

## Original Contribution

# Determinants and Outcomes of Serious Attempted Suicide: A Nationwide Study in Finland, 1996–2003

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Suicide is among the 10 leading causes of death. Attempted suicide is 10–40 times more frequent than completed suicide and is the strongest single predictor of subsequent suicide. The current study population included all persons in Finland who were hospitalized with a diagnosis of attempted suicide between 1996 and 2003 ( $N = 18,199$ ). Information on background variables and mortality was obtained by register linkage. The risk of repeated attempted suicide was 30% and the risk of suicide was 10%. The risks of repeated attempted suicide, completed suicide, and death from any cause were high immediately after discharge from the hospital. Analysis of competing causes of death revealed that while alcohol-related disorder was not associated with suicide, it markedly increased the risk of other violent death: The subdistribution hazards rate (SHR) was 2.61 (95% confidence interval (CI): 2.12, 3.21). Schizophrenia-related disorders (SHR = 1.87, 95% CI: 1.57, 2.21) and mood disorders (SHR = 1.72, 95% CI: 1.47, 2.01) were associated with the risk of suicide. The risks of suicide and all-cause mortality were extremely high immediately after hospitalization for attempted suicide.

mental disorders; mortality; suicide; suicide, attempted

Abbreviation: ICD-10, *International Classification of Diseases*, Tenth Revision.

Suicidal behavior is a major public health problem in developed countries. Suicide is among the 10 leading causes of death for all age groups in most countries for which information is available (1). Furthermore, attempted suicide may be up to 10–40 times more frequent than completed suicide, and it is clearly the strongest single clinical predictor of subsequent suicide. Thus, suicide prevention has become central to mental health policy in many countries (2–6).

Most previous epidemiologic studies have focused on completed suicide rather than attempted suicide (7), since data resulting from the former are systematically gathered. Little attention has been paid to persons who are hospitalized after attempted suicide, despite accumulating evidence that their rate of subsequent suicide is much higher than

expected (8–10). However, hospitalization after attempted suicide offers a chance for treatment intervention in a group well known to be at high risk for later suicide.

Attempted suicide is more difficult to study than completed suicide because it lacks generally approved reporting procedures (11). Thus, most previous studies of attempted suicide have been based on data from one or more hospitals or from one city or province, and there have been few nationwide studies. In addition, most previous outcome studies have only investigated completed suicide after attempted suicide, not both nonfatal and fatal further suicidal behavior. Furthermore, most research on suicide after nonfatal self-harm has been poor, using small and highly selected samples, weak methods for detecting suicide during follow-up,

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and flawed analysis (9, 12). The reason for the use of selected samples and the failure to detect suicides during follow-up is usually the lack of national records, which rules out complete tracking of individuals.

Recently, a large-sample study of repeated suicide attempts confirmed that the only factor differentiating people with more than four repetitions from people with no repetition was personality disorder (13). In a greater than 2-year follow-up study of 11,583 deliberate self-harm patients' suicides, accidental poisonings were much more frequent than in the general population (14). In addition, deaths due to accidents other than poisoning, as well as overall mortality, were more frequent than expected (14). Deaths due to suicide and accidents occurred at the beginning of follow-up; deaths due to other causes were fairly evenly spread over the follow-up period. In an urban catchment area in Helsinki, Finland, a mortality rate 15 times higher than expected was found among suicide attempters in follow-up of an unselected sample of 2,782 suicide attempters (15). Mortality was highest in the first year after the suicide attempt, and male sex, single marital status, retirement, drug overdose as a suicide method, an index suicide attempt not involving alcohol, and a repeated suicide attempt were risk factors for mortality.

In a nationwide study, we investigated the epidemiology of repeated suicide attempts and mortality among all first-time hospitalized suicide attempters in Finland during the period 1996–2003. We aimed to determine the risk of repeated suicide attempts, completed suicide, and death due to other causes in these patients and to investigate risk factors for these three outcomes in this population. Age, sex, mental disorders, and the method of the first suicide attempt, which were the factors contributing the most to the risk of subsequent attempts and mortality (16, 17), were used as explanatory variables. With suicide prevention in mind, we wanted to analyze whether subgroups of the population differed with respect to cause of death.

## MATERIALS AND METHODS

### Study population

The study population included all persons in Finland who were hospitalized with a diagnosis of attempted suicide (*International Classification of Diseases*, Tenth Revision (ICD-10), codes X60–X84, code Z72.8, or code Z91.5) from January 1, 1996, to December 31, 2003 (the first hospital treatment was considered the index hospitalization) but had no prior hospitalizations due to a suicide attempt. Only patients who were at least 12 years old when the index hospitalization began were included.

The hospitalization data were obtained from the National Hospital Discharge Register and included the dates of hospital admission and discharge and the diagnosis code. The accuracy of data on psychiatric diagnoses in the Finnish Hospital Discharge Register was assessed in 1986 and found to be excellent: The diagnosis in the register and the diagnosis in the hospital case notes were identical in 99 percent of cases for schizophrenia and 98 percent of cases for all mental disorders (18–21). Especially when a broad concept

of schizophrenia was applied, the diagnoses of the register were accurate (93 percent of reviewed cases fulfilled the criteria) (19). Causes of death were obtained from the Causes of Death Register of Statistics Finland and were categorized using two different classifications. Deaths were initially classified as suicides (ICD-10 codes X60–X84), other violent deaths (ICD-10 codes V01–X59 and X85–Y84), or deaths due to other causes.

The following information was eventually obtained for each individual in the study population by linking the National Hospital Discharge Register with the Causes of Death Register: sex, age at the time of index hospitalization, date of index hospitalization, prior hospitalizations due to psychiatric causes, and prior hospitalizations related to alcohol use (ICD-10 code F10). Prior hospitalizations due to psychiatric causes were categorized as being related to schizophrenia or schizotypal and delusional disorders (ICD-10 codes F20–F29), mood disorders (ICD-10 codes F30–F39), or personality disorders (ICD-10 codes F60–F69). If there were hospitalizations in more than one category, the above order was used; that is, codes F20–F29 were used before other diagnoses, and codes F30–F39 were used before codes F60–F69. During the follow-up period, any hospitalizations due to attempted suicide were recorded and their number was used as a time-varying variable.

The study population consisted of 18,199 persons, whose baseline characteristics are shown in table 1. The entire study population accumulated 65,344 person-years of follow-up, and the mean follow-up time was 3.6 years. We excluded the duration of hospitalization episodes (2,277 person-years) from the analysis of suicide attempts, because an individual is not at risk of hospitalization when he or she is already in a hospital.

### Data analysis

For each individual, the follow-up time was split into shorter time periods delineated by any recurrent hospitalization episodes due to suicide attempts. Thus, the follow-up time of each individual consisted of several contiguous time periods, each defined by specific entry and exit times. This allowed us to use time since previous suicide attempt and number of previous suicide attempts as time-varying covariates in the models. We also divided time since discharge from the hospital into contiguous periods in order to study the development of risk of the endpoint event (death or attempted suicide) as a function of time.

We modeled data with a Poisson regression model and Cox proportional hazards regression with a counting process approach (22). Poisson regression was applied because it makes it possible to include more than one time scale in the analysis (in Cox's proportional hazards regression, only one time scale at a time is possible). It also provides good estimates of relative risk (23). In this study, time since the start of follow-up, time since the last discharge from the hospital, and/or calendar month were the time scales of interest. Modeling was conducted using death or recurrent attempted suicide as outcome variables and the end of follow-up as censoring time. To take into account the multiple time periods from one individual in the Cox model, we

**TABLE 1. Characteristics of suicide attempters at the first attempt and their causes of death, Finland, 1996–2003**

	Males ( <i>n</i> = 8,917)		Females ( <i>n</i> = 9,282)		Total ( <i>n</i> = 18,199)	
	No.	%	No.	%	No.	%
Median age (years)	39 [29–48]*		39 [27–49]		39 [28–49]	
Hospitalization due to mental disorder (before index suicide attempt)						
Schizophrenia, schizotypal and delusional (ICD-10† codes F20–F29)	1,629	18	1,744	19	3,373	19
Mood disorders (ICD-10 codes F30–F39)	2,260	25	2,904	31	5,164	28
Personality disorders (ICD-10 codes F60–F69)	1,068	12	700	8	1,768	10
Alcohol-related disorders (ICD-10 code F10)	4,302	48	2,426	26	6,728	37
Cause of death						
All causes	1,565	18	852	9	2,417	13
Suicide	661	42	360	42	1,021	42
Other violent cause	327	21	137	16	464	19
Other cause	577	37	355	42	932	39
Alcohol-related death	491	31	173	20	664	27
Recurrent suicide attempt	1,738	19	2,066	22	3,804	21
Mean no. of recurrent attempts	0.37 (1.11)‡		0.41 (1.09)		0.39 (1.09)	
Mean no. of recurrent attempts among persons with at least one repeated attempt	1.90 (1.83)		1.85 (1.64)		1.87 (1.73)	

\* Numbers in brackets, interquartile range (first and third quartiles).

† ICD-10, *International Classification of Diseases*, Tenth Revision.

‡ Numbers in parentheses, standard deviation.

calculated robust variance estimators based on the grouped jackknife method. We also analyzed risk factors for competing risks of death in order to check whether risk factors for different causes of death varied (24). Data analyses were carried out using R software (25).

## RESULTS

We recorded 25,321 serious, hospital-treated attempted suicides during the follow-up period of 8 years, of which 7,122 were repeat attempts; altogether, there were 18,199

persons with attempted suicide. The number of new suicide attempters remained fairly stable over the study period. Self-poisoning remaining the most frequent method throughout the study period (table 2). On the basis of our data, the incidence of first attempted suicide leading to hospitalization in Finland was approximately 44 per 100,000 person-years (based on an average Finnish population size of 5.1 million during the 8-year follow-up time).

The incidence of repeated attempted suicide was higher among women than among men (table 3). The highest risk of repeated attempted suicide was associated with the age

**TABLE 2. Frequencies of first hospital-treated attempted suicide in Finland from 1996 to 2003, by year of first attempt and method of attempt**

Method (ICD-10* code(s))	1996	1997	1998	1999	2000	2001	2002	2003
Self-poisoning (X61–X69)	1,419	1,970	1,935	2,005	2,044	1,954	1,869	1,819
Firearm (X74)	2	1	27	27	21	31	26	23
Smoke, fire, or flames (X76)	3	10	15	7	20	9	10	11
Sharp object (X78)	78	67	99	87	85	97	93	102
Jumping from a high place (X80)	52	41	34	55	43	20	36	40
Unspecified means (X84)	2	6	17	27	27	26	16	21
Self-damaging behavior (Z728)	37	27	33	18	34	28	26	27
Personal history of self-harm (Z915)	86	129	84	78	48	32	29	23
Other	331	371	133	36	47	41	45	27
Total	2,010	2,622	2,377	2,340	2,369	2,238	2,150	2,093

\* ICD-10, *International Classification of Diseases*, Tenth Revision.

**TABLE 3. Univariate rate ratios for repeated attempted suicide based on a Poisson model and hazard ratios for repeated attempted suicide based on a multivariate Cox model, Finland, 1996–2003**

	No. of persons	Person-years of observation	Rate	Rate ratio	95% CI*	Hazard ratio	95% CI
Sex							
Male	3,310	30,196	0.1096	1.000	Reference	1.000	Reference
Female	3,812	32,871	0.1160	1.058	1.010, 1.108	1.168	1.113, 1.226
Age (years)							
12–<16	120	1,990	0.0603	1.000	Reference	1.000	Reference
16–<20	370	3,989	0.0928	1.538	1.252, 1.890	1.391	1.132, 1.709
20–<30	1,610	12,958	0.1242	2.061	1.712, 2.480	1.435	1.190, 1.731
30–<40	2,292	16,234	0.1412	2.341	1.949, 2.813	1.463	1.214, 1.763
40–<50	1,771	15,632	0.1133	1.879	1.562, 2.260	1.203	0.998, 1.451
50–<60	705	7,612	0.0926	1.536	1.266, 1.864	1.010	0.830, 1.229
60–<100	254	4,652	0.0546	0.905	0.729, 1.125	0.704	0.566, 0.875
Hospitalization due to mental disorder (before index suicide attempt)							
None	1,967	27,254	0.0722	1.000	Reference	1.000	Reference
Schizophrenia	1,879	12,071	0.1557	2.157	2.025, 2.298	1.525	1.427, 1.630
Mood disorder	2,469	17,028	0.1450	2.009	1.893, 2.132	1.587	1.492, 1.687
Personality disorder	807	6,714	0.1202	1.665	1.534, 1.808	1.223	1.124, 1.331
Hospitalization due to alcohol-related disorder (before index suicide attempt)							
No	3,483	39,720	0.0877	1.000	Reference	1.000	Reference
Yes	3,639	23,348	0.1559	1.777	1.697, 1.862	1.401	1.332, 1.474
No. of suicide attempts during follow-up							
0	3,264	47,940	0.0681	1.000	Reference	1.000	Reference
1–5	3,263	14,397	0.2266	3.329	3.171, 3.494	4.134	3.929, 4.350
>5	595	731	0.8143	11.960	10.960, 13.052	20.244	18.437, 22.227

\* CI, confidence interval.

group 30–40 years. Having any diagnosis of a mental disorder or alcohol-related disorder before baseline was associated with higher risk of recurrent suicide attempts and higher risk of repeated suicide attempts during follow-up. All-cause mortality consistently increased with age and was substantially lower among females (hazard ratio = 0.52, 95 percent confidence interval: 0.47, 0.56) (table 4). Having a mental disorder was not associated with mortality, but having an alcohol-related disorder before baseline increased the risk of mortality.

The curves of cumulative events showed that the risk of repeated attempted suicide was nearly 30 percent and the risk of suicide mortality was nearly 10 percent during the 8-year follow-up period (figure 1). The risks of repeated attempted suicide, completed suicide, and death from any cause were high immediately after discharge from the hospital (figure 2). Especially, the risk of suicide decreased greatly after the first week following discharge.

We detected significant seasonal variation in suicide attempts using the Poisson regression model with age, sex, baseline diagnosis, follow-up period, and calendar month included as explanatory variables (likelihood ratio test:  $\chi^2_{11} = 27.0$ ,  $p = 0.005$ ) but no seasonal variation for the other endpoints. The incidence of attempted suicide was lowest in December and highest in April.

Analysis of competing causes of death revealed that while alcohol-related disorder was not associated with suicide, it markedly increased the risk of other violent death; the sub-distribution hazards rate was 2.61 (95 percent confidence interval: 2.12, 3.21) (table 5). Schizophrenia-related disorders or mood disorders nearly doubled the risk of suicide but had little effect on other causes of death. If the index method of attempting suicide was use of a firearm (ICD-10 code X74), a higher subsequent risk of suicide was observed. An index suicide attempt method of jumping from a high place (ICD-10 code X80) predicted higher violent death

**TABLE 4. Univariate rate ratios for all-cause mortality based on a Poisson model and hazard ratios for all-cause mortality based on a multivariate Cox model, Finland, 1996–2003**

	No. of persons	Person-years of observation	Rate	Rate ratio	95% CI*	Hazard ratio	95% CI
Sex							
Male	1,565	31,198	0.05016	1.000	Reference	1.000	Reference
Female	852	34,146	0.02495	0.497	0.458, 0.541	0.516	0.473, 0.563
Age (years)							
12–<16	7	2,066	0.00339	1.000	Reference	1.000	Reference
16–<20	55	4,141	0.01328	3.920	1.785, 8.607	3.404	1.550, 7.476
20–<30	289	13,510	0.02139	6.313	2.983, 13.361	4.454	2.102, 9.439
30–<40	475	16,827	0.02823	8.331	3.950, 17.571	5.682	2.689, 12.006
40–<50	596	16,111	0.03699	10.918	5.182, 23.001	7.660	3.629, 16.165
50–<60	410	7,840	0.05230	15.435	7.312, 32.581	10.629	5.027, 22.475
60–<100	585	4,849	0.12065	35.609	16.901, 75.024	26.551	12.590, 55.993
Hospitalization due to mental disorder (before index suicide attempt)							
None	923	27,650	0.03338	1.000	Reference	1.000	Reference
Schizophrenia	535	13,078	0.04091	1.225	1.102, 1.363	1.047	0.938, 1.169
Mood disorder	701	17,741	0.03951	1.184	1.073, 1.306	1.037	0.938, 1.147
Personality disorder	258	6,875	0.03753	1.124	0.979, 1.291	1.056	0.916, 1.218
Hospitalization due to alcohol-related disorder (before index suicide attempt)							
No	1,283	41,111	0.03121	1.000	Reference	1.000	Reference
Yes	1,134	24,233	0.04680	1.499	1.384, 1.624	1.264	1.159, 1.379
No. of suicide attempts during follow-up							
0	1,740	49,367	0.03525	1.000	Reference	1.000	Reference
1–5	633	15,175	0.04171	1.183	1.081, 1.296	1.674	1.521, 1.841
>5	44	802	0.05488	1.557	1.154, 2.100	2.687	1.981, 3.645

\* CI, confidence interval.

mortality. Poisoning (ICD-10 codes X61–X69) and self-harm by a sharp object (ICD-10 code X78) as methods in the first suicide attempt were associated with lower risks of suicide.

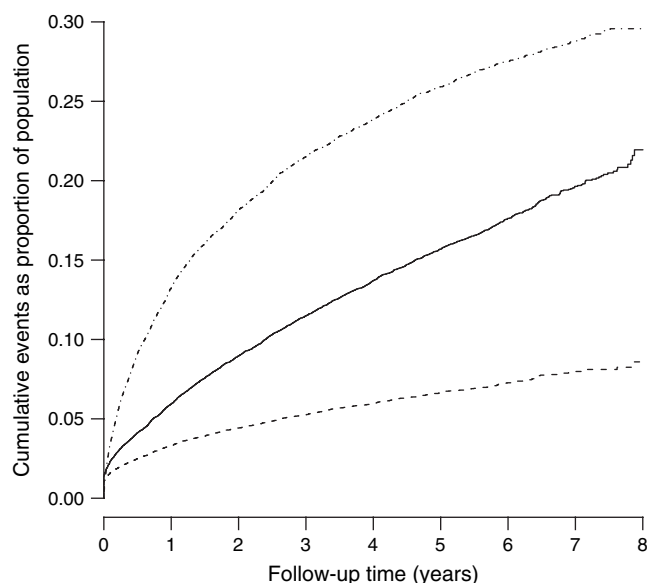
## DISCUSSION

Our findings suggest that serious attempted suicide and completed suicide have both common and distinct risk factors. Mental disorders are associated with both outcomes, whereas alcohol-related disorders are associated with violent death. This is in line with earlier findings (16).

To our knowledge, this is the first study to have investigated outcomes for all hospitalized attempted-suicide patients in a large nationwide cohort over an 8-year period. Earlier outcome studies of attempted suicide have been based on samples from one or more hospitals or other entities treating attempted-suicide patients. Our cohort included follow-up data from all hospitalized suicide attempters in

Finland from 1997 to 2003 (26). In addition, we were able to investigate both repeat suicide attempts and overall deaths, including eventual suicides and violent deaths, whereas most previous outcome studies have concentrated either on repeat attempts or on fatal outcomes.

In the present study, suicide attempters were more often women. Previously, Finland has been one of the few countries where men have reportedly attempted suicide more often than women (27). However, when comparing the present results with earlier findings, it should be noted that this study dealt with the most serious attempts, all of which led to hospitalization. Suicide attempters in our cohort more often had schizophrenia spectrum disorders and less often had mood or personality disorders than participants in previous studies. In this study, 18 percent of suicide attempters had schizophrenia spectrum disorders, while Beautrais et al. (28) reported 1 percent and Suominen et al. (29) reported 6 percent. Percentages for mood disorders were 28 percent in this study, as opposed to 77 percent in the study by Beautrais et al. (28) and 74 percent in the study by Suominen et al.

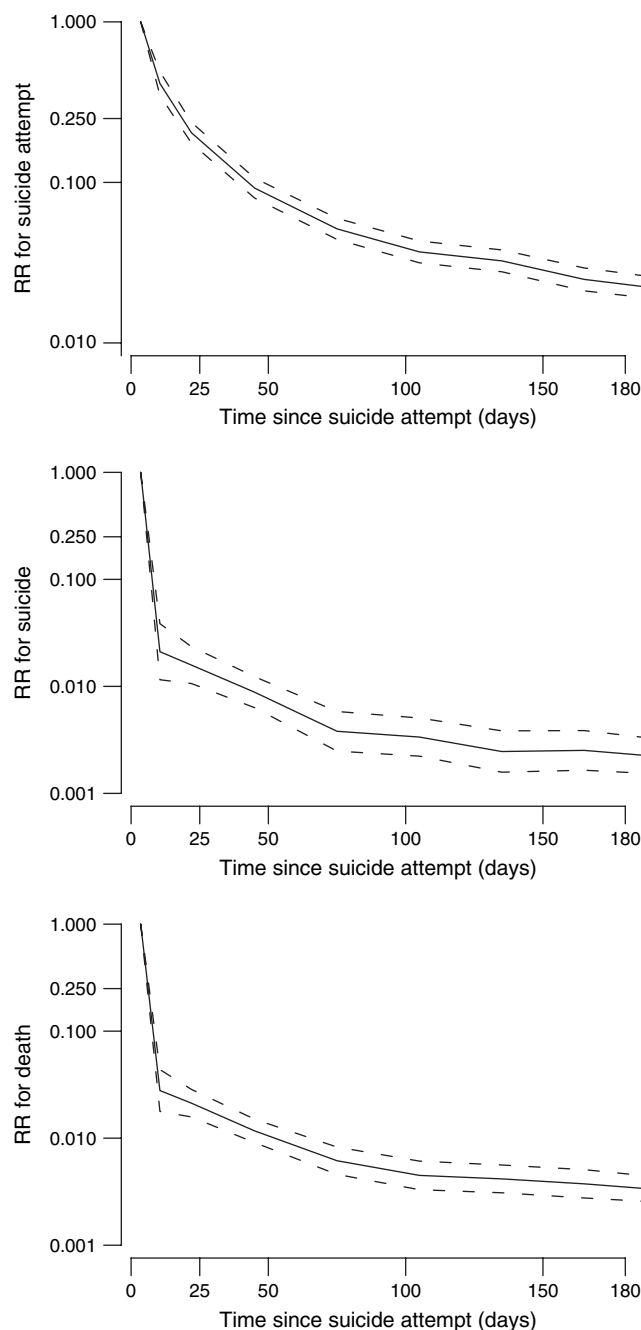


**FIGURE 1.** Cumulative numbers of first repeated attempted suicides (dotted-and-dashed line), deaths from all causes (solid line), and completed suicides (dashed line) during an 8-year follow-up period, Finland, 1996–2003.

(29). This conflicting finding is explained by the nature of our cohort, which included only hospitalized suicide attempters. Over one third of suicide attempters in this study suffered from alcohol-use disorders, which accords with the findings of previous studies (28–30). Moreover, we found seasonal variation only in attempted suicide, not in completed suicides or other causes of death.

In a systematic review, Owens et al. (9) estimated that 16 percent (interquartile range, 12–25) of suicide attempters repeat their attempt and 1.8 percent (interquartile range, 0.8–2.6) commit suicide within 1 year, which is well comparable with the 12 percent observed in this study. However, findings regarding fatal and nonfatal repetition of self-harm have been inconsistent (9). In our study, the suicide rate in the first year was 3.2 percent, which is higher than the 1.8 percent obtained in the meta-analysis (9). In line with previous studies, overall mortality in the present study was high immediately after attempted suicide (15, 31–37).

Risk factors for a new suicide attempt during follow-up were a clinical diagnosis of mental disorder, an alcohol-use disorder, female sex, an age of 30–40 years, and repeated suicide attempts during follow-up. Risk factors for overall mortality were increasing age, male sex, repeated suicide attempts during follow-up, and alcohol-use disorders, but not mental disorders. The risk factors for repeated suicidal behavior were roughly similar to those found in previous studies (9, 36–40). Interestingly, patients with mood disorders had a 59 percent higher risk and patients with schizophrenia spectrum disorders a 53 percent higher risk of a subsequent suicide attempt during follow-up than did persons without these disorders. These numbers are considerably lower than the odds ratios of 3.43 for schizophrenia



**FIGURE 2.** Rate ratios (RRs) for attempted suicide, completed suicide, and death from all causes according to time since discharge from a hospital after attempted suicide, Finland, 1996–2003. Results were adjusted for sex, age, baseline diagnosis, and time since the start of follow-up. The reference period was the first week after hospital discharge. Dashed lines, 95% confidence interval.

and 2.83 for depression reported by Colman et al. (39). This discrepancy could be at least partly due to the use of different criteria for cases; in the current study, all patients were hospitalized, but in the study by Colman et al. (39), the study population consisted of patients treated in the emergency

**TABLE 5. Mortality hazards rates based on a subdistribution model accounting for three competing causes of death, Finland, 1996–2003**

	Suicide		Violent death		Death from other causes	
	SHR*	95% CI*	SHR	95% CI	SHR	95% CI
Sex						
Male	1.00	Reference	1.00	Reference	1.00	Reference
Female	0.55	0.48, 0.63	0.52	0.43, 0.65	0.60	0.53, 0.70
Age (years)						
12–<16	1.00	Reference	1.00	Reference	1.00	Reference
16–<20	3.36	1.32, 8.57	5.39	0.71, 41.11	2.64	0.32, 21.85
20–<30	5.03	2.07, 12.24	5.21	0.72, 37.91	5.55	0.77, 40.09
30–<40	5.31	2.19, 12.89	8.24	1.14, 59.34	9.06	1.27, 64.81
40–<50	5.66	2.33, 13.74	9.37	1.30, 67.63	18.35	2.58, 130.70
50–<60	6.89	2.82, 16.80	8.26	1.14, 60.04	34.10	4.78, 243.07
60–<100	8.87	3.64, 21.63	7.79	1.06, 57.23	127.12	17.89, 903.20
Hospitalization due to mental disorder (before index suicide attempt)						
None	1.00	Reference	1.00	Reference	1.00	Reference
Schizophrenia	1.87	1.57, 2.21	0.82	0.63, 1.06	0.83	0.69, 0.99
Mood disorder	1.72	1.47, 2.01	0.80	0.63, 1.02	0.81	0.69, 0.96
Personality disorder	1.24	0.98, 1.57	1.07	0.81, 1.42	0.95	0.75, 1.20
Hospitalization due to alcohol-related disorder (before index suicide attempt)						
No	1.00	Reference	1.00	Reference	1.00	Reference
Yes	0.90	0.78, 1.03	2.61	2.12, 3.21	1.41	1.23, 1.62
Method of index suicide attempt (ICD-10* code(s))						
Other	1.00	Reference	1.00	Reference	1.00	Reference
Self-poisoning (X61–X69)	0.33	0.28, 0.40	1.22	0.82, 1.80	1.29	1.00, 1.68
Firearm (X74)	1.71	1.15, 2.54	1.70	0.70, 4.12	0.48	0.20, 1.16
Smoke, fire, or flames (X76)	1.10	0.61, 1.96	1.62	0.49, 5.39	0.00	0.00, 0.00
Sharp object (X78)	0.27	0.18, 0.40	1.04	0.55, 1.95	1.43	0.96, 2.13
Jumping from a high place (X80)	0.69	0.46, 1.04	2.44	1.25, 4.76	0.42	0.18, 1.02
Unspecified means (X84)	0.27	0.11, 0.66	1.14	0.34, 3.85	0.85	0.30, 2.43
Self-damaging behavior (Z728)	0.38	0.21, 0.69	1.08	0.41, 2.82	1.99	1.21, 3.26
Personal history of self-harm (Z915)	0.30	0.20, 0.46	0.83	0.41, 1.66	1.37	0.90, 2.07

\* SHR, subdistribution hazards rate; CI, confidence interval; ICD-10, *International Classification of Diseases*, Tenth Revision.

room. In general, our results support earlier findings that persons committing suicide and persons engaging in medically serious suicide attempts comprise two overlapping populations (16).

It was evident that the risk of competing causes of death varied greatly according to the background factors. The risk of suicide was substantially higher among persons with mental disorders, but the risk of violent death was not elevated. On the other hand, alcohol was a major factor associated with violent deaths but not with suicides. Lunetta et al. (41) found a high percentage (30.5 percent) of alcohol-

positive deaths among violent deaths, including suicides. This discrepancy could be due to differences in study populations: In this study, we had a high-risk population, but Lunetta et al. (41) observed the general population.

In summary, people with mental health disorders form a subpopulation with a higher risk of suicide, and people with alcohol-related diagnoses are at higher risk of violent death. However, it is reasonable to assume that many violent, alcohol-related deaths are inherently connected to suicidal behavior. Thus, it could be questionable to make a clear distinction between suicides and alcohol-related

deaths. On the other hand, people with mental disorders clearly form a high-risk group with respect to suicide.

A major limitation of this study is that we were able to identify only hospital-treated suicide attempters. To our knowledge, no country in the world has collected official statistics on attempted suicide. Because the database we used was based on attempted suicide diagnoses recorded in a hospital discharge register, it is possible that we missed patients who had actually attempted suicide before hospitalization but whose attempt had not been recognized by health-care personnel. Overall, the accuracy of the National Hospital Discharge Register is good (19–21, 42, 43). However, we cannot exclude the possibility of some underreporting of attempted suicide in the present study.

Another limitation is that the diagnoses of mental disorders were not based on standardized diagnostic interview schedules but were clinical diagnoses made by the physicians treating the patients. Finally, generalization of these findings may be limited by the varying health-care practices and strategies between countries. For example, resource allocation between outpatient care and hospital care may differ greatly, and the intensity of and methods used in outpatient treatment may also vary.

In conclusion, our results show that concerning hospitalization due to attempted suicide, the risks of suicide and all-cause mortality were very high immediately after discharge. This implies that outpatient care after attempted suicide is of paramount importance. Another observation of clinical importance was that the risk factors for different causes of death varied considerably.

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## REFERENCES

- Bertolote JMF, Fleischmann A. Suicidal behavior prevention: WHO perspectives on research. *Am J Med Genet C Semin Med Genet* 2005;133:8–12.
- Taylor SJ, Kingdom D, Jenkins R. How are nations trying to prevent suicide? An analysis of national suicide prevention strategies. *Acta Psychiatr Scand* 1997;95:457–63.
- United Kingdom Department of Health. The health of the nation key area handbook: mental illness. London, United Kingdom: United Kingdom Department of Health, 1993.
- United Kingdom Department of Health. National suicide prevention strategy for England. London, United Kingdom: United Kingdom Department of Health, 2002.
- Vastag B. Suicide prevention plan calls for physicians' help. *JAMA* 2001;285:2701–3.
- World Health Organization. The world health report 2001—mental health: new understanding, new hope. Geneva, Switzerland: World Health Organization, 2002.
- Doshi A, Boudreaux ED, Wang N, et al. National study of US emergency department visits for attempted suicide and self-inflicted injury, 1997–2001. *Ann Emerg Med* 2005;46:369–75.
- Jenkins GR, Hale R, Papanastassiou M, et al. Suicide rate 22 years after parasuicide: cohort study. *BMJ* 2002;325:1155.
- Owens D, Horrocks J, House A. Fatal and non-fatal repetition of self-harm. Systematic review. *Br J Psychiatry* 2002;181:193–9.
- Hawton K, Zahl D, Weatherall R. Suicide following deliberate self-harm: long-term follow-up of patients who presented to a general hospital. *Br J Psychiatry* 2003;182:537–42.
- Alaghebandan R, Gates KD, MacDonald D. Suicide attempts and associated factors in Newfoundland and Labrador, 1998–2000. *Can J Psychiatry* 2005;50:762–8.
- Owens D, Wood C, Greenwood DC, et al. Mortality and suicide after non-fatal self-poisoning: 16-year outcome study. *Br J Psychiatry* 2005;187:470–5.
- Haw C, Bergen H, Casey D, et al. Repetition of deliberate self-harm: a study of the characteristics and subsequent deaths in patients presenting to a general hospital according to extent of repetition. *Suicide Life Threat Behav* 2007;37:379–96.
- Hawton K, Harriss L, Zahl D. Deaths from all causes in a long-term follow-up study of 11,583 deliberate self-harm patients. *Psychol Med* 2006;36:397–405.
- Ostamo A, Lönnqvist J. Excess mortality of suicide attempters. *Soc Psychiatry Psychiatr Epidemiol* 2001;36:29–35.
- Beautrais AL. Suicides and serious suicide attempts: two populations or one? *Psychol Med* 2001;31:837–45.
- Hawton K, Sutton L, Haw C, et al. Schizophrenia and suicide: systematic review of risk factors. *Br J Psychiatry* 2005;187:9–20.
- Keskimäki I, Aro S. Accuracy of data on diagnoses, procedures and accidents in the Finnish Hospital Discharge Register. *Int J Health Sci* 1991;2:15–21.
- Mäkikyrö T, Isohanni M, Moring, et al. Accuracy of register-based schizophrenia diagnoses in a genetic study. *Eur Psychiatry* 1998;13:57–62.
- Suvisaari J, Haukka JK, Tanskanen A, et al. Decline in the incidence of schizophrenia in Finnish cohort born from 1954–1965. *Arch Gen Psychiatry* 1999;56:733–40.
- Pajunen P, Koukkunen H, Matti Ketonen M, et al. The validity of the Finnish Hospital Discharge Register and Causes of Death Register data on coronary heart disease. *Eur J Cardiovasc Prev Rehabil* 2005;12:132–7.
- Andersen PK, Borgan Ø, Gill RD, et al. Statistical models based on counting processes. New York, NY: Springer-Verlag, 1993.
- McNutt LA, Wu C, Xue X, et al. Estimating the relative risk in cohort studies and clinical trials of common outcomes. *Am J Epidemiol* 2003;157:940–3.
- Fine JP, Gray RJ. A proportional hazards model for the subdistribution of a competing risk. *J Am Stat Assoc* 1999;94:496–509.
- R Development Core Team. R: a language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing, 2004.
- Tiihonen J, Lönnqvist J, Wahlbeck K, et al. Antidepressants and the risk of suicide, attempted suicide and overall mortality in a nation-wide cohort. *Arch Gen Psychiatry* 2006;63:1358–67.
- Schmidtke A, Bille-Brahe U, DeLeo D, et al. Attempted suicide in Europe: rates, trends and sociodemographic characteristics of suicide attempters during the period



- 1989–1992. Results of the WHO/EURO Multicentre Study on Parasuicide. *Acta Psychiatr Scand* 1996;93:327–38.
28. Beautrais AL, Joyce PR, Mulder RT, et al. Prevalence and comorbidity of mental disorders in persons making serious suicide attempts: a case-control study. *Am J Psychiatry* 1996; 153:1009–14.
29. Suominen K, Henriksson M, Suokas J, et al. Mental disorders and comorbidity in attempted suicide. *Acta Psychiatr Scand* 1996;94:234–40.
30. Haw C, Hawton K, Houston K, et al. Psychiatric and personality disorders in deliberate self-harm patients. *Br J Psychiatry* 2001;178:48–54.
31. Hawton K, Fagg J. Suicide, and other causes of death, following attempted suicide. *Br J Psychiatry* 1988;152:359–66.
32. Rygnestad T. A prospective 5-year follow-up study of self-poisoned patients. *Acta Psychiatr Scand* 1988;77:328–31.
33. Ekeberg O, Ellingsen O, Jacobsen D. Suicide and other causes of death in a five-year follow-up of patients treated for self-poisoning in Oslo. *Acta Psychiatr Scand* 1991;83:432–7.
34. Nordentoft M, Breum L, Munck LK, et al. High mortality by natural and unnatural causes: a 10 year follow up study of patients admitted to a poisoning treatment centre after suicide attempts. *BMJ* 1993;306:1637–41.
35. Nordström P, Samuelsson M, Asberg M. Survival analysis of suicide risk after attempted suicide. *Acta Psychiatr Scand* 1995;91:336–40.
36. Suominen K, Isometsä E, Haukka J, et al. Substance use and male gender as risk factors for deaths and suicide: a 5-year follow-up study after deliberate self-harm. *Soc Psychiatry Psychiatr Epidemiol* 2004;39:720–4.
37. Kapur N, Cooper J, King-Hele S, et al. The repetition of suicidal behavior: a multicenter cohort study. *J Clin Psychiatry* 2006;67:1599–609.
38. Carter G, Reith DM, Whyte IM, et al. Repeated self-poisoning: increasing severity of self-harm as a predictor of subsequent suicide. *Br J Psychiatry* 2005;186: 253–7.
39. Colman I, Newman SC, Schopflocher D, et al. A multivariate study of predictors of repeat parasuicide. *Acta Psychiatr Scand* 2004;109:306–12.
40. Gibb SJ, Beautrais AL, Fergusson DM. Mortality and further suicidal behaviour after an index suicide attempt: a 10-year study. *Aust N Z J Psychiatry* 2005;39:95–100.
41. Lunetta P, Penttilä A, Sarna S. The role of alcohol in accident and violent deaths in Finland. *Alcohol Clin Exp Res* 2001: 1654–61.
42. Keskimäki I, Aro S. Accuracy of data on diagnosis, procedures and accidents in Finnish Hospital Discharge Register. *Int J Health Sci* 1991;2:15–21.
43. Poikolainen K. Accuracy of hospital discharge data: five alcohol-related diseases. *Drug Alcohol Depend* 1983;12: 315–22.