Time trends and geographical variations in mortality due to suicide and causes of undetermined intent in Spain, 1991–2008

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ABSTRACT

Background This study analyses the trends, geographical variations, seasonal patterns and methods of mortality due to the combination of suicide and causes of undetermined intent in Spain between 1991 and 2008.

Methods Age-adjusted suicide rates were calculated. Poisson models were used to estimate rate ratios and annual percentage changes.

Results Suicide rates decreased in all age groups with the exception of the 35–44 and 45–54 age groups. There were important geographic variations in suicide rates. Spring and summer were the seasons with the highest suicide rates. Suicide rates for hanging decreased, although the rates increased in the 35–44 age group of males. A significant upward trend in suicide by jumping was observed for males aged 15–54 and for females aged 25–64. There were almost no differences when the deaths of undetermined intent were excluded.

Conclusions Suicide rates decreased in both males and females, although the downward trend was not observed in males and females aged 35–44 or in females in the 45–54 age group. A significant upward trend in suicide rates for jumping was observed in some age groups. Substantial geographical variations in suicide rates were observed. The highest rates were observed in the warmest months.

Keywords mortality, Spain, suicide, suicide methods, trend

Introduction

Suicide is considered an important public health problem[1] and is one of the three leading manners of death among the most productive age group (15–44 years).[2]

In Europe, the highest suicide rates have been observed in Central European countries and in Scandinavian countries, and the lowest rates have been found in the Mediterranean countries.[3] In the European Union[4] (27 countries) in 2008, Lithuania, Hungary, Latvia, Finland, Slovenia and Estonia had the highest suicide rates, which were at least 50% higher than the overall European rate (10.1 for 100 000 inhabitants). The rate in Spain (6.5) was lower than the overall European rate, similar to the rate in the UK and Italy, but higher than in Cyprus and Greece. In recent years, suicide rates have been decreasing in the European Union, from 11.8 in 2000 to 10.1 in 2008.[4]

Few published studies have examined suicide mortality in Spain. An initial study[5] from 1950 to 1991 describes a downward trend from 1959 until the late 1970s and an upward trend from 1982. A second study suggests that suicide rates in Spain (1952–1996) increased in the early 1980s, stabilizing in the early 1990s for males and they beginning to decrease for females.[6] A third study, from 1986 to 2001,[7] shows that suicide rates decreased for both males and females in the 55–74 age group and displayed an upward trend in the 25–54 age group.

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The validity of the suicide statistics obtained from official registries of mortality may be biased due to under-reporting.[8] In England and Wales, official suicide statistics for adult suicides combine suicides and open verdict deaths because most deaths given open verdicts are likely to be suicides.[9,10] Two definitions have been used to address this problem: the first is a restrictive and conservative definition that includes only deaths catalogued as suicide,[5,7,11–13] and the second is a broad definition that includes deaths catalogued as suicide and deaths of undetermined intent.[14–16] One of the aims of the current study is to assess the possible impact of these definitions.

Several epidemiological studies have described a seasonal variation in suicide rates, with a consistent peak in springtime regardless of the country or the hemisphere (reviewed in ref. [17]). However, this seasonal pattern (higher rates in spring and summer) seems to be diminishing[11] and this pattern may be related exclusively to more violent methods of suicide.[18]

The importance of suicide in Spain and the complexity of its aetiology explain the need for epidemiological surveillance to better assess the associated risk factors and to improve prevention. Using the broad definition of suicide, the objectives of this study are (i) to analyse time trends by age and sex and geographical variations by sex in suicide mortality in Spain; (ii) to determine whether a seasonal pattern of suicides exists and (iii) to analyse methods of suicide by sex and age.

Methods

Mortality data for the period 1991–2008 were obtained from the National Statistics Institute [Instituto Nacional de Estadística (INE) http://www.ine.es] through microdata files comprising individual data. The variables included in the files were sex, province of residence, month and year of death, age and cause of death. Population data for the estimation of mortality rates were drawn from the INE for 1 July of each year for the period from 1991 to 2008.

In this study, we use the broad definition of suicide. Thus, the codes of the causes were E950–E959 and E980–E989 according to the International Classification of Diseases, 9th revision (ICD-9) for the period from 1991 to 1998 and X60–X84, Y10–Y34, Y87.0 and Y87.2 according to the ICD-10 (10th revision) for the period from 1999 to 2008.

Standardized rates for 100 000 inhabitants were calculated using the direct method with the European population as the standard. The rates were also calculated for eight age groups (0–14, 15–24, 25–34, 35–44, 45–54, 55–64, 65–74 and ≥75). The geographical distribution of suicide mortality was identified by province through standardized rates and maps.

The mortality rate ratio (RR) was used to assess the influence of the variables sex, age and month of death. The annual percentage change (APC) was used to describe the trend. Poisson models were applied to estimate the RR, the APC and the 95% confidence intervals (CIs). To fit the models, the effect of the variables on the log-rate scale was assumed to be additive. In the estimation of the RR, these categorical variables were age (18 categories: 0–4, 5–9, 10–14, 15–19, ..., ≥85), sex, year (1991, ..., 2008), month and province (52 provinces) of residence. The year of death was included in the models as a continuous variable for estimating the APC and adjusting for sex, age, month and province (for the 0–14 age group the APC was adjusted for sex and age due to the low number of deaths). Overdispersion was controlled.

The standardized rates and the APC were also calculated by considering the restrictive definition of suicide and were compared with the broad definition to assess the influence of the inclusion of the deaths of undetermined intent.

The month of death as a variable in the models facilitated the analysis of the seasonal pattern.

The methods of suicide were also analysed and were grouped into two categories: poisoning as a non-violent method (ICD-9: E950–E952, E980–E982) and violent methods (hanging: E953, E983; drowning: E954, E984; firearms/explosives: E955, E985; cutting and piercing: E956, E986; falling/jumping from a high place: E957, E987; other: E958, E988). The seasonal pattern and the geographical distribution of the two groups were analysed.

All statistical analyses were performed using the STATA 10.0 software package (Stata Corporation, College Station, TX, USA).

Results

From 1991 to 2008, the number of completed suicides was 60 176 (75.4% males), representing 0.93% of the deaths in Spain during the same period. The number of deaths by *sequelae* was 20 (of which 7 were deaths of undetermined intent). The number of deaths caused by violent methods was 54 124 (76.9% males), whereas 6032 deaths (62.8% males) were classified as deaths resulting from non-violent (poisoning) methods.

Suicide trends

Age-standardized suicide rates in Spain (Table 1) decreased for both males and females between 1991 and 2008. Among males, this decline was observed in all age groups

with the exception of the 35–44 age group, for which a significant upward trend was observed, and the 45–54 age group, for which the suicide rates remained relatively stable. Among females, the decline in rates was observed in all age groups over the age of 55 years and in the 15–24 age group, whereas the trend was not significant in the other age groups.

When the restrictive definition of suicide was applied, the estimates were very similar. The age-standardized rates were 6.76 (95% CI: 6.71 to 6.82) according to the restrictive definition and 7.02 (95% CI: 6.96 to 7.08) according to the broad definition. Among males, the age-standardized rates were 10.82 (95% CI: 10.72 to 10.92) with the restrictive definition and 11.20 (95% CI: 11.09 to 11.30) when the broad

criterion was applied. Among females, the rates was 3.14 (95% CI: 3.09 to 3.20) when the restrictive definition was applied and 3.29 (95% CI: 3.23 to 3.34) using the broad criterion. The estimated APC with the restrictive and broad definitions were −1.18 (95% CI: −1.33 to −1.02) and −1.29 (95% CI: −1.44 to −1.14), respectively. In males, they were −1.04 (95% CI: −1.22 to −0.86) and −1.21 (95% CI: −1.39 to −1.04), respectively, and in females, they were −1.24 (95% CI: −1.56 to −0.93) and −1.52 (95% CI: −1.83 to −1.22), respectively. The significant trends based on the broad definition were also significant with the restrictive definition and were in the same direction, with the exception of the 35–44 age group for females, for which the APC was 0.68 (95% CI: −0.18 to 1.54) with

Table 1 Suicide rates per 100 000 inhabitants by sex, period and age group and APC with a 95% confidence interval (95% CI); Spain, 1991–2008

Sex	Age group	Period					APC	95% CI
		1991–2008		1991–1996	1997–2002	2003–2008		
		n	Rate	Rate	Rate	Rate		
Total	0–14	207	0.18	0.23	0.17	0.13	−4.02	−6.52 to −1.44
	15–24	4833	4.51	5.08	4.62	3.7	−2.84	−3.38 to −2.29
	25–34	8945	7.21	7.8	7.54	6.44	−1.69	−2.08 to −1.29
	35–44	8871	7.96	7.3	8.15	8.28	0.95	0.54 to 1.36
	45–54	8156	8.93	8.87	8.86	9.03	0.05	−0.37 to 0.47
	55–64	8251	10.58	11.69	10.5	9.66	−1.51	−1.91 to −1.11
	65–74	9476	14.09	15.69	14.26	12.5	−1.99	−2.38 to −1.60
	≥75	11 437	21.43	23.93	22.27	19.09	−2.25	−2.59 to −1.90
	Total[a]	60 176	7.02	7.45	7.13	6.53	−1.29	−1.44 to −1.14
Males	0–14	146	0.25	0.35	0.23	0.15	−6.08	−9.07 to −2.99
	15–24	3888	7.09	8.01	7.33	5.72	−2.94	−3.55 to −2.34
	25–34	7271	11.47	12.6	12.1	10.04	−1.91	−2.34 to −1.48
	35–44	6889	12.26	11.16	12.6	12.74	1.03	0.57 to 1.50
	45–54	6128	13.48	13.62	13.26	13.57	−0.06	−0.54 to 0.43
	55–64	5966	15.8	17.79	15.65	14.17	−1.73	−2.20 to −1.26
	65–74	6737	21.95	24.11	22.1	19.92	−1.61	−2.07 to −1.15
	≥75	8372	42	45.87	44.09	37.9	−1.72	−2.12 to −1.31
	Total[a]	45 397	11.20	11.93	11.41	10.36	−1.21	−1.39 to −1.04
Females	0–14	61	0.11	0.11	0.1	0.11	0.81	−3.86 to 5.70
	15–24	945	1.81	2.01	1.79	1.58	−2.39	−3.61 to −1.15
	25–34	1674	2.76	2.89	2.82	2.59	−0.69	−1.61 to 0.23
	35–44	1982	3.59	3.45	3.68	3.63	0.68	−0.18 to 1.54
	45–54	2028	4.42	4.23	4.52	4.48	0.34	−0.50 to 1.19
	55–64	2285	5.68	6.05	5.67	5.36	−0.93	−1.70 to −0.16
	65–74	2739	7.49	8.8	7.66	6.14	−2.91	−3.63 to −2.19
	≥75	3065	9.17	11.35	9.39	7.5	−3.62	−4.28 to −2.96
	Total[a]	14 779	3.29	3.52	3.34	3.05	−1.52	−1.83 to −1.22

[a]Age-adjusted rates (European standard population).

the broad definition and 0.96 (95% CI: 0.08 to 1.85) with the restrictive definition (Supplementary data, Table S1).

Geographical variations

There were important geographical variations in suicide rates (broad definition) in Spain during the 2003–2008 period. The highest age-standardized suicide rates in males were observed in the provinces of Coruña (A), Jaén and Málaga, which were at least 50% higher than the overall Spanish rate (Figs 1 and 2). The provinces of Almería, Córdoba, Lugo and Granada had rates that were at least 40% higher than the national rate in Spain. In these provinces, the rates were also higher than the overall Spanish rate in the 1991–1996 and 1997–2002 periods (data not shown). For females, the highest rates were observed in the provinces of Málaga, Granada and Coruña (A), which were at least 60% higher than the overall Spanish rate in 2003–2008 (Figs 1 and 2). The rates in Lugo, Navarra, Ourense and Almería were at least 50% higher than in Spain as a whole. Asturias and Soria had rates that were 48 and 47% higher than Spain, respectively, although the 95% CI was very wide for Soria. In these provinces, the rates were also higher than the overall Spanish rate in the 1991–1996 and 1997–2002 periods, with the exception of Navarra, for which the suicide rate was lower than the Spanish rate in the 1997–2002 period (data not shown). When a restrictive definition of suicide was used, the above conclusions did not change.

Differences by age and sex

The multivariate analysis showed that males had higher rates of suicide than females (RR = 3.53; 95% CI: 3.46 to 3.59). The suicide rate increased with age. However, in males, the rate was almost constant in the 25–60 age range and increased after that age, whereas in females, the increase was progressive (Supplementary data, Fig. S3). The estimations were almost the same and the conclusion was identical when the narrow definition of suicide was used.
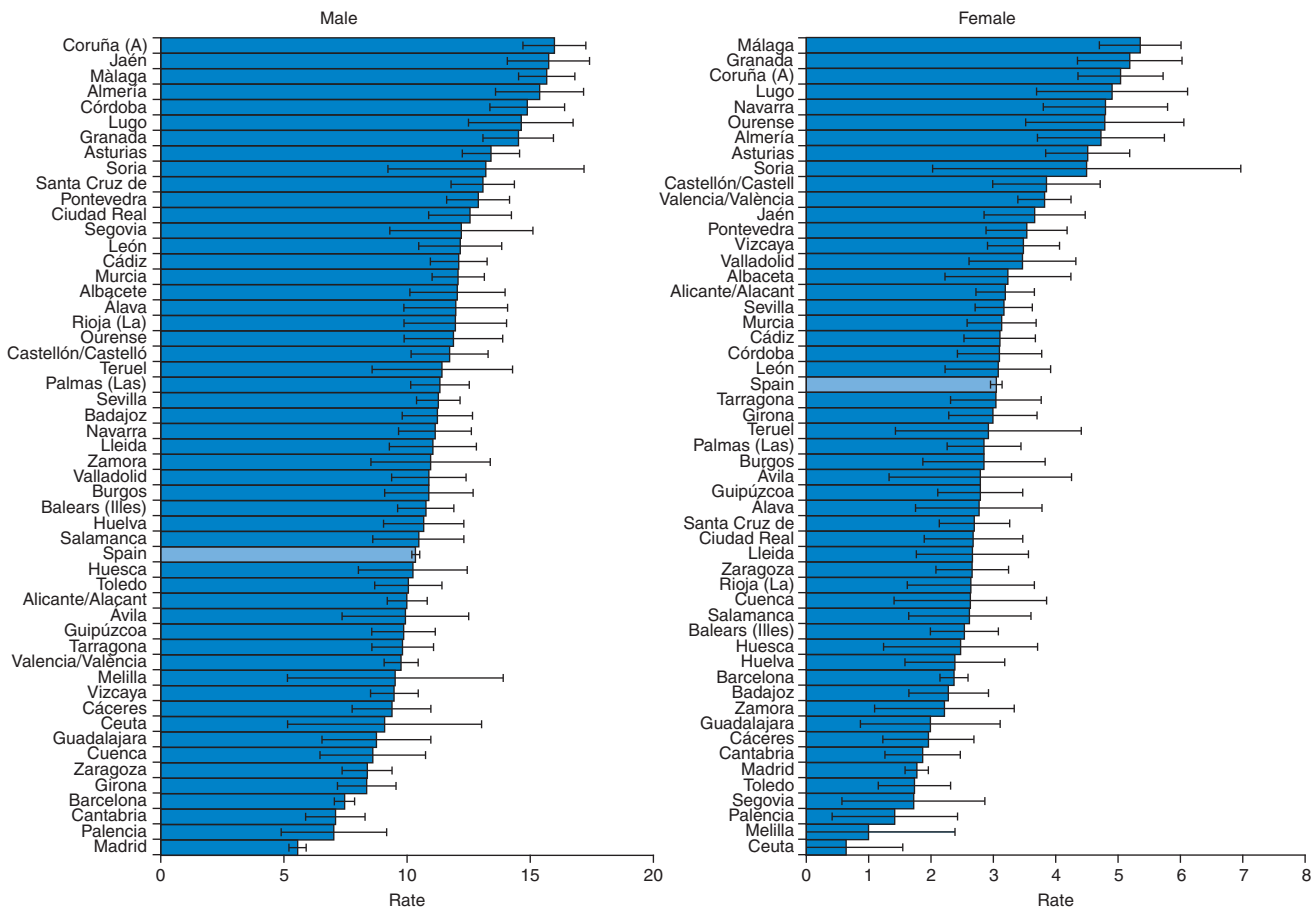

Fig. 1 Age-adjusted suicide rates (European standard population) per 100 000 inhabitants and 95% confidence intervals by sex and province. Spain, 2003–2008.
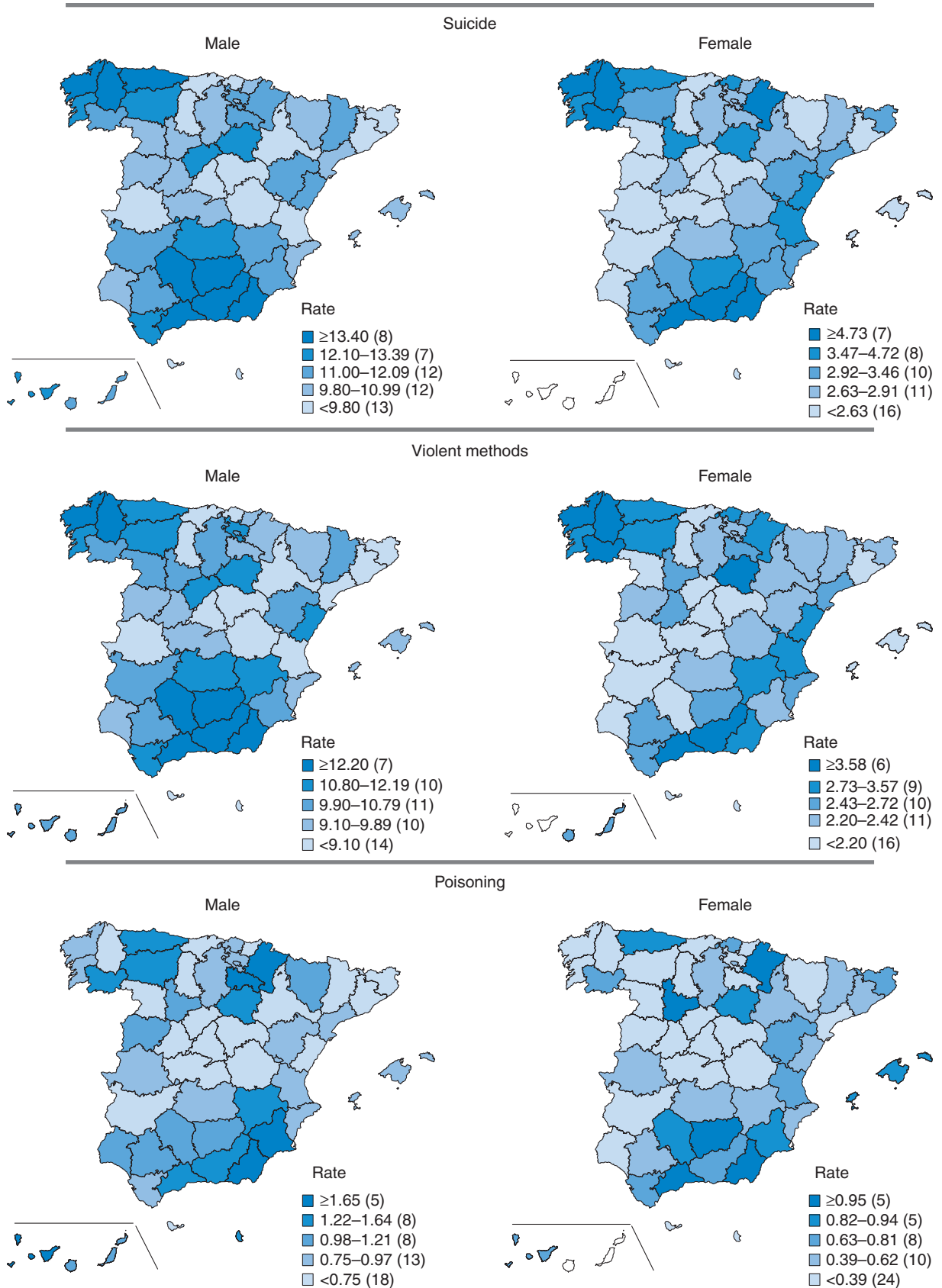
Fig. 2 Geographical variation in the age-adjusted rates (European standard population) per 100 000 inhabitants by sex and province. Suicide, poisoning and violent methods. Spain, 2003–2008.

Seasonal pattern of suicide

Spring and summer were the seasons with the highest suicide rates, mainly due to a corresponding increase in violent methods (Supplementary data, Fig. S4). The same results were obtained when the restrictive definition of suicide was considered.

There was a less marked seasonality in the suicide rate by poisoning (non-violent method). The stratified (data not shown) analysis by sex showed the results very similar to the combined analysis of males and females.

Methods of suicide

Hanging and jumping were the most common methods of suicide, with 40 122 (66.7%) deaths during 1991−2008 (Supplementary data, Table S2).

Hanging

The hanging rate among males was higher than the rate for females (RR = 6.37; 95% CI: 6.15 to 6.57). Age-standardized rates decreased for both males and females (Table 2), with an overall APC = −0.92; 95% CI: −1.15 to −0.69. In males, this decline in rates was observed in all age groups with the exception of the 35−44 age group, for which a significant upward trend was observed. In females, this decline was only significant in the groups over the age of 55 years. Using the restrictive definition of hanging (ICD-10: X70), the overall trend was almost the same (APC = −0.92; 95% CI: −1.14 to −069).

Jumping

The jumping rate among males was higher than among females (RR = 1.82; 95% CI: 1.76 to 1.89). Age-standardized rates increased from the 1991−1996 period to 1997−2002 and decreased in 2003−2008 (Table 2). Overall, a significant upward trend in suicide rates by jumping was observed for males, mainly in the 35−44 and 45−54 age groups. In females, the overall trend was not significant; however, a significant upward trend was observed in the 25−64 age range, markedly so in the 45−54 age group. A significant downward trend was observed in the 65−74 age group and in the 75 years and older group. Using the restrictive definition of jumping (IDC-10: X80), the overall APC was 1.12 (95% CI: 0.67 to 1.58) in males and was not significant in females.

Poisoning

The poisoning rate for males was higher than for females (RR = 1.82; 95% CI: 1.72 to 1.92). Overall, the trend was stable for both males (APC = −0.23; 95% CI: −1.02 to 0.57) and females (APC = −0.18; 95% CI: −0.80 to 0.43). However, an upward trend was observed in the 45−54 and 55−64 age groups in males [APC = 2.46 (95% CI: 0.56 to 4.40) and APC = 2.66 (95% CI: 0.73 to 4.62), respectively] and in females [APC = 3.39 (95% CI: 2.07 to 4.73) and APC = 2.34 (95% CI: 0.78 to 3.92), respectively]. Considering the restrictive definition of poisoning (ICD-10: Y10−Y19), the overall trend was stable for both males and females.

Discussion

Main findings of this study

Our study presents the most recent analysis of trends, geographical variations, seasonal patterns and methods of suicide mortality in Spain for the 1991−2008 period using an analysis adjusted for age, sex, month and year of death and the province of residence. The results confirm an overall downward trend in suicide mortality in Spain. However, the downward trend is not observed for both males and females aged 35−44 or for females in the 45−54 age group.

Recent and important geographical variations have been observed, with Galicia and Andalusia having the highest suicide rates.

The hanging rate among males was six times higher than among females. Age-standardized rates decreased in both males and females. In males, this decline in rates was observed in all age groups, with the exception of the 35−44 age group, for which a significant upward trend was observed.

The jumping rate among males was almost two times higher than among females. Overall, a significant upward trend in suicide rates by jumping was observed for males, mainly in the 35−44 and 45−54 age groups. In females, a significantly strong upward trend was observed in the 25−64 age range, markedly so in the 45−54 age group.

For poisoning, significant strong upward trends were observed in the 45−64 age range.

The highest rates were observed in the warmest months, mainly for violent methods. There was less of a marked seasonality in the suicide rate for non-violent methods.

What is already known on this topic

In Spain, a number of studies have been previously published on suicide trends in certain geographical areas.[7,19−23] However, there are few national studies.[5−7]

The time trend found in our study is consistent with a previous study for the 1986−2001 period.[7]

Table 2 Suicide rates per 100 000 inhabitants by sex, age group, period and method of suicide (hanging, jumping) and APC with a 95% confidence interval (95% CI); Spain, 1991–2008

	Age group	Male					Female				
		1991–1996 Rate	1997–2002 Rate	2003–2008 Rate	APC	95% CI	1991–1996 Rate	1997–2002 Rate	2003–2008 Rate	APC	95% CI
Hanging	0–14	0.24	0.08	0.08	−9.03	−13.07 to −4.8	0.04	0.03	0.07	5.8	−1.7 to 13.87
	15–24	3.62	3.07	2.63	−3.08	−3.98 to −2.17	0.55	0.53	0.55	−0.78	−3.02 to 1.5
	25–34	5.69	5.61	4.76	−1.4	−2.04 to −0.76	0.67	0.75	0.75	0.67	−1.13 to 2.51
	35–44	5.45	5.9	6.3	1.24	0.57 to 1.92	0.9	0.88	0.97	1.5	−0.22 to 3.24
	45–54	7.5	6.75	7.07	−0.53	−1.19 to 0.13	1.37	1.2	1.19	−1.07	−2.61 to 0.51
	55–64	10.12	8.7	7.95	−1.81	−2.43 to −1.18	2.17	1.65	1.67	−1.47	−2.81 to −0.11
	65–74	12.72	12.74	11.3	−0.92	−1.54 to −0.29	2.46	2.36	1.92	−2.11	−3.42 to −0.78
	≥75	22.9	23.4	21.27	−0.8	−1.36 to −0.24	2.74	2.64	2.34	−1.37	−2.65 to −0.08
	Total[a]	6.1	5.78	5.41	−0.93	−1.18 to −0.69	1.02	0.92	0.9	−0.86	−1.44 to −0.28
Jumping	0–14[b]	0.02	0.07	0.05	3.28	−4.09 to 11.22	0.03	0.06	0.01	−5.19	−13.1 to 3.44
	15–24	1.21	1.89	1.52	1.79	0.46 to 3.15	0.66	0.77	0.61	−0.5	−2.5 to 1.53
	25–34	1.79	2.31	2.11	1.1	0.04 to 2.16	0.94	1.06	1.07	1.64	0.1 to 3.2
	35–44	1.41	1.95	1.96	2.69	1.46 to 3.95	1.02	1.25	1.28	1.69	0.18 to 3.22
	45–54	1.39	1.79	1.95	3.02	1.62 to 4.44	1.05	1.56	1.52	2.6	1.06 to 4.17
	55–64	1.74	2.15	1.76	0.26	−1.13 to 1.67	1.38	1.88	1.74	1.61	0.16 to 3.09
	65–74	3.75	3.54	3.29	−1.02	−2.17 to 0.15	2.36	2.43	1.95	−1.61	−2.93 to −0.28
	≥75	10.09	10.57	8.01	−1.71	−2.57 to −0.85	4.03	3.8	2.76	−3.16	−4.24 to −2.07
	Total[a]	1.69	2.04	1.81	0.53	0.09 to 0.97	1	1.18	1.06	−0.06	−0.6 to 0.48

[a]Age-adjusted rates (European standard population).

[b]In the 0–14 age group the APC is not adjusted for age due to the low number of deaths in the age groups 0–4 and 5–9. In the age group 10–14 the APC was 4.95 (−2.74 to 13.25) for boys and −3.54 (−11.80 to 5.50) for girls.

Recent studies support our argument for the use of a broad definition that includes deaths of undetermined intent.[8–10] In England and Wales, official suicide statistics for adult suicides combine suicide and open-verdict deaths.[9] In Spain, the inclusion of deaths of undetermined intent for the 1984–1997 period modified the significant upward trend to a non-significant trend, in contrast to other European countries.[14] In Germany during 1991–2002, it was observed that the inclusion of deaths of undetermined intent most commonly affected people over 75 years of age,[15] increasing the trend. These potential discrepancies can be explained by the quality of the registries. Spain is among the European countries with the lowest use of causes of undetermined intent.[14] Given the potential effect of under-reporting, a broad definition of suicide may be a more realistic approach for analysing long periods. Poor classifications may not differentiate between suicide and un-determined intent.

Various factors associated with suicide may contribute to geographical variations, such as socioeconomic status, education level, employment and the prevalence of physical pathologies.[24] Deprivation in Spain [http://www.demap.es/es/productos/indice-de-privacion-material] has a geographical northwest-southwest pattern. Geographical variations may be associated with psychiatric comorbidity[25] or with socioeconomic factors.

The upward trend in hanging rates found in our study for males in the 35–44 age group is consistent with the trend observed in England, Wales and other countries.[26] In another study conducted in Italy,[27] an upward trend was observed in jumping for males aged 15–24 and in hanging for both males and females aged 15–44.

The results confirm the traditional seasonal pattern of suicide. However, this pattern seems to be explicitly related to violent methods. These data, consistent with the literature,[11,18,28] suggest that meteorological factors may influence violent suicides but not suicides due to non-violent methods. It has been suggested that the description of seasonal patterns of non-violent methods of suicide[29] may be due to different methodologies or to cultural and sociodemographic factors.

What this study adds

The present study adds the most recent analysis of suicide trends in Spain, including geographical variations, seasonal patterns and methods. When a restrictive definition of suicide was used, the results were very similar.

Limitations

The study is based on the official data that may be affected by under-notification problems and misclassification, as described above. This situation may underestimate actual suicide rates and trends because the proportion of under-reported cases may change over time and is unknown. Furthermore, geographic variations may be affected by this problem because the proportion of under-reported cases may have geographical variations.[30] To minimize this possible effect, we have used a broad definition of suicide. However, this type of database lacks important information for the assessment of suicide, such as the existence of a psychiatric condition at the time of the suicide and social or family support.

Conclusions

A significant upward trend was observed in males in the 35–44 age group, especially for hanging. For jumping, a significant upward trend was observed in the 25–64 age range, and for poisoning, significant strong upward trends were observed in the 45–64 age range. Substantial geographical variations in suicide rates were observed. The highest rates were observed in the warmest months.

It is necessary to continue to analyse suicide mortality to establish adequate epidemiological surveillance that can facilitate the development of prevention programmes, as reflected in the Strategy of Mental Health of the National Health System (Ministry of Health and Consumer Affairs, 2007).

Supplementary data

Supplementary data are available at the *Journal of Public Health* online.

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