicide mortality in Finland. This was especially pronounced during the 1950s, followed by a relatively
long and stable period starting from the middle of the 1960s. The next rise in suicide rates in Finland occurred in the 1980s (Lönnqvist et al. 2003). In Eastern Finland, suicide rates were already above the national average before the time period under investigation. Suicide mortality rates for men in 1987 were 76.3 / 100 000 in the province of Kuopio and 44.6 / 100 000 inhabitants in the whole country and the corresponding figures for women were 20.7 and 11.7 / 100 000 inhabitants (Itsemurhat Kuopion läänissä 1987, 1989, Statistical Yearbook of Finland 1987, 1987). During the study period (1988-1997) the male suicide rates remained at a high level, but turned to a large decrease during 1988-1992 (from 71 to 53 / 100 000 per year) followed by a subsequent increase from 1993-1997 (from 55 to 58 / 100 000 per year). Rates for men remained higher than mean rates for the whole country. Female suicide rates in the province varied and remained at a higher level than the national average. On the national level, suicide mortality started to decrease from the early 1990s, which coincided with a severe economic recession in Finland (Hintikka et al. 1999). This decrease in mortality has continued until today (Lönnqvist et al. 2003, Pirkola and Sohlman 2005).

In Finland, the prevalence of completed suicides, attempted suicides as well as suicidal ideation is higher in men than in women. In many other countries this difference cannot be observed (Ostamo et al. 1994). The higher rates of suicidal thoughts among men, higher lethality of the suicide methods chosen and easy access to firearms in regions where hunting is common (Hintikka et al. 1997) may together explain the greater difference between men and women in this local region compared to national data. This may also explain the divergence between local and national suicide rates.

6.4. Regional differences (urban-rural)

The male suicide mortality rate and the mean age of the male victims were higher in less densely populated regions. In addition, a declining trend in suicide mortality was only found for men from urban areas. Since 1992-1993 there has been a considerably increase in suicide mortality in middle-aged and old men from rural environments. This
is in keeping with earlier findings (Dudley et al. 1992; Isometsä et al. 1997a; Saunderson et al. 1998) and indicates a very worrying development.

Many of the male suicide victims from an urban environment lived alone. Living alone may be a deliberate choice or it may be related to a poor quality of life and an insufficient social network. In rural regions, living as an adult in a household with one or more persons may also mean living with one or both parents. This may be associated with psychiatric illness, alcohol abuse or difficulties in finding a partner. The latter is often related to a relative shortage of young adult women in less densely populated regions. Similar results have been found in previous studies (Heikkinen et al. 1994b; Heikkinen et al. 1995; Saarinen 1995; Elder et al. 1996; Isometsä et al. 1997a).

People in rural environments may have less access to public health services than people from more densely populated regions (Yuen et al. 1996, Salander Rehnberg and Jacobsson 1999). Between 1991 and 1994, Finland suffered from a severe economic recession. On a national level this led to a reduction in psychiatric in-patient treatment facilities. Furthermore, the outpatient treatment was shifted to communal health center related services at the expense of specialized services at psychiatric clinics. These changes in connection with other economic constraints may have had a negative effect on secondary prevention for suicidal patients. This may have been more so in rural regions with a lower population density.

6.5. Gender related differences

Gender-related differences in the mean age of suicide victims, with male victims being on average younger than females, decreased during the study period. At the same time there was a decline in the mean age of female victims from urban environments. However, in rural environments the mean age of male victims increased. As far as suicide methods are concerned, only hanging, which represents 30% of all cases, showed a statistically significant difference between men and women. During the 10-year study period the mean age of victims remained unchanged when analyzed according to suicide method. One possible explanation may be the rise in the mean age of the general population in the study area during 1988-1997 (Official Statistics of
Finland 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998). The mean age of male suicide victims rose slightly more than the mean age of the population as a whole. However, the change in the general population does not explain the decline in the mean age of female suicide victims. This seems to be a multifactorial phenomenon and the present study does not provide an answer to this question.

Depressive mood and major depressive episodes are more prevalent among women (Isometä et al. 1997b; Kessler 2003). On the other hand, women generally more actively seek help for their psychiatric problems than men (Lester 1995). The violence and lethality of the chosen suicide method among male suicide victims showed a declining trend. This may increase the number of suicide survivors in the future and thus provide possibilities for preventive interventions. However, suicide prevention should also be part of the management of minor mental disorders, since they also lead to an increase in suicide risk. This is especially seen in men (Gunnel et al. 2002). In this respect, general practitioners are in a very important position (Rutz 2001).

6.6. Alcohol and suicide

The results for the relationship between alcohol consumption and the expression of female suicides may be important, but need discussion. Nearly 30% of the female suicide victims were under the influence of alcohol (BAC ≥ 0.5‰), which was higher than in earlier Finnish investigations. The BAC of female suicide victims in Finland has previously been found to be over 0.5‰ in 13% of cases (Lunetta et al. 2001). In an earlier study by Öhberg et al. (1996) the BAC was equal to or over than 0.5‰ in 20% of Finnish women who had committed suicide. In addition, the mean BAC of 1.7‰ at death in victims under the influence of alcohol was much higher than in earlier studies (Hayward et al. 1992). At the beginning of the study period the mean BAC of these suicide cases remained relatively unchanged, but after 1990-1991 a rising trend was observed, reaching 2.0‰ by 1996-1997. This could be explained as reflecting an increase in regional alcohol consumption per capita, which appeared during the last 4 years of the study period (1994-97).
The female suicide victims who had a BAC ≥ 0.5% were younger than sober victims and those with a lower blood alcohol concentration. Furthermore, being under the influence of alcohol during the suicidal act was more common among female victims from an urban environment. In earlier study by Qin and coworkers (Qin et al. 2003), urban living was found to be an even more significant risk factor for suicide in women than in men based on their higher gender-related susceptibility to alienation and social isolation. Hence, urban women’s culture of alcohol consumption together with alienation and social isolation may include elements that increase the risk of self-harming behavior more than that of women living in other environments. Although this study addresses the situation in the 1990s, it may well have relevance for the present situation, with alcohol consumption rising among Finnish women.

Untreated alcoholism has been found to worsen the symptoms of depression and thus to elevate the suicide risk (Thase et al. 2001). In young adulthood, hazardous or harmful alcohol consumption among women has been associated with higher levels of negative affect and depression than in non- or occasionally-drinking females of the same age (Caldwell et al. 2002). However, the recognition of a comorbid psychiatric disorder in substance abusers is difficult because of the interactive effects of heavy drinking and psychiatric symptomatology (Modesto-Lowe and Kranzler 1999). Furthermore, the clinical diagnosis and treatment of substance abuse in relation to depression and suicidality is still insufficient. A Finnish study on suicide attempters treated in a general hospital emergency room setting showed that patients drinking alcohol shortly after a drug overdose do not generally have lower suicide risk, and are less often referred to a psychiatrist and receive later treatment (Suokas and Lönnqvist 1995). However, as a follow-up study demonstrated, this group runs a high risk of later suicide. Furthermore, a Finnish nationwide examination of committed suicides showed that substance abuse is often unrecognized and frequently remains untreated (Pirkola et al. 1999b).

In general, the treatment of suicidality connected to depression has improved during the last decade (Rihmer 2001). The decline in female suicide mortality shown by present study may be the consequence of an improvement in the management of depression by the local health care system.
6.7. Prevention and postvention

Suicidal behavior can be viewed as a process or continuum, where the severity of the suicidal state may vary and boundaries between expressions with different degrees of severity are sliding (Diekstra and Garnefski 1995; Hintikka et al. 1998). This shows the multifactorial nature of suicidal behavior. Generally, there is more than one predisposing factor for suicide. Two-thirds of suicides are the result of a first suicide attempt. In patient evaluation it is essential to consider a large enough range of predisposing factors (Mann 2002). These should include all, even small, self-destructive signs. It is important to realize that it is impossible to confirm or exclude the risk of suicide by the presence or absence of a single risk factor. An adequate clinical assessment must include a careful evaluation of the present life situation and past suicide attempts (Buddeberg et al. 1996; Lönnqvist et al. 2003; Mann 2002). Both distal and proximal risk factors for suicide have to be evaluated.

As far as the examination and management of a suicidal patient are concerned, the availability of general and mental health services is crucial. These services are typically concentrated in urban regions, while in rural regions people have to travel longer distances to get help. Hence, an efficient cooperation between general health services and specialized psychiatric units is of great importance (Yuen et al. 1996). In addition, persons in a severe suicidal crisis must have the possibility to receive efficient psychiatric hospital care (Goldney 2003). Furthermore, evaluation of the mental state and the offering of psychiatric help to patients during treatment in a general hospital setting who are in distress due to physical disease must not be ignored (Suominen et al. 2002).

The phenomenon of self-destructiveness is more general than official statistics can tell. Minor destructive suicidal behavior is not uncommon among people who never seek help from health professionals (Diekstra and Gulbinat 1993). Training in the detection of suicidal signs is important and should be given not only to general and mental health providers but also to other professionals who meet people in mental distress or in difficult life situations. In this respect, it is important to differentiate the
nature of persistent and transient suicidal ideation as well as the severity of the intention to die (Buddeberg et al. 1996).

Despite all available preventive efforts and treatment measures, suicide cannot be prevented in all cases. Completed suicide generally leads to a deep crisis among people close to the victim. This situation, if it is long-lasting, may lead to psychological distress, depressive conditions and self-harming behavior. In this respect, early support of significant others and possibly other members of the victim's social network is of great importance (Parsons 2001).

6.8. Strengths and weaknesses of the study

In Study I suicidal ideation was screened only at baseline and on 12-month follow-up. As a consequence, there may have been some cases of short-term episodic suicidal ideation in the non-suicidal group. Moreover, although suicidal ideation seems to be a long-term mental state, some cases in the persistent suicidal ideation group may have been episodic. Although one-third of the initial sample did not respond at baseline and one-fifth of the baseline respondents missed the 12-month follow-up, the response rate can be considered acceptable. There could have been more depressive subjects among the non-respondents than among the respondents, as a poor capacity for concentration and tiredness are examples of depressive symptoms that could decrease the probability of responding to postal questionnaires. One strength of Study I is that the dropouts during the study period did not distort the sample, since there was no difference in the baseline prevalences of suicidal ideation between those who where respondents or non-respondents on follow-up. Additionally, the relatively persistent nature of suicidal ideation was also found in the study of Gunnell and coworkers (2004), where the survey method was the same, the follow-up period was longer (18 months) and over 40% respondents at baseline also responded during the follow-up. Still, it can be presumed that combining the baseline survey with two successive follow-up surveys would have been a more powerful indicator of the persistent nature of suicidal ideation.

On the other hand, one weakness of Study I was the use of only one BDI item in surveying suicidal ideation. This is a very simple but acceptable method, especially in
general population surveys with postal questionnaires, where using large scales is very problematic. When the size of the postal questionnaires expands the number of non-respondents may increase. The same BDI suicidality item has also previously been used in a large epidemiologic study (Kaltiala-Heino et al. 1999).

Determination of causes of death has been very reliable in Finland (Karkola 1993; Öhberg and Lönqvist 1998). During the research phase of the national Suicide Prevention Project between 1.4.1987-31.3.1988 the procedure for determining the cause of death in cases causing suspicion of suicide were even more specific than under routine conditions (Henriksson et al. 1995). The medico-legal autopsy procedure was also used after the research phase and hence makes the data for Studies II-IV particularly reliable. Data for the trends in suicide mortality are also valid, because the cause of death was determined in similar way throughout the study period. This included a high accuracy in screening for the presence of alcohol as well as the routine collection of forensic samples. Studies II-IV included the vast majority of all suicides from a single geographical and administrative region, covering a ten-year time period. The possibility to analyze virtually all suicide cases in the region provided a unique opportunity to investigate changes in suicide-related phenomena.

Although medico-legal autopsies were performed very professionally, certain important data were not available for Studies II-IV. These data were not gathered and reported in a sufficiently systematic form for statistical analysis. The autopsy reports did not generally include a sufficiently extensive medical history of the victims or information on the psychiatric diagnosis, medication records, alcohol dependence or other substances detected in the toxicological analysis. This made it impossible to address other questions that could be relevant in this context. For example, alcohol tolerance may have altered the effects of a high BAC on the expression of suicidal behavior. Furthermore, there was no possibility to study a possible relationship between psychiatric morbidity and suicidality under the influence of alcohol. The relationship between alcohol consumption and psychiatric morbidity is complex, since alcoholism may be a potential reason for psychiatric morbidity or a consequence of it (Caton et al. 2000; Strakowski et al. 2005).
In addition, when studying the state of inebriation in Study IV, the missing group in which the urine alcohol concentration could not be determined could have biased the interpretation of the results.

Furthermore, national and regional data for mean per capita alcohol consumption do not differentiate between males and females. Due to the lack of exact data on women, interpretation of our findings was based on the assumption that changes in mean alcohol consumption are similar for both genders. However, these changes may not be identical, although a recent trend has been reported in women’s alcohol consumption that resembles drinking behavior in men (e.g. frequency of drinking alcohol and binge drinking; Metso et al. 2002; Bloomfield et al. 2005).

Another shortcoming of Studies II-IV was the comparatively short time period under study (1988-1997), which made it difficult to compare mean suicide mortality values for periods of several years (e.g. 3 or 5-year periods). In addition, one further shortcoming of the study was the small catchment area of the province of Kuopio, with 260 000 inhabitants and hence relatively small numbers of suicides. This may have increased the risk of type II errors and of false negative findings, especially in Studies III and IV.
7. General conclusions

These results show that for male suicide mortality the regional differences in Finland are increasing. On the other hand, differences in features of suicide between men and women are decreasing. However, these results were apparent concerning one Finnish province, and further investigation should therefore focus attention on other Finnish regions large enough for the results to be repeated and confirmed.

The violence and lethality of the chosen suicide method among male suicide victims showed a declining trend. This may increase the number of suicide survivors in the future and thus provide possibilities for preventive interventions. However, earlier attention should be paid by general health care practitioners to the signs of suicidal behavior in persons living in difficult life situations, especially in less densely populated areas with several current risk factors.

Suicide mortality rates may change over a relatively long time period and the present ten-year study period may not be long enough to reveal all developing trends. For example, the changes concerning alcohol in female suicide victims may reflect the temporal changes in female alcohol consumption in the 1990s. This may have been the basis of further unsatisfactory development in this respect during the 2000s following the changes in EU legislation during 2004, including the lowering of alcohol taxation and removal of import quotas between the EU countries (Alkoholijuomien kulutus vuonna 2004 (2005)). The long-term significance of these changes connected to suicide mortality needs to be clarified in further studies.
References


Balazic J, Marusic A. The completed suicide as interplay of genes and environment. Forensic Science International 2005;147S:S1-S3.


Beautrais A. Suicides and serious suicide attempts: two populations or one? Psychol Med 2001;31:837-45.


Diekstra RFW, Garnefiñski N. On the nature, magnitude and causality of suicidal behaviors: an international perspective. Suicide Life Threat Behav 1995;25:36-57.


Hasin DS, Goodwin RD, Stison FS, Grant BF. Epidemiology of major depressive disorder. Results from the National Epidemiologic Survey on alcoholism and related conditions. Arch Gen Psychiatry 2005;62:1097-106.


Isometsä E. Suicide in bipolar I disorder in Finland: psychological autopsy findings from the National Suicide Prevention Project in Finland. Arch Suicide Res 2005;9:251-60.


Lehtonen J. Mental health as recurrent resource-like phenomenon and some considerations of suicide problems. Psychiatria Fennica 1978:139-42.


Lester D. Suicide in an international perspective. Suicide Life Threat Behav 1997;27:104-11.


Mumenthaler MS, Taylor JL, O'Hara R, Yesavage JA. Gender differences in moderate drinking effects. Alcohol Research and Health 1999; 23:55-64.


Qin P, Mortensen PB. The impact of parental status on the risk of completed suicide. Arch Gen Psychiatry 2003;60.797-802.


Strakowski SM, DelBello MP, Fleck DE, Adler CM, Anthenelli RM, Keck PE Jr, Arnold LM, Amicone J. Effects of co-occurring alcohol abuse on the course of


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