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# Suicidal drowning deaths in northern Sweden 1992–2009 – The role of mental disorder and intoxication

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ABSTRACT

Suicides by drowning have received limited attention by researchers. A recent finding that almost one-third of all drowning deaths in Sweden were classified as suicide instigated this study. We identified 129 cases of suicide by drowning in Northern Sweden and analyzed the circumstances and the psychiatric history prior to the suicide. Information was obtained from autopsy, police and medical records, as well as from the National Inpatient Register. One-third of the suicide victims had previously attempted suicide and half of the victims had been hospitalized due to mental health problems. One-third of these had left the hospital less than one week before the suicide. Alcohol and psychoactive drugs were present in 16% and 62% of the cases, respectively.

A history of mental disorder and previous suicide attempt (s), especially by drowning, is an ominous combination necessitating efficient clinical identification, treatment and follow-up if a complete suicide is to be prevented.



## 1. Introduction

Suicide constitutes an important global public health problem with almost one million people committing suicide every year.[1] Suicide by drowning, defined as self-inflicted death due to immersion or submersion,[2] constitutes 4.2% of all suicides according to a survey from 16 European countries,[3] 3.6% in Australia,[4] 5% in Sweden,[5] and 10% in Croatia.[6]

Almost one-third of all drowning deaths in Sweden are classified as suicide,[7] but the rate varies with age. In a study on suicide by drowning from England and Wales, 13.5% of the victims were older than 60 years, making this suicide method the third most common among the elderly and the second most common among elderly women.[8] Thus, the rate of suicide by drowning is also related to gender. A study from 56 countries, based on WHO's database, yielded a higher rate of suicidal drowning among females compared to males.[9] Furthermore, in a German study of more than 145,000 suicides, drowning was the only suicide method that was more frequent among females than males.[10]

Alcohol, licit psychoactive drugs and illicit drugs are commonly found in suicide victims, especially when more violent methods are used.[11] In studies of suicidal drowning in Finland,[11] Australia,[4] USA,[12] and Croatia,[6] alcohol was found in 20–28% of the cases. Licit psychoactive drugs were present in 16% and 42%, respectively, of suicidal drowning deaths in Australia[4] and Finland.[11] Illicit drugs were detected in 2% of cases from Australia[4] and in 12% of cases from USA.[12]

Mental disorder is a risk factor for suicide in general,[13–15] and people with a mental disorder have a clearly reduced life expectancy, with suicide as the predominant manner of death.[16] In studies on suicide by drowning, the rate of mental disorder was 43% in Australia,[4] 38% in USA,[17] and 18% in Croatia.[6] A Finnish study found that 16% of suicides by drowning occurred within one week of discharge from psychiatric in-patient care.[18]

A Swedish 21–31-year follow-up study of almost 50,000 suicide attempts resulting in hospital admission showed that the highest risk for a later complete suicide was when the method in the

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first attempt was hanging/strangulation/suffocation, followed by drowning and shooting.[19] Of the 153 females with a record of a drowning attempt, 66 (43%) did later commit suicide. The corresponding figure for the 149 males was 46 (30%). Eleven (7%) of the females and 13 (9%) of the males did not have a psychiatric diagnosis at the time of hospital discharge. In order to prevent suicide by drowning, detailed knowledge is required about the suicide victims and the suicidal act itself. The aims of this study were to analyze the circumstances of the suicides, the presence of alcohol, licit and illicit drugs, as well as the psychiatric history of the suicide victims.

## 2. Methods

The present study is based on the 641 individuals who drowned in the northern half of Sweden from January 1, 1992 through December 31, 2009. These cases were identified in the database at the Department of Forensic Medicine in Umeå, where victims of all unnatural deaths are autopsied. The catchment area of the department covers the four northernmost counties of Sweden, a scarcely populated region with 883,215 inhabitants.[20]

Of these 641 cases, the forensic pathologist, who in Sweden establishes both the cause and the manner of death, stated that 437 (68%) were unintentional drowning (accidents), 129 (20%) were suicides, and 75 (12%) were classified as undetermined ("open verdict").

We examined the 129 suicidal drowning deaths by retrieving information on age, sex, cause and manner of death as well as circumstances of the event from the database of the National Board of Forensic Medicine. Autopsy, police and medical records were examined to provide further information on the circumstances of the suicide, such as drowning site, presence of witnesses, previous suicide attempts, weariness with life, farewell notes, and psychiatric history.

Data on hospitalization were obtained from the National Inpatient Register of the National Board of Health and Welfare. The register covers data on all hospital admissions and discharge diagnoses. The validity of these data is robust, covering 98% of all hospital discharges.[21] The register also provides information on admission to hospital for a suicide attempt requiring medical attention, such as intoxication. Suicide attempts that do not result in a hospital admission are not systematically registered in Sweden.

Information on hospitalization for suicide attempts or mental disorder could not be traced in three cases; the victims had not been granted the status of permanent residency in Sweden and thus had not been provided with a personal identity number, which is needed for case linkage. These cases were registered as not hospitalized in this study.

The presence of mental disorder is defined as having a primary psychiatric diagnosis in the National Inpatient Register. Diagnosis were classified as follows: psychotic disorders, affective disorders, anxiety disorders, substance use disorders and other psychiatric disorders according to the international classification ICD 9[22] and ICD 10[23] within the five years prior to the suicide (see Table 1). Supplementary sources for identification of mental disturbance were notes in the autopsy records and information from relatives suggesting a current mental health problem.

It is common forensic practice in Sweden to test all autopsy cases for alcohol and licit drugs, but testing for illicit drugs is done only in selected cases. Toxicological analyses on femoral vein blood and urine were performed by the Department of Forensic Toxicology, National Board of Forensic Medicine, Linköping. Headspace gas chromatography was used for analyses of alcohol, and licit and illicit drugs.[24,25] WHO's Anatomical Therapeutic Chemical (ATC) Classification System was used to classify the drugs into psychoactive drugs, i.e. benzodiazepines, opiates, neuroleptics, antiepileptics and other drugs.[26]

**Table 1**
Subgrouping of diagnosis of mental disorder among 129 victims of suicide by drowning in northern Sweden 1992–2009. Classification based on ICD-9 and ICD10 (WHO, 2010).

| | ICD9 | ICD10 |
|---|---|---|
| **Psychotic disorders** | | |
| *Schizophrenia* | 295A, 295B, 295D, 295G, 295X | F200, F209 |
| *Other psychoses* | 297X, 298A, 298X | F159, F192, F239, F250, F259 |
| **Affective disorders** | | |
| *Psychotic type* | 296C, 296X | F312, F323 |
| *Non-Psychotic* | 296D,296W, 309B, 311X | F300, F311, F314, F318-F322, F329, F331, F339, F341, F388, F412 |
| **Anxiety disorders** | 300D, 300X | F419, F430, F431 |
| **Substance use disorders** | | |
| *Alcohol* | 300E | F101, F102, F104 |
| *Other substances* | – | F159 |
| **Other disorders** | 309X | F039, F459, F841, F849, F900, F952 |

A blood alcohol concentration (BAC) below 0.2 g/l was considered to be negative, since the BAC may increase due to decomposition.[27] The alcohol result was used only if the analysis was performed in both blood and urine (vitreous fluid in one case) to avoid overestimation of the alcohol concentration. Twelve cases were not tested for alcohol and drugs due to decomposition.

Permission to use data from the National Inpatient Register was obtained from the National Board of Health and Welfare (Dnr 25940/2013).

### 2.1. Statistical methods

Descriptive data and proportions are described by using percentages. Calculations of means and comparisons of age in males versus females were performed using the Wilcoxon Rank test. All statistical analyses were conducted in the statistical package SPSS 19. Comparisons of groups were tested by using a Chi-square test performed in Epi Info 3.4. A Fisher exact test was used when numbers were less than five. Statistical significance was defined as a p value of $<0.05$.

## 3. Results

Of all 641 cases of drowning, a significantly ($p < 0.01$) higher proportion of the females (46%) were classified as suicide rather than accident and undetermined manner of death compared to the males (14%).

Sex and age of the 129 suicide victims is shown in Fig. 1; 72 (56%) were males with a mean age of 52 years (range 16–85) and 57 (44%) were females and significantly older ($p < 0.05$) with a mean age of 59 years (range 25–84). One-hundred and six (82%) suicides occurred outdoors with at least one witness present in 16 (12%) instances. In the remaining 23 (18%) cases, the suicide occurred indoors, all without witnesses: 22 (96%) in a bathtub and one in a pool. A significantly ($p < 0.01$) higher proportion of the female suicides occurred indoors (28%) compared to male suicides (10%).

Ten (14%) victims, all males, had jumped from bridges and drowned. In another four cases (3%), the victim had driven a vehicle into water. Indoor suicides were evenly distributed over the year, while outdoor suicides were more frequent during May to September, which is expected since there is a long winter period in northern Sweden with temperatures well below the freezing point.