

## Seasonality of suicide attempts: association with gender

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**Abstract** Some studies suggest seasonality of suicide attempts in females, but not in males. The reasons for this gender difference remain unclear. Only few studies addressed the question whether gender differences in seasonality of suicide attempts reflect gender differences in the choice of method for suicide attempts, with inconsistent results. So, this study aimed to analyze the association of gender with seasonality in suicide attempts by persons living in two Northern Bavarian regions [city of Nuremberg (480,000 inhabitants) and region of Wuerzburg (270,000 inhabitants)] between 2000 and 2004. We addressed this question by focussing on the frequency of suicide attempts in relation to the seasons. The sample consisted of 2,269 suicide attempters (882 males and 1,387 females). The overall seasonality was assessed using the  $\chi^2$  test for

multinomials. Moreover, the ratio of observed to expected number of suicide attempts (OER) with 95% confidence intervals within each season was calculated. As a result, overall distribution of suicide attempts differed significantly between seasons for women ( $\chi^2 = 9.19$ ,  $df = 3$ ,  $P = 0.03$ ), but not for men. Female suicide attempts showed a trough in the spring (decline compared to the expected value by 10%; OER = 0.9, 95% CI = 0.8–1.0). This trough was restricted to female low-risk suicide attempts (decline by 13%; OER = 0.87, 95% CI = 0.77–0.98). No seasonality was found for men. Seasonality of high-risk methods was more pronounced than that of low-risk methods; however, no significant gender differences were found concerning this aspect. The overall distribution of the sub-types of suicidal acts (parasuicidal gestures, suicidal pauses, suicide attempts in the strict sense) showed seasonality neither for males nor for females. Whereas seasonality was absent in male suicide attempters, the frequency of low-risk suicide attempts in females was 13.1% lower than expected in the spring.

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### Introduction

Seasonality of completed suicides is a well-known phenomenon (e.g., [1, 6, 13, 19, 21, 25, 36, 38, 42, 44, 50]), which, however, appears to be different in men and women, whereas single spring peaks were reported for men, two peaks (one in spring and the other one in autumn) were found in females [7, 22, 27, 28, 32, 37]. The female bimodality in suicide seasonality may be due to the fact that drowning and poisoning peaked during autumn among female suicide victims, but not male ones [38].

Concerning attempted suicides, seasonality has also been reported [4, 17, 26, 35, 43]. This seasonality was evident in females, but not in males [4, 17, 26, 35]. The reasons for this gender difference remain unclear. Only few studies addressed the question whether gender differences in seasonality of suicide attempts reflect gender differences in the choice of method for suicide attempts [43, 49]. The results were not consistent (marked [49] vs. low [43] gender differences).

As to our knowledge, gender differences in seasonality of suicide attempts with respect to different motives (parasuicidal gesture, suicidal pause, suicide attempts in the strict sense) have not been investigated so far although this differentiation might be important: seasonality is associated with depression [33] and mood disorders were found to be more frequent in suicide attempters in the strict sense (69.9%) than in subjects with suicide gestures (46.7%) [18]. Therefore, more pronounced seasonal fluctuations of suicidal acts could be expected in subjects with suicide attempts in the strict sense, especially in women (due to their higher prevalence of affective disorders) [41].

So, the present study addressed the following questions:

- Are there gender differences in seasonality of suicide attempts?
- If there are differences, are they dependent from the predominant motive or chosen suicide method?

If seasonal peaks in certain subgroups could be detected, this would be relevant for suicide prevention because therapists could be sensitized for the existence of certain periods of an increased risk for certain types of suicides, based on these findings.

Data were collected within the “Nuremberg Alliance against Depression” (NAD) [16], a “community-based 2-year action programme against depression and suicidality in Nuremberg [...], targeting primary care physicians, the media and general public, community facilitators of access to care for depression and depressed persons and suicide attempters as well as their relatives” ([16]).

## Methods

Information about suicide attempts in Nuremberg (480,000 inhabitants) and Wuerzburg (270,000 inhabitants) between 2000 and 2004 were obtained in cooperation with the hospitals in these cities, a representative sample of psychiatric practices ( $N = 28$ ), crisis intervention centres as well as the local authorities. In each case of suicide attempts, an interview was performed. This interview was based on the monitoring form of the WHO/EURO Multi-centre Study on Suicidal Behaviour (compare [17]). Using

data from this interview, all suicide attempts could be classified by gender, suicide method, predominant motive of the suicide attempt (parasuicidal gesture, suicidal pause, suicide attempt in the strict sense), year and week of the suicide attempt. Standardized information about suicide attempts was gathered in the study centre. Further procedures to ensure high reliability of the study data included continuous harmonization of the data assessment in Nuremberg and Wuerzburg and regular supervision of the interviewers.

The study has been reviewed by the appropriate ethics committee and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

The WHO definition of parasuicide was chosen to define suicide attempts [5].

The classification of methods of suicide attempts was based on the 10th revision of the International Classification of Diseases and Related Health Problems (ICD-10; codes: X60–X84) [8]. Based on differences in mortality associated with different methods [16] we separated ‘high-risk’ suicide attempt methods from ‘low-risk’ ones. ‘Medication overdose’ and ‘cuts/stabs’ were defined as low-risk methods, ‘hanging’, ‘jumping’, ‘shooting’, ‘being run over’ and ‘drowning’ as high-risk methods. A third category (other methods) included autointoxication by other methods than medication overdose (ICD-10: X65–X69), self injury by explosive materials, fire, hot objects (ICD-10: X75–X77), self injury by blunt objects (ICD-10: X79), deliberately induced automobile accidents (ICD-10: X82) and suicide attempt methods not otherwise specified (ICD-10: X83–X84).

The investigators had to assess the intention to kill oneself by means of the Feuerlein scale [11]. Using this scale, they decided whether the criteria for parasuicidal gesture, suicidal pause or suicide attempts in the strict sense were given. A parasuicidal gesture was coded if the suicidal act had more appellative character than the intention to effectuate the own death in a violent way. Suicidal pauses were defined as suicidal acts the main aim of which was the interruption of a situation which the persons concerned experienced as unsupportable and not to handle at all. Instead, suicide attempts in the strict sense were characterized by the subjects’ will to effect forcibly the own death.

Based on their clinical examinations, the investigators also made psychiatric diagnoses according to the ICD-10 criteria [8].

Data analysis was related to suicide attempt cases. The data about suicide attempts were grouped by week (1–53). In a next step, the meteorological seasons of suicide attempts were computed. We analyzed the period from

2000 to 2004 and studied the seasonal distribution of suicide attempts based on the hypothesis that the suicide attempts are evenly distributed within a year.

The four seasons were defined as follows: spring (March–May), summer (June–August), autumn (September–November) and winter (December–February). The gender differences in the seasonal distribution of suicide attempts were tested with the  $\chi^2$  test for independent sample comparison. The overall seasonality was assessed using the  $\chi^2$  test for multinomials. Moreover, the ratio of observed to expected number of suicide attempts (OER) with 95% confidence intervals within each season was calculated by using a simple calculator (EUROCAT<sup>TM</sup>) (<http://www.bio-medical.co.uk/eurocatlive/clusterstats/page6.html>). Calendar effects [i.e. leap years (2000, 2004) as well as unequal number of days in a season] were always taken into account in the data analyses. These analyses were performed using the statistical software package SPSS for Windows (version 12.0; SPSS Inc.; Chicago, IL, USA).

All tests were two-tailed and  $P \leq 0.05$  determined statistical significance.

## Results

During the study period, 2,269 persons (882 males and 1,387 females) made at least one suicide attempt.

### Gender differences in suicide attempt methods and motives

Demographic and clinical features of the suicide attempters are presented in Table 1. 539 of 2,269 suicide attempters (23.8%) fulfilled the diagnostic criteria for a major depressive episode (either in the context of unipolar depression or bipolar affective disorders according to ICD-10; codes: F31.3–5; F32; F33.0–3,8,9) [8]. Double depression in the sense of a major depressive episode (ICD-10: F32 or F33.0–3,8,9) combined with dysthymia (ICD-10: F34.1) was very rare and only found in four (female) suicide attempters.

Table 2 summarizes the gender differences regarding the predominant motive of the suicidal act and the subtype of suicide attempts (low- vs. high-risk methods).

### Seasonality of suicide attempts in males and females

Seasonality of suicide attempts in males and females is illustrated by Fig. 1. Tables 3 and 4 demonstrate how suicide attempt methods and motives are distributed within the seasons and how suicide attempts by a specific method and motive are allocated over the seasons.

### Seasonality of the number of suicide attempts

Overall distribution of suicide attempts differed significantly between seasons for women, but not for men (women:  $\chi^2 = 9.19$ ,  $df = 3$ ,  $P = 0.03$ ; men:  $\chi^2 = 1.37$ ,  $df = 3$ ,  $P = 0.71$ ), due to a trough occurring in female suicide attempts in the spring (decline by 10% compared to the expected value; OER = 0.9; 95% CI = 0.8–1.0). No such seasonality was found for men. Although seasonality was found in females, but not in males, gender differences in seasonality of suicide attempts was not statistically significant ( $\chi^2 = 2.72$ ,  $df = 3$ ,  $P = 0.44$ ).

### Seasonality of high- versus low-risk methods

Overall, there is a statistical tendency for more pronounced seasonal variation in high-risk suicide attempts than in low risk ones ( $\chi^2 = 6.78$ ,  $df = 3$ ,  $P = 0.08$ ). However, the overall distribution of suicide attempts by suicide risk (low vs. high) neither differed significantly between seasons for males nor for females (males:  $\chi^2 = 2.81$ ,  $df = 3$ ,  $P = 0.42$ ; females:  $\chi^2 = 6.65$ ,  $df = 3$ ,  $P = 0.08$ ). Significant seasonal peaks of low-risk or high-risk suicide attempts were not present. The only statistically significant trough was related to low-risk methods and found among female suicide attempts by ‘medication overdose’ or ‘cuts/stabs’ in the spring (decline by 13%; OER = 0.87; 95% CI = 0.77–0.98).

### Seasonality of different motives of suicide attempts

In males, seasonal variation of different sub-types of suicidal acts (parasuicidal gestures, suicidal pauses, suicide attempts in the strict sense) was low and not significant ( $P \geq 0.20$ ). For females, a statistical tendency for significant differences between seasons in the frequency of suicidal acts was only found for parasuicidal gestures ( $\chi^2 = 7.14$ ,  $df = 3$ ,  $P = 0.07$ ); however, statistically significant peaks or troughs could not be identified.

## Discussion

In the present study, suicide attempts in Nuremberg and Wuerzburg were registered between 2000 and 2004 based on data from a community-based action programme against depression and suicidality. Overall, our sample does not considerably differ from other samples of suicide attempters in demographic and clinical variables [10, 30, 31, 47].

**Table 1** Demographic and clinical characteristics of the sample

Variables	Males ( <i>n</i> = 882)	Females ( <i>n</i> = 1,387)	Significance test for sex differences
Age (in years), <i>n</i> (%)	–	–	$\chi^2 = 14.53$ , <i>df</i> = 6, <i>P</i> = 0.024 <sup>a</sup>
18–29	249 (28.2)	455 (32.8)	
30–39	232 (26.3)	345 (24.9)	
40–49	180 (20.4)	257 (18.5)	
50–59	105 (11.9)	134 (9.7)	
60–69	58 (6.6)	69 (5.0)	
70–79	28 (3.2)	63 (4.5)	
≥80	30 (3.4)	64 (4.6)	
Main diagnosis, <i>n</i> (%)	–	–	$\chi^2 = 68.13$ , <i>df</i> = 6, <i>P</i> < 0.000001 <sup>a</sup>
Any depressive disorders <sup>c</sup>	199 (22.6)	380 (27.4)	
Stress disorders	291 (33.0)	519 (37.4)	
Personality disorders	85 (9.6)	182 (13.1)	
Schizophrenia	81 (9.2)	91 (6.6)	
Alcohol/drug dependency	145 (16.4)	109 (7.9)	
Other diagnoses	18 (2.0)	50 (3.6)	
No diagnoses	63 (7.1)	56 (4.0)	

*n* sample size<sup>a</sup> By  $\chi^2$  test for independent samples (two-sided)<sup>b</sup> By Mann–Whitney *U* test (two-tailed)<sup>c</sup> including major depression, recurrent depressive disorders, dysthymia and other persistent depressive disorders according to the correspondent diagnostic criteria in the International Classification of Diseases and Related Health Problems (ICD-10) [8]**Table 2** Characteristics of the suicidal acts in the sample

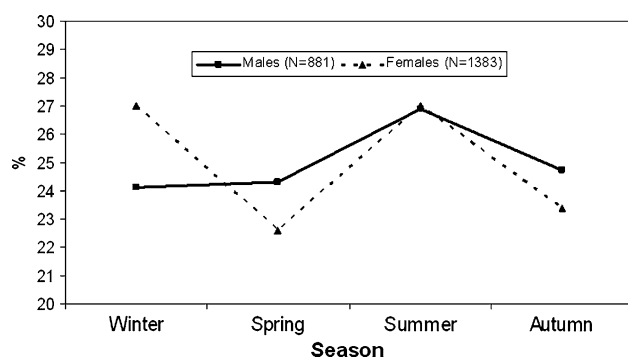
Variables	Males	Females	<i>P</i>
Predominant motive of the suicidal act	846	1,348	0.000004 <sup>a</sup>
Parasuicidal gesture (%)	25.8	25.5	
Suicidal pause (%)	24.7	34.1	
Suicide attempt in the strict sense (%)	49.5	40.4	
Low-risk methods	703	1,219	0.000001 <sup>a</sup>
Medication overdose (ICD-10: X60–X64 <sup>b</sup> ) (%)	73.3	86.3	
Cuts/stabs (ICD-10: X78 <sup>b</sup> ) (%)	26.7	13.7	
High-risk methods	126	99	0.06 <sup>a</sup>
Hanging (ICD-10: X70 <sup>b</sup> ) (%)	31.0	31.3	
Drowning (ICD-10: X71 <sup>b</sup> ) (%)	6.3	10.1	
Shooting (ICD-10: X72–X74 <sup>b</sup> ) (%)	9.5	1.0	
Jumping from high (ICD-10: X80 <sup>b</sup> ) (%)	42.1	49.5	
Being run over (ICD-10: X81 <sup>b</sup> ) (%)	11.1	8.1	
Other methods	52	65	

*M* means, *n* sample size, *s* standard deviation<sup>a</sup> By  $\chi^2$  test for independent samples (two-sided)<sup>b</sup> The classification of methods of suicide attempts based on the 10th revision of the International Classification of Diseases and Related Health Problems (ICD-10; codes: X60–X84) [8]

## Main findings

The focus of our study laid on analysis of seasonality in male versus female suicide attempts. Overall, males and females did not significantly differ in the seasonal distribution of suicide attempts. This finding differs from several other studies finding seasonality of parasuicide in females, but not in males [4, 17, 26, 35]. For example, Masterton [26] analyzed over 22,000 suicide attempts over 19 years (1969–1987) in Scotland and found seasonal variations of female suicide attempts with an increase during the summer and a decrease during the winter whereas there was no evidence for a seasonal cycle in parasuicide among men. Barker et al. [4] could confirm these results in a study of

over 12,000 suicide attempts in Oxford. Jessen et al. [17] investigated seasonal variations in suicide attempts using data on more than 13,500 suicide attempts committed by adolescent and adult subjects from 13 centres taking part in the WHO/EURO Multicentre Study on Parasuicide. They found a cyclic seasonal pattern of suicide attempts with a peak in the spring and a nadir in the winter (December) which was restricted to females. However, there were considerable differences between the study centres, with the suicide attempts at Wuerzburg being characterized by a peak in January in both males and females. Negative results have also been reported: Kreitman [20] neither detected any indicators of seasonality of suicide attempts in Mannheim (Germany) nor in Edinburgh (Scotland).



**Fig. 1** Seasonality of suicide attempts in males versus females

More detailed analysis of our data revealed that distribution of suicide attempts differed significantly between seasons for women, but not for men, due to a significant trough in female (low-risk) suicide attempts in the spring.

In both genders, seasonality of high-risk suicide attempts was more accentuated than that of low-risk ones although this method-related difference only tended to be

statistically significant. This finding is interesting because several studies indicate that seasonality of violent suicide methods is also more pronounced (in both genders) than that of nonviolent suicides [14, 25, 36]. Contrasting these two types of suicide attempts is significant at least in the clinical sense. The seasonal profile of high-risk suicide attempts found in our study (peaks in the spring/summer; trough in the autumn) is similar to the pattern of violent suicide deaths (peaks in the spring/early summer; trough in the winter) [14, 36]. In this respect, males and females were comparable. However, it must be noted that the seasonal fluctuations of high-risk methods were rather moderate because they did not exceed a peak-minus-trough amplitude of 15%.

Furthermore, seasonality of suicide attempts was neither clearly associated with predominant motives for the suicidal act in males nor in females. It is therefore unlikely that parasuicidal gestures, suicidal pauses and suicide attempts in the strict sense have different seasonal peaks.

**Table 3** Seasonal distributions of suicide attempt methods by gender and suicide risk at Nuremberg and Wuerzburg between 2000 and 2004

Variables	Winter, <i>n</i> (%)	Spring, <i>n</i> (%)	Summer, <i>n</i> (%)	Autumn, <i>n</i> (%)	Total, <i>n</i>
<b>Males</b>					
Low-risk methods	171 (24.3)	164 (23.3)	184 (26.2)	184 (26.2)	703
High-risk methods	30 (23.8)	32 (25.4)	39 (31.0)	25 (19.8)	126
Other methods	11 (21.2)	18 (34.6)	14 (26.9)	9 (17.3)	52
<b>Females</b>					
Low-risk methods	323 (26.5)	267 (21.9)	330 (27.1)	299 (24.5)	1,219
High-risk methods	28 (28.3)	31 (31.3)	24 (24.2)	16 (16.2)	99
Other methods	22 (33.8)	15 (23.1)	20 (30.8)	8 (12.3)	65

The classification of methods of suicide attempts based on the 10th revision of the International Classification of Diseases and Related Health Problems (ICD-10; codes: X60–X84) [8]

*n* sample size

**Table 4** Seasonal distributions of suicide attempt methods by gender and predominant motive at Nuremberg and Wuerzburg between 2000 and 2004

Variables	Winter, <i>n</i> (%)	Spring, <i>n</i> (%)	Summer, <i>n</i> (%)	Autumn, <i>n</i> (%)	Total, <i>n</i>
<b>Males</b>					
Parasuicidal gesture	48 (22.0)	57 (26.1)	67 (30.7)	46 (21.1)	218
Suicidal pause	40 (19.1)	54 (25.8)	59 (28.2)	56 (26.8)	209
Suicide attempt in the strict sense	112 (26.7)	100 (23.9)	101 (24.1)	106 (25.3)	419
<b>Females</b>					
Parasuicidal gesture	99 (28.8)	76 (22.1)	97 (28.2)	72 (20.9)	344
Suicidal pause	125 (27.2)	100 (21.7)	111 (24.1)	124 (27.0)	460
Suicide attempt in the strict sense	140 (25.7)	127 (23.3)	155 (28.5)	122 (22.4)	544

The classification of methods of suicide attempts based on the 10th revision of the International Classification of Diseases and Related Health Problems (ICD-10; codes: X60–X84) [8]

*n* sample size



## Possible explanations

Our lack of evidence for marked seasonality of suicide attempts in both females and males might have several reasons.

### *Epidemiological explanation models*

Low seasonality of suicide attempts in both females and males might point to a generally decreasing seasonality of suicidal acts at the beginning of the twenty-first century. Indeed, the majority of studies about seasonality of suicide attempts with positive findings were conducted before 2000 [4, 17, 43, 46, 49]. In this context, it is interesting to note that Erazo et al. [9] could demonstrate a pronounced seasonality of suicidal acts on the German railway system for the first analyzed time period (1997–1999) with peaks in April and September, but did not find any evidence of seasonality for the second time period (2000–2002). These findings are in line with results from suicidological studies according to which seasonal asymmetries of suicidal acts completely vanished at the end of the twentieth century [34, 41, 48]. In this context, Rihmer et al. [41] hypothesized that seasonality of suicidal acts might reflect the rate of suicides associated with depression in a given population and that decreasing seasonality might indicate lowering rates of depressive suicides and represent a marker of improvements in diagnosis and therapy of depression as, for example, suggested by increasing prescription of antidepressant drugs. Data from ecological studies suggest that modern antidepressants might reduce suicide risk although the corresponding evidence base is limited [3, 15]. In this context, one study is of special interest because the authors (Ludwig and Marcotte [23]) investigated the suicide mortality in 27 countries with data on sales of antidepressants between 1980 and 2000. They found that after controlling for several sociodemographic factors (like unemployment, gross domestic product, divorce rate, age, gender) increase in the use of antidepressants (mainly selective serotonin reuptake inhibitors) was associated with declining suicide rates due to the well-known beneficial effects of antidepressants on suicidality and suicidal behaviour [29]; the faster was the increase of antidepressant use, the larger was the decline in suicide rates, and this relationship was more pronounced in adults than in children or adolescents.

This prompted us to reanalyse our data with respect to depressed subjects. Men and women suffering from depressive disorders did not significantly differ in the seasonal distribution of suicide attempts ( $\chi^2 = 0.08$ ,  $df = 3$ ,  $P = 0.995$ ) and significantly asymmetrical seasonal distribution of suicide attempts was neither present in males nor in females ( $\chi^2 \leq 2.95$ ,  $df = 3$ ,  $P \geq 0.40$ ).

This lack of seasonality in depressive suicide attempts is in line with Rihmer's hypothesis of an association of decreasing seasonality of suicidal acts and declining national suicide statistics from several countries (also including Germany) in the last years [40].

### *Psychiatric/psychological explanation models*

In line with the high biological vulnerability of patients with psychiatric disorders regarding suicidal behaviour [45], over 90% of the suicide attempters in our sample were characterized by at least one (principal) psychiatric diagnosis, and if we consider the DSM-IV Axis I diagnoses only, 83.3% of the males and 82.9% of the females have had at least one Axis I diagnosis. This is consistent with the international literature on consecutive (unselected) suicide attempters (e.g., [2, 39]). The relative rates of schizophrenia, stress disorders and substance-abuse disorders in our study (see Table 1) are also in agreement with the afore-mentioned literature, but the rates of depressive disorders (males 22.6%, females 27.4%) are much lower. Suicide attempts related to mood and substance use disorders are more seasonal than suicide attempts related to schizophrenia and other psychiatric disorders [12, 41, 46]. The low rate of depression-related suicide attempts might partly explain why seasonality of suicide attempts was generally low in our sample.

### Methodological limitations

When interpreting our findings, some limitations of the present study have to be addressed:

Although suicide attempts were assessed in close cooperation with several institutions (local hospitals, a representative sample of 28 psychiatric practices in Nuremberg and Wuerzburg, crisis intervention centers and the local authorities [16]), it cannot be excluded that suicide attempters with only minor injuries or non-fatal suicide attempts have not been identified. A further methodological limitation is the lack of population-based data due to the difficulties to create a national case register of suicide attempts. The psychiatric diagnoses were based on clinical diagnosis according to ICD-10 and were not verified by standardized diagnostic instruments. Due to the limited sample size, separate analyses for each suicide method (e.g., jumping or drowning) were impossible.

Moreover, our sample was genetically heterogeneous since only 84.7% of the subjects had German citizenship and only 80% of the subjects were born in Germany. This aspect is relevant in view of the role of genetic factors in seasonality for behaviour and mood and the fact that about 30% of affective variations in seasonality can be explained by genetic effects, as shown by Madden et al.

[24]. Finally, it must be kept in mind that the assessment of the predominant motive of suicidal acts is difficult because it is strongly dependent from the situational impression of the raters and in many cases suicidal acts can be interpreted as parasuicidal gestures as well as suicidal pauses [11].

Data were obtained for a region (Nuremberg) where an intense intervention for improving the care of depressed patients and for preventing suicidality was implemented. This intervention was associated with a clear reduction of the number of suicidal acts in the intervention region compared to a control region [16]. It can therefore not be excluded that this intervention has influenced the results concerning seasonality of suicide attempts.

## General conclusions

In conclusion, gender differences in seasonality of suicide attempts were rather moderate. Whereas seasonal differences lack in male suicide attempters, the frequency of suicide attempts in females seems to be slightly decreased in the spring (at least in the case of low-risk suicide attempts).

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