


BMJ Open Excess mortality by suicide in high-risk subgroups of suicide attempters: a prospective study of standardised mortality rates in suicide attempters examined at a medical emergency inpatient unit

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ABSTRACT

Objectives The primary aim of the present study was to investigate the putative excess mortality by suicide in suicide attempters. As a secondary aim, we investigate excess mortality in specific, clinically relevant subgroups: individuals with repeated suicide attempts (RA); individuals who used violent method at the attempt (VA); and those who scored high on the Suicide Intent Scale (HS) at the time of the baseline attempt. Finally, we investigate excess mortality in men and women separately and within 5 years and over 5 years after hospital admission for attempted suicide.

Design Prospective register-based follow-up for 21–32 years. Standardised mortality ratio (SMR) was calculated for suicide using national census data. Clinically relevant subgroups were investigated separately.

Setting Medical emergency inpatient unit in the south of Sweden.

Participants 1039 individuals who were psychiatrically assessed at admission to medical inpatient care for attempted suicide between 1987 and 1998.

Outcome measure Suicide.

Results The overall SMR for suicide was 23.50 (95% CI 18.68 to 29.56); significantly higher ($p < 0.001$) among women (30.49 (95% CI 22.27 to 41.72)) than men (18.61 (95% CI 13.30 to 26.05)). Mortality was highest within the first 5 years after the index suicide attempt (48.79 (95% CI 35.64 to 66.77)) compared with those who died after 5 years ($p < 0.001$) (14.74 (10.53 to 20.63)). The highest independent SMR was found for VA (70.22 (95% CI 38.89 to 126.80)). In a regression model including RA, VA and HS all contributed significantly to excess suicide mortality.

Conclusions An elevated risk of premature death by suicide was found in suicide attempters compared with the general population. Assessment of previous suicide attempts is important, even though the attempt/s may have occurred decades ago. When assessing suicide risk, clinicians should consider repeated attempts and whether the attempts involved high suicidal intent and violent method. Healthcare interventions may benefit from targeting identified subgroups of attempters.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Access to annual general population death rates for the study period within gender and age subgroups permitted generation of accurate estimates of expected numbers of deaths.
- ⇒ The structured psychiatric assessment at baseline provided a broad set of clinically relevant data.
- ⇒ The large clinical population ($n = 1039$) provided sufficient statistical power for subgroup comparisons.
- ⇒ An observation time of up to 32 years enabled a long-term investigation of suicide mortality.
- ⇒ Participants were only recruited from one hospital, limiting generalisability, though this was the only medical emergency unit in the catchment area.

INTRODUCTION

A suicide attempt is widely recognised as one of the most robust predictors of suicide,^{1–10} especially within the first years of the attempt and over the long term.^{7–9 11–16} Long-term follow-ups of suicide attempters have found suicide rates between 2% and 13%.^{14–19} Studies investigating risk factors for suicide among suicide attempters have for instance identified male sex (though inconsistently)^{15 24} and older age,^{3 20–23} mental disorder^{15 24} substance abuse,^{21 24 25} previous psychiatric care,^{25 26} earlier suicide attempts,^{11 21 26} violent method,^{18 26 27} and suicidal intent.²⁸

While these studies provide knowledge about crude death rates and about risk factors among the high-risk group of suicide attempters, they do not provide knowledge about the degree of increased suicide mortality risk as compared with the total population. Knowledge about the degree of increased risk associated with different



clinical factors could aid clinicians in the challenging task of assessing suicide risk in suicide attempters, especially if these clinical factors are easy to identify in a clinical emergency setting. Further, knowledge about the degree of excess mortality for different subgroups of suicide attempters as compared with the general population adds to the theoretical basis of suicidology, which in turn may guide policy-makers and decision-makers in mental health and society in suicide prevention.

Excess mortality in suicide attempters has been found in several studies,^{5 21 29–36} but very few investigations^{32 37} involved observation times as long as the current study (32 years). In a previous study employing the same cohort as here,¹⁹ we reported on the role played by repeated attempts, scores on the Suicide Intent Scale (SIS), and diagnosis at emergency hospital admission for a suicide attempt, on short-term and long-term risk for completed suicide. The present study extends these findings by comparing excess mortality by suicide in the cohort versus the general population and re-examining risk based on transdiagnostic, presumed important clinical aspects of the behaviour of the suicide attempt, that could easily be identified at an emergency consultation. Specifically, we examine repeated attempts, as well as the type of method and suicidal intent involved in suicide attempts. In relation to these risk factors, there is evidence that individuals who had made repeated suicide attempts, sometimes referred to as repeaters, have an increased suicide risk.^{38–42} Scoring high on the SIS has also been linked to the risk of suicide,^{8 28 43–45} though inconsistently. A review from 2008 found higher SIS scores to be a risk factor for suicide in 6 of the 13 included studies.⁴³ Suicide attempters who use a violent method have been identified as a risk group for suicide among suicide attempters,^{18 26 27} though other research indicates that the choice of attempt method is not associated with subsequent suicidal behaviour.⁴⁶ High suicidal intent in suicide attempters has also been linked to the use of violent methods.⁴⁷ To the best of our knowledge, no previous studies have investigated whether suicide mortality is elevated among these clinically relevant subgroups of suicide attempters (repeaters, use of more violent methods, higher SIS scores).

The primary aim of the present study is to investigate the putative long-term excess mortality by suicide in suicide attempters assessed at a medical emergency inpatient unit in southern Sweden over a 32-year period. The secondary aim is to investigate the level of excess suicide mortality in clinically relevant subgroups defined by repeated suicide attempts, use of a violent method during the attempt, and high scorers on the SIS. Finally, as previous studies have found an association between suicide mortality and time since the index suicide attempt, we investigate suicide mortality within 5 years or over 5 years after the index attempts, as well as separately for men and women.

METHOD

Study design and cohort collection

The present study is a follow-up of overall excess suicide mortality and mortality of risk groups within a population of suicide attempters previously studied.^{19 45} It consists of a clinical interview and register data from a large population (n=1039) of suicide attempters. The participants were admitted to a medical emergency inpatient unit, MEIU, in southern Sweden. The medical emergency unit where the data were collected was the only one in the catchment area. Data were collected in a standardised manner at the emergency psychiatric consultations that are routinely requested in cases of suicide attempts. A semi-structured interview that had been developed at the Suicide Research Centre based in the Department of Psychiatry at Lund University was used,⁴⁸ including sociodemographic data, method of the suicide attempt, occurrence of previous attempts, suicidal intent, etc. The assessments were carried out by a psychiatrist and a social worker at the emergency setting of MEIU, usually within 24 hours of the suicide attempt. The psychiatrist diagnosed psychiatric disorders in accordance with DSM-III-R by clinical interviewing. The baseline in this study refers to the time of assessment at the MEIU after the index suicide attempt. The study population constitutes approximately half of all suicide attempters who were admitted to the MEIU during the years 1987 and 1998 (estimated 1065/2000²⁸). Individuals who were admitted on weekends or holidays were not assessed for inclusion. Individuals who were already included and reattempted were not included again. For more detailed descriptions, see Öjehagen *et al.*⁴⁸ and Skogman *et al.*⁴⁵

Information about deaths by suicide in the study population and in the Swedish population was obtained from the Swedish Cause of Death Register, National Board of Health, covering the time from the study start in January 1987 until 31 December 2018. The cause of death register has been found to be a high-quality source of data suitable for research purposes.⁴⁹ The data regarding the Swedish population was divided into gender and age groups by every year for the purpose of standardisation, thus allowing for a comparison of mortality between the study population and the population in the nation during the same period. In line with the previous follow-ups of this population,^{19 45} we chose not to include uncertain suicides as an outcome in the analysis of risk factors, due to the uncertain nature of these deaths.

There were 411 men (39.6%) and 628 women (60.4%) in the study population. The age group 18–39 years represented 55.1% (n=572), the age group 40–69 years represented 36.7% (n=381) and the group 70+ years 8.3% (n=86). The mean age at baseline was 40 years (range 18–96). At follow-up, 36.8% of the study population were dead (n=382) and 7% of all had died by suicide (n=73). Of all suicide attempters in the study, 47% had made previous suicide attempts before baseline (n=488), 5.3% had used a violent method at the baseline suicide attempt (n=55) and 22% had an SIS score ≥ 19 (n=230). The mean

observation time was 20 years (range=0–32 years) and the median was 22 years and 10 months. The total observation time was 20 773 person-years. At baseline, 42% were married or living with a partner and 55% were employed or studying. Participants were diagnosed with adjustment disorder (32%), major depression (16%), substance abuse disorder (11%), depression not otherwise specified (9%), psychosis (7%), dysthymia (5%), anxiety disorder (2%), other axis I-diagnosis (4%), no diagnosis (3%), axis II diagnosis (but not an axis I diagnosis) (1%) and cases with missing data for diagnosis (12%). The Strengthening the Reporting of Observational Studies in Epidemiology cohort reporting guidelines were used.⁵⁰

Baseline variables

With the exception of *suicide* (certain and uncertain), *all-cause death* and *all-cause death except certain suicide*, all other variables were assessed at the time of admission to the MEIU (baseline).

Suicide attempt was defined as a situation in which a person has performed an actually or seemingly life-threatening behaviour with the intent of jeopardising their life or give the appearance of such an intent, but which has not resulted in death.⁵¹ *Index suicide attempt* refers to the suicide attempt that led to inclusion in this study. *Repeaters* refer to individuals who had made at least one suicide attempt before the index suicide attempt. *Violent method* refers to the method of attempted suicide; either a method other than drug overdose or single wrist-cut, or a combination of different methods.⁵² *SIS*⁵³ is a 20-item, clinician-completed measure of the severity of suicidal intent of a suicide attempt. A total score is computed based on the sum of the 0–2 severity ratings for the first 15 items.⁵³ The index suicide attempt was rated. Participants who were missing three items or more from the SIS were excluded from the analysis (n=87). In cases with 1–2 missing items were replaced by the mean of that individual's responses to the SIS (n=52). Cases with more than three values were excluded from further analysis of this variable. In a previous study by Niméus and coworkers²⁸ of a subgroup of this patient sample, an optimal cut-off at 19 points was identified in predicting suicide (5-year follow-up). The same cut-off was employed in this study to distinguish between low/high scores. *Age* was divided into three groups to facilitate interpretation. *Observation time* refers to the time patients were followed from the index date (time of assessment at the MEIU) until death, emigration or the study end.

Individual-level register data

Information about the causes of death in the study population was obtained from the Cause of Death Register, National Board of Health, the information in the register covered the time from the study start in January 1987 until 31 December 2018. Suicide was defined as classified in the Cause of Death Register⁵⁴; external cause of morbidity and mortality; intentional self-harm in accordance to ICD-10,⁵⁵ codes X60–X84 (certain) and Y10–Y34

(uncertain) and ICD-9⁵⁶ codes starting with E95 (certain) and E98 (uncertain).

Census data

An additional extraction from the Cause of Death Register⁵⁴ was requested. The data requested was at an aggregate level regarding all combinations of ages 18–100 years, men and women, during the years 1987–2018. Further, data on the size of the Swedish population for each cell (age/gender/year) was collected from Statistics Sweden. This way we received information on how many deaths by suicide occurred in the entire Swedish population for each year 1987–2018 broken down by gender and age group (1-year age groups).

Data analysis

A crude death rate of how many within a given population die within a specified time frame, does not consider the study population's distribution of age and sex. Both age and sex distribution can be assumed to have an impact on mortality. One way to investigate the risk of excess mortality is to calculate standardised mortality ratio (SMR). This way, differences in age and sex distribution compared with the total population are controlled for and the analysis allows information about the level of excess mortality in the study population compared with the expected level, based on the mortality of the chosen total population.

The baseline data set was first restructured so that the structure matched that of the census data, that is, a total of 5312 rows with all unique combinations of the years 1987–2018, both sexes and 1-year age intervals of 18–100 years. Thus, the observation time for a given individual in the study would be distributed among several rows as the individual ages and the chronological year shifts during the course of the study, as long as the individual remained under observation (which ended when the individual died, by any cause, or at 31 December 2018). This process was then repeated for all 16 combinations of the dichotomous variables *repeaters*, *violent attempt* and *SIS>20p*, as well as *the time period* (1–5 years vs more than 5 years of follow-up), for a total of 84992 rows of data. The total number of suicide deaths in the study population for each row of data was considered *observed suicide deaths*, and by using the total observation time per row from the study population and the incidence of suicide death for each row of data from the census data, we could calculate *expected suicide deaths* for each row of the data.

SMRs and rate ratio (RR) were calculated using Poisson regression models⁵⁷ with *observed suicide deaths* as the dependent variable and the logarithm of *expected suicide deaths* as an offset variable. In the subgroup analyses, the covariates were included as independent variables in the regression models. Tests of the statistical significance of the SMR were based on the Poisson distribution using 95% CIs. The SMRs of several subgroups were investigated, and the difference between levels of covariates was assessed by CIs of the RR and p values. The main analyses

were performed with certain suicide as the outcome variable. Competing risks may lead to underestimation of the true risk of the investigated outcome because other causes of death may occur before suicide. Since death from all causes was as high as 36.8% in this sample, an additional set of analyses was made with the outcome variable *death all causes except certain suicide*.

The investigated variables were analysed separately, category by category. They were then investigated with the categories within the variable in relation to each other. The next step was to include the investigated subgroups in a regression model, thereby adjusting for the effect of one another. As the last step, a regression model also including interaction terms was calculated, controlling for the possible interaction between the variables repeater, violent method and a high score on SIS. In this way, the interaction model was used as a sensitivity analysis. The model with the interaction effect had a worse Akaike Information Criterion value than the model without the interaction effects (965.2 vs 962.5, and the p value from the likelihood ratio test was 0.427, which means that the simpler model is preferred). We thus used the results from the model with the three covariates included, but not the interaction terms.

Another sensitivity analysis was performed repeating all the main analyses with the outcome variable *certain plus uncertain suicide*. As per convention, a significance threshold of 0.05 was set throughout. All analyses were performed using V.25 of SPSS.⁵⁸

Patient and public involvement

Patients or the public were not involved in this study.

RESULTS

The overall suicide mortality in the study population was elevated compared with that of the total population, SMR was 23.50 (18.68 to 29.56). Further, table 1 presents SMR for each category of the investigated variables independently. SMR for suicide was higher among women than among men. It was over 30 times the expected for women and over 18 times for men compared with the general population. The age group with the highest individual SMR was the individuals over 70 years of age who had suicide mortality just over 37 times the expected. Excess mortality for death by suicide was higher in the first 5 years after the attempt compared with after more than 5 years (see table 1), especially in the first year,

Table 1 Unadjusted standardised mortality ratio (SMR) (95% CI), and adjusted models of rate ratio (RR) (95% CI), death by suicide

	Observed no. of deaths	Expected no. of deaths	Unadjusted SMR (95% CI)	Adjusted RR (95% CI)	P value*
Gender					
Men	34	1.83	18.61 (13.30 to 26.05)	1	0.035
Women	39	1.28	30.49 (22.27 to 41.72)	1.64 (1.03 to 2.59)	
Age groups (years)					
18–39	21	0.73	28.79 (18.77 to 44.15)	0.77 (0.38 to 1.57)	0.475
40–69	40	2.05	19.47 (14.28 to 26.54)	0.52 (0.27 to 1.00)	0.048
70+	12	0.32	37.27 (21.17 to 65.63)	1	
Time groups (years)					
≤5	39	0.80	48.79 (35.64 to 66.77)	3.31 (2.09 to 5.24)	<0.001
>5	34	2.31	14.74 (10.53 to 20.63)	1	
Repeated suicide attempts at baseline					
Repeater	47	1.38	34.14 (25.65 to 45.44)	2.27 (1.41 to 3.67)	0.001
Non-repeater	26	1.73	15.03 (10.24 to 22.08)	1	
Method at baseline attempt					
Violent	11	0.16	70.22 (38.89 to 126.80)	3.34 (1.76 to 6.34)	<0.001
Non-violent	62	2.95	21.02 (16.39 to 26.96)	1	
SIS score					
≥19p	30	0.64	46.90 (32.79 to 67.07)	2.69 (1.69 to 4.28)	<0.001
<19p	43	2.47	17.43 (12.93 to 23.51)	1	

Unadjusted standardised mortality ratio (SMR) (95% CI), and adjusted models of rate ratio (RR) (95% CI), death by suicide. Unadjusted SMR investigates each category within the variable separately. Adjusted RR includes the categories within the variables, reference category marked as '1'. Bold marks statistically significant results.

*P value for difference between categories within the variable.

SIS, Suicide Intent Scale.

Standardized suicide mortality per year of follow-up

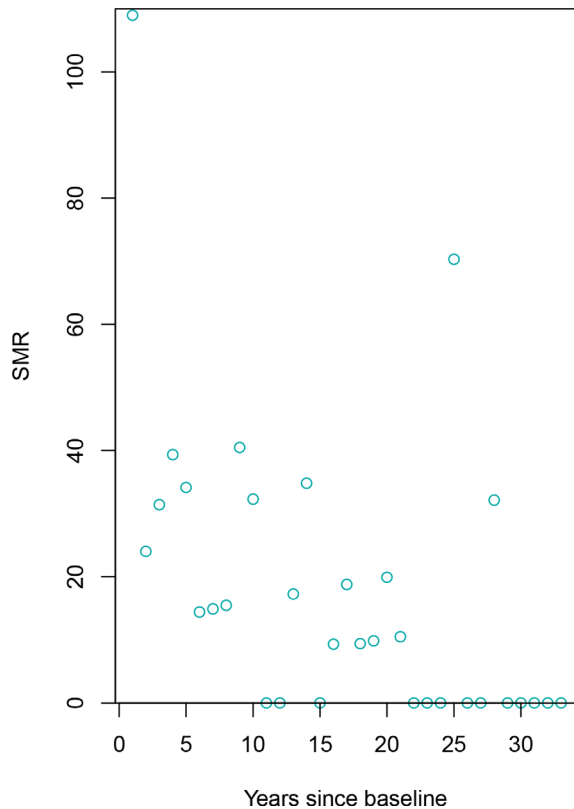


Figure 1 Overview of the change of SMR over the course of follow-up. The SMR is plotted for each year of follow-up. SMR, standardised mortality ratio.

illustrated in [figure 1](#). Individuals who had made suicide attempts prior to the index attempt had suicide mortality over 34 times the expected. The group of individuals who had made a violent suicide attempt represented the group with the highest SMR with suicide mortality over 70 times the expected. In attempters who scored high

on the SIS, suicide mortality was 47 times the expected compared with the total population ([table 1](#)).

In Poisson regression models including the three investigated clinical variables repeated attempts, violent method and high SIS score, all were identified as statistically significant variables contributing to excess suicide mortality ([table 2](#)). Violent method demonstrated the highest independent levels of SMR ([table 1](#)) as well as the highest adjusted RR in the model ([table 2](#)). In the last adjusted model, including interaction terms for sensitivity analysis purposes, the adjusted RRs are similar to that of the main model, but the CIs are wider. In this model, only violent method remained statistically significant.

The competing risks analysis, using *all-cause mortality except for certain suicide* as the outcome variable, are reported in [tables 3 and 4](#). The overall SMR was 2.17 (1.93 to 2.43). The SMR for all investigated subgroups was around 2. There were no statistically significant differences within or after 5 years after the index suicide attempt, for violent method versus no violent method, or for high versus lower SIS score. The SMR was slightly higher for men than for women. It was higher among repeaters than non-repeaters. The highest SMR was found for the youngest investigated age group of individuals between 18 and 39 years, 8.84 (5.97 to 13.08). In the adjusted models, only the variable repeated attempts remained statistically significant.

In the sensitivity analyses using both certain and uncertain suicides as outcomes, the results were overall very similar to the main analyses using only certain suicides (see online supplemental file). The overall SMR was 23.52 (19.24 to 28.76). Compared with the SMRs of the main analysis, it was slightly higher for men, 20.95 (15.84 to 27.72), and for women slightly lower, 27.06 (20.27 to 36.13). The SMR for

Table 2 Unadjusted and adjusted models of standardised mortality ratio (SMR) and rate ratio (RR) (95% CI) including interaction variables, death by suicide

	Unadjusted model		Adjusted model 1		Adjusted model 2	
	RR (95% CI)	P value	RR	95% CI	RR	95% CI
Intercept (SMR)	23.50 (18.68 to 29.56)	<0.001	10.05	6.49 to 15.57	11.50	6.98 to 18.96
Baseline variables						
Repeated attempts at baseline	2.27 (1.41 to 3.67)	0.001	2.39	1.48 to 3.87	1.80	0.95 to 3.42
Violent method	3.34 (1.76 to 6.34)	<0.001	3.28	1.71 to 6.31	3.22	1.05 to 9.86
SIS score \geq 19p	2.69 (1.69 to 4.29)	<0.001	2.42	1.51 to 3.88	1.66	0.60 to 4.57
Interaction terms						
Repeater*violent method					2.13	0.52 to 8.68
Repeater*SIS score \geq 19p					1.66	0.60 to 4.57
Violent method*SIS score \geq 19p					0.41	0.11 to 1.61

Unadjusted and adjusted models of standardised mortality ratio (SMR) and rate ratio (RR) (95% CI) including interaction variables, death by suicide. The unadjusted model includes only the categories within the variable. Adjusted model 1 includes the three baseline variables. Adjusted model 2 includes the baseline variables and the interaction terms. Bold marks statistically significant results. SIS, Suicide Intent Scale.

Table 3 Unadjusted standardised mortality ratio (SMR) (95% CI), and adjusted models of rate ratio (RR) (95% CI), death by all causes except certain suicide

	Observed no. of deaths	Expected no. of deaths	Unadjusted SMR (95% CI)	Adjusted RR (95% CI)	P value*
Gender					
Men	155	61.30	2.53 (2.16 to 2.96)	1.35 (1.07 to 1.69)	0.010
Women	154	77.22	1.88 (1.60 to 2.21)	1	
Age groups (years)					
18–39	27	2.83	8.84 (5.97 to 13.08)	6.18 (4.03 to 9.47)	<0.001
40–69	144	44.18	3.26 (2.77 to 3.84)	2.28 (1.80 to 2.88)	<0.001
70+	138	91.51	1.43 (1.21 to 1.70)	1	
Time groups (years)					
≤5	75	32.77	2.26 (1.80 to 2.84)	1.06 (0.81 to 1.37)	0.681
>5	234	105.75	2.14 (1.88 to 2.44)	1	
Repeated suicide attempts at baseline					
Repeater	148	56.74	2.52 (2.14 to 2.97)	1.31 (1.05 to 1.65)	0.019
Non-repeater	161	81.78	1.92 (1.64 to 2.25)	1	
Method at baseline attempt					
Violent	18	6.98	2.44 (1.52 to 3.92)	1.13 (0.69 to 1.85)	0.617
Non-violent	291	131.55	2.15 (1.92 to 2.42)	1	
SIS score					
≥19p	79	38.00	2.00 (1.60 to 2.50)	1	0.416
<19p	230	100.52	2.23 (1.96 to 2.54)	1.11 (0.86 to 1.45)	

Unadjusted standardised mortality ratio (SMR) (95% CI), and adjusted models of rate ratio (RR) (95% CI), death by all causes except certain suicide. Unadjusted SMR investigates each category within the variable separately. Adjusted RR includes the categories within the variables, reference category marked as '1'. Bold marks statistically significant results.

*P value for difference between categories within the variable.

SIS, Suicide Intent Scale.

the youngest age group was somewhat higher, 32.99 (23.20 to 46.91). For the subgroup who used violent method and those with high SIS score, the SMR was

slightly lower than in the main analyses, 64.42 (37.41 to 110.94) and 41.19 (29.43 to 57.64), respectively.

Table 4 Unadjusted and adjusted models of standardised mortality ratio (SMR) and rate ratio (RR) (95% CI) including interaction variables, death by all causes except certain suicide

	Unadjusted model		Adjusted model 1		Adjusted model 2	
	RR (95% CI)	P value	RR	95% CI	RR	95% CI
Intercept (SMR)	2.17 (1.93 to 2.43)	<0.001	1.97	1.67 to 2.33	1.84	1.52 to 2.22
Baseline variables						
Repeated attempts at baseline	1.31 (1.05 to 1.65)	0.019	1.32	1.05 to 1.66	1.50	1.15 to 1.96
Violent method	1.13 (0.69 to 1.85)	0.617	1.13	0.69 to 1.85	1.61	0.82 to 3.19
SIS score≥19p	1.11 (0.86 to 1.45)	0.416	0.87	0.67 to 1.14	1.09	0.76 to 1.57
Interaction terms						
Repeater*violent method					0.65	0.24 to 1.81
Repeater*SIS score≥19p					0.68	0.40 to 1.15
Violent method*SIS score≥19p					0.69	0.23 to 2.07

Unadjusted and adjusted models of standardised mortality ratio (SMR) and rate ratio (RR) (95% CI) including interaction variables, death by all causes except certain suicide. The unadjusted model includes only the categories within the variable. Adjusted model 1 includes the three baseline variables. Adjusted model 2 includes the baseline variables and the interaction terms. Bold marks statistically significant results. SIS, Suicide Intent Scale.

DISCUSSION

The present study aimed to fill a gap in the literature by examining excess mortality by suicide in hospitalised suicide attempters versus the general population and to examine clinically relevant risk factors for the same. We found substantial excess mortality by suicide among suicide attempters; higher among women than among men and higher within the first 5 years than over 5 years after the index attempt. The highest independent SMR was found for the suicide attempters who had made a violent index attempt. In a regression model including repeated suicidal attempts (RA), more violent attempts (VA) and higher scores on a measure of suicidal intent (HS), all three clinical characteristics were significantly associated with excess suicide mortality. This means that a female patient hospitalised following attempted suicide stands a much higher risk of dying by suicide than women of the same age in general. This may be important to bear in mind, especially as it is generally known that male sex is an important statistical risk factor for suicide.⁵⁹ This study highlights that the risk of premature death and suicide among younger and female attempters is also important to consider, especially if they have a history of attempted suicide, particularly within the 5 years after the index attempt, and if they at the current attempt report a high suicidal intent and have employed a violent method.

Findings from the present study need to be considered within the context of several strengths and limitations. A standardised clinical assessment provided a broad set of baseline data on a large sample of suicide attempters who had been admitted to an emergency medical unit because of a suicide attempt. The generalisability of the study population to the wider group of suicide attempters in general is limited by only including participants from one site only, although this was the only emergency unit in a large catchment area and also by the fact that these participants were admitted to a medical emergency unit, indicating a certain severity of the suicide attempt. However, to our knowledge, this is the largest population of suicide attempters followed for this length of time, with baseline data available from a semi-structured clinical interview designed specifically for use with suicide attempters. The study also benefits from the inclusion of annual general population death rates for the study period, within gender and age subgroups, making a more accurate estimation of the expected numbers of deaths. This population data enabled computation of the overall excess mortality by suicide (SMR) in the study population as well as for clinically relevant subgroups defined by putative risk groups for suicide (RA, VA and HS) within the group of suicide attempters. Still, further studies are needed employing similar designs, both in other countries and with individuals recruited from outside of inpatient (emergency) medical settings. In addition, future studies should attempt to assess the level of violence and suicidal intent involved in repeated suicide attempts that did not result in death.

The results of the present study confirm the conclusions of previous studies that suicide attempters have an elevated risk of suicide mortality. Previous studies have found SMRs of between 17 and 77, though these studies had different standard populations.^{5 29–36} The number of suicides in this study population of suicide attempters was approximately 23.5 times that which would be expected in the general Swedish population. The SMR was particularly high in females, mirroring the results of previous studies.^{29–31 33 37} The finding that the excess mortality was higher in the first 5 years after the attempts compared with after that, is in line with the results of previous studies investigating the risk of death by suicide over time who found the highest risk in the first year^{21 29} and the first 3 years³⁴ after the attempt.

RA, VA and HS were all identified as statistically significant variables contributing to excess suicide mortality. Since VA was the only variable still statistically significant in the interaction model that was used as sensitivity analysis, it may indicate stronger support for this variable as an independent contributing factor. To the best of our knowledge, no previous studies have investigated the excess suicide mortality of these subgroups of suicide attempters although repeated suicidal behaviour,^{38–42} violent method^{18 26 27} and a high score on the SIS^{8 28 43–45} have been identified as risk factors for suicide within the group of suicide attempters in several studies. The results of this study strengthen the suicide mortality risk associated with these subgroups and while they may be linked to each other, all three are independent relevant risk groups. Further, this study clearly demonstrates the severe risk of premature death by suicide in suicide attempters compared with the general population, especially in the years following the attempt. The excess suicide mortality is especially high in women, and in those who have made repeated attempts, in those who made a violent suicide attempt, and among those who were high in suicidal intent.

All-cause mortality in this sample was 36.8% and the SMR was 2.42 (2.19 to 2.68). Given that individuals dying from another cause cannot die by suicide, death from any other cause than suicide might represent a competing risk. Consequently, the results may represent biased estimates of differences between study population and overall population and between subgroups of the study population. In order to assess the influence of competing risks, we investigated all-cause death with certain suicide excluded. The analyses showed an overall around doubled risk of death by other causes than suicide compared with the general population. The only clearly deviant SMR of 8.84 was found for the youngest age group (18–39 years). The fact that the youngest individuals in the study had an unexpectedly high rate of death by causes such as somatic illness and accidents is a worrying feature which represents an important area for further investigation. The high excess mortality in this group indicates that there might be a possible underestimation of the absolute suicide risk among the youngest people in this study.



Using only certain suicides in the analyses could risk resulting in errors regarding the estimation of differences between the study population and total population. Therefore, we included uncertain suicides in a sensitivity analysis. The results of the sensitivity analyses, that were extended to include uncertain suicides in the outcome measure, showed highly similar estimates of SMR with some minor differences. While it's reasonable to assume that some of the uncertain suicides were indeed actual suicides, the absence of meaningful differences between the sensitivity analyses and the main analyses indicates that this does not bias the results significantly.

The results of this study underscore the importance of a thorough assessment of the history of previous suicide attempts, even though the attempt/s may have occurred many years ago. In the psychiatric assessment of suicide attempters, clinicians could benefit from asking questions about previous suicide attempts, retrieving information about the method of the attempt and gaining knowledge about the suicidal intent, for instance, using the SIS. Clinicians may be aided by including these aspects in their suicide risk assessment of suicide attempters at both short-term and long-term follow-up. By doing so they may have a better chance of identifying patients with a higher risk of suicide for many years after a suicide attempt. Suicide prevention programmes may benefit from targeting the identified subgroups of attempters with specific interventions. Suicide risk most likely changes over time and highly complex interactions between multiple factors are probable. Future research would benefit from repeated assessment over a life course to shed further light on the process of suicide risk over time. A follow-up assessment of those still living could provide information on possible sources of resilience.

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REFERENCES

- Bostwick JM, Pabbati C, Geske JR, *et al*. Suicide attempt as a risk factor for completed suicide: even more lethal than we knew. *Am J Psychiatry* 2016;173:1094–100.
- Harris EC, Barraclough B. Suicide as an outcome for mental disorders. A meta-analysis. *Br J Psychiatry* 1997;170:205–28.
- 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.
- 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.
- 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.
- 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.
- De Moore GM, Robertson AR. Suicide in the 18 years after deliberate self-harm a prospective study. *Br J Psychiatry* 1996;169:489–94.
- Suominen K, Isometsä E, Ostamo A, *et al*. Level of suicidal intent predicts overall mortality and suicide after attempted suicide: a 12-year follow-up study. *BMC Psychiatry* 2004;4:11–17.
- Tidemalm D, Beckman K, Dahlin M, *et al*. Age-Specific suicide mortality following non-fatal self-harm: national cohort study in Sweden. *Psychol Med* 2015;45:1699–707.
- Maser JD, Akiskal HS, Schettler P, *et al*. Can temperament identify affectively ill patients who engage in lethal or near-lethal suicidal behavior? A 14-year prospective study. *Suicide Life Threat Behav* 2002;32:10–32.
- Tejedor MC, Díaz A, Castillón JJ, *et al*. Attempted suicide: repetition and survival—findings of a follow-up study. *Acta Psychiatr Scand* 1999;100:205–11.
- Suokas J, Suominen K, Lönnqvist J. Chronic alcohol problems among suicide attempters - post-mortem findings of a 14-year follow-up / Chronic alcohol problems among suicide attempters - post-mortem findings of a 14-year follow-up. *Nordic Journal of Psychiatry* 2005;1:45.
- Wang AG, Mortensen G. Core features of repeated suicidal behaviour: a long-term follow-up after suicide attempts in a low-suicide-incidence population. *Soc Psychiatry Psychiatr Epidemiol* 2006;41:103–7.
- Jenkins GR, Hale R, Papanastassiou M, *et al*. Suicide rate 22 years after parasuicide: cohort study. *BMJ* 2002;325:1155.
- Tidemalm D, Långström N, Lichtenstein P, *et al*. Risk of suicide after suicide attempt according to coexisting psychiatric disorder: Swedish cohort study with long term follow-up. *BMJ* 2008;337:1328–31.
- Suominen K, Isometsä E, Suokas J, *et al*. Completed suicide after a suicide attempt: a 37-year follow-up study. *Am J Psychiatry* 2004;161:562–3.
- Dahlgren KG. Attempted suicides-35 years afterward. *Suicide Life Threat Behav* 1977;7:75–9.
- Runeson B, Tidemalm D, Dahlin M, *et al*. Method of attempted suicide as predictor of subsequent successful suicide: national long term cohort study. *BMJ* 2010;341:c3222.

- 19 Probert-Lindström S, Berge J, Westrin Åsa, *et al.* Long-Term risk factors for suicide in suicide attempters examined at a medical emergency in patient unit: results from a 32-year follow-up study. *BMJ Open* 2020;10:e038794.
- 20 Chen VCH, Tan HKL, Chen C-Y, *et al.* Mortality and suicide after self-harm: community cohort study in Taiwan. *Br J Psychiatry* 2011;198:31–6.
- 21 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.
- 22 Nordström P, Samuelsson M, Asberg M. Survival analysis of suicide risk after attempted suicide. *Acta Psychiatr Scand* 1995;91:336–40.
- 23 Han B, Kott PS, Hughes A, *et al.* Estimating the rates of deaths by suicide among adults who attempt suicide in the United States. *J Psychiatr Res* 2016;77:125–33.
- 24 Nielsen B, Wang AG, Brille-Brahe U. Attempted suicide in Denmark. IV. A five-year follow-up. *Acta Psychiatr Scand* 1990;81:250–4.
- 25 Cooper J, Kapur N, Webb R, *et al.* Suicide after deliberate self-harm: a 4-year cohort study. *Am J Psychiatry* 2005;162:297–303.
- 26 Christiansen E, Jensen BF. Risk of repetition of suicide attempt, suicide or all deaths after an episode of attempted suicide: a register-based survival analysis. *Aust N Z J Psychiatry* 2007;41:257–65.
- 27 Runeson B, Haglund A, Lichtenstein P, *et al.* Suicide risk after nonfatal self-harm: a national cohort study, 2000–2008. *J Clin Psychiatry* 2016;77:240–6.
- 28 Niméus A, én M, Träskman-Bendz L. High suicidal intent scores indicate future suicide. *Archives of Suicide Research* 2002;6:211–9.
- 29 Ostamo A, Lönnqvist J. Excess mortality of suicide attempters. *Soc Psychiatry Psychiatr Epidemiol* 2001;36:29–35.
- 30 Hawton K, Fagg J. Suicide, and other causes of death, following attempted suicide. *Br J Psychiatry* 1988;152:359–66.
- 31 Pederson AM, Tefft BM, Babigian HM. Risks of mortality of suicide attempters compared with psychiatric and general populations. *Suicide* 1975;5:145–57.
- 32 Mehlum L. Young male suicide attempters 20 years later: the suicide mortality rate. *Mil Med* 1994;159:138–41.
- 33 Ettlinger R. Evaluation of suicide prevention after attempted suicide. *Acta Psychiatr Scand Suppl* 1975;260:5–135.
- 34 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.
- 35 Bratfos O. Attempted suicide. A comparative study of patients who have attempted suicide and psychiatric patients in general. *Acta Psychiatr Scand* 1971;47:38–56.
- 36 Harris EC, Barraclough B. Excess mortality of mental disorder. *Br J Psychiatry* 1998;173:11–53.
- 37 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.
- 38 Menon V, Kattimani S, Sarkar S, *et al.* How do repeat suicide attempters differ from first timers? an exploratory record based analysis. *J Neurosci Rural Pract* 2016;7:91–6.
- 39 Cedereke M, Öjehagen A. Prediction of repeated parasuicide after 1–12 months. *Eur Psychiatry* 2005;20:101–9.
- 40 De Leo D, Padoani W, Lonqvist J, *et al.* Repetition of suicidal behaviour in elderly Europeans: a prospective longitudinal study. *J Affect Disord* 2002;72:291–5.
- 41 Chandrasekaran R, Gnanaselane J. Predictors of repeat suicidal attempts after first-ever attempt: a two-year follow-up study. *Hong Kong Journal of Psychiatry* 2008;18:131–5.
- 42 Kotila L, Lönnqvist J. Adolescents who make suicide attempts repeatedly. *Acta Psychiatr Scand* 1987;76:386–93.
- 43 Freedenthal S. Assessing the wish to die: a 30-year review of the suicide intent scale. *Arch Suicide Res* 2008;12:277–98.
- 44 Stefansson J, Nordström P, Jokinen J. Suicide intent scale in the prediction of suicide. *J Affect Disord* 2012;136:167–71.
- 45 Skogman K, Alsén M, Öjehagen A. Sex differences in risk factors for suicide after attempted suicide—a follow-up study of 1052 suicide attempters. *Soc Psychiatry Psychiatr Epidemiol* 2004;39:113–20.
- 46 Nordentoft M, Branner J. Gender differences in suicidal intent and choice of method among suicide attempters. *Crisis* 2008;29:209–12.
- 47 Stenbacka M, Jokinen J. Violent and non-violent methods of attempted and completed suicide in Swedish young men: the role of early risk factors. *BMC Psychiatry* 2015;15:196.
- 48 Öjehagen A, Regnéll G, Träskman-Bendz L. Deliberate self-poisoning: repeaters and nonrepeaters admitted to an intensive care unit. *Acta Psychiatr Scand* 1991;84:266–71.
- 49 Brooke HL, Talbäck M, Hörnblad J, *et al.* The Swedish cause of death register. *Eur J Epidemiol* 2017;32:765–73.
- 50 von Elm E, Altman DG, Egger M, *et al.* The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.
- 51 Beck AT. *Classification and nomenclature, in suicide prevention in the seventies.* Washington DC: Government Printing Office, 1972.
- 52 Träskman L, Åsberg M, Bertilsson L, *et al.* Monoamine metabolites in CSF and suicidal behavior. *Arch Gen Psychiatry* 1981;38:631–6.
- 53 Beck AT, Herman I, Scuyler D, eds. *Development of suicidal intent scales, The prediction of suicide.* Charles Press, 1974.
- 54 The national board of health and welfare. Statistikdatabas för dödsorsaker [Statistical database cod. Cause of death register, 2021. Available: https://sdb.socialstyrelsen.se/lf_dor/resultat.aspx [Accessed 28 Jan 2021].
- 55 World Health Organization. *International statistical classification of diseases and related health problems : ICD-10.* 10. rev. ed. World Health Organization, 1992.
- 56 World Health Organization. *International classification of diseases 9th revision, 1977.*
- 57 Liu J, Louis TA, Pan W, *et al.* Methods for estimating and interpreting Provider-Specific standardized mortality ratios. *Health Serv Outcomes Res Methodol* 2003;4:135–49.
- 58 Norusis M. *SPSS for windows.* Chicago: SPSS Inc, 1995.
- 59 Werbeloff N, Dohrenwend BP, Levav I, *et al.* Demographic, behavioral, and psychiatric risk factors for suicide. *Crisis* 2016;37:104–11.