Suicide in the Canary Islands: standardized epidemiological study by age, sex, and marital status

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Summary. The authors analyze the distribution of suicides according to the variables of sex, age and marital status in the Canary Islands, during the period 1977-1983, by means of a register that they themselves created in order to correct serious deficiencies in the official data. There were notable differences between men and women, and the tendencies observed in each case are also very different. The authors argue that this makes it necessary to sep-arate the sexes in the epidemiological studies on suicide. The advantages and disadvantages of the direct and indirect methods in the standardization of the specific suicide rates are discussed. The specific rates related to marital status are standardized according to age and, likewise, the specific rates related to age are standardized according to marital status, for each sex. Once confounding factors are controlled, it becomes clear that there is a direct relation-ship between age and suicide. After adjusting for age, it is noted that the pattern of risk for different marital status categories varies by sex.

In a previous study the authors verified the important discrepancies which existed between official suicide figures registered in the Canary Islands and those obtained using their own methodology [1], thereby confirming the need to undertake specific studies to describe the epidemiology of this important Public Health problem, widely addressed in literature [2, 3, 4].

In this study we carried out an epidemiological analysis of the possible risk factors associated with the following personal variables: age, sex and marital status.

Methods

The study covers the period 1977-1983. The age and gender specific reference populations were calculated using official census figures. Only the resident population was used and the suicides considered were limited to those by people actually living in the Canary Islands. Cases involv-ing foreigners were included, but only if they were habit-ual residents of the Canarian Archipelago. The marital status structure was taken from the most recent census and hence the analysis carried out using this variable refers to the population in 1981, taken as the average population for the period.

To collect data about suicides in the 15 judicial districts of the Canary Islands, we reviewed the judicial proceed-ings (dockets and previous proceedings) which take place in Spain following either a violent death or an apparently natural one where there is not enough medical information to be sure that the cause of death was natural. We consider as suicide any self-inflicted death that resulted from the victim's willingness to die, and that coincided, in terms of mechanisms, with the basic causes covered in sections E950-E959 of the 9th revision of the I. C. D. In order to decide whether or not to include undetermined deaths, this group of causes, classified in sections E980-E989, was compared with the suicides.

This procedure was used to ensure the reliability of cases recorded by sex, age and marital status.

In order to describe suicides according to sex, the spe-cific rates, the ratio for each year and the average for the period' were calculated. In addition, evolution over time was analyzed and the results were adjusted for 2-year and 3-year periods, to control the influence of interannual variations on regions with small populations.

For each age the specific rates of mortality due to suicide'were calculated, following the W. H. O. classifica-tions, using 4 broad age-groups for each of the 7 years studied. The mean for the period was also calculated and broken down by gender.

Finally, a classification was made of the total number of suicides during the 7 years according to marital status, gender and age-group. In order to control interannual variability, the numerators used to calculate rates are the mean values of the period for each age-group, sex and marital status, while the denominators are the corre-sponding populations as of 1981.

In order to eliminate the influence of age and marital status variables, direct and indirect standardizations of

Table 1. Annual distribution and rates of suicide (per 10^5) according to in adolescents (1977-8 vs. 1982-3) X^2 =1.352, (*df* = 1), *P* = n. s.; age groups, Canary Islands 1977-1983. Overall suicide rates by age Overall suicide rates, 0-20 vs 65 + (1977-83) X^2 =81.282, (*df*=1), (1977-83) X^2 = 74.501, (*df* = 3), *P* < 0.001; Overall suicide rates *P* < 0.001

Age-groups Year	0-20		20-45		45-65		65 and +		Total	
	n	Rate	*n*	Rate	*n*	Rate	*n*	Rate	*n*	Rate
1977	4	0.73	33	7.39	26	11.73	27	26.67	90	6.81
1978	3	0.54	43	9.56	31	13.70	13	12.52	90	6.75
1979	3	0.54	38	8.39	37	16.01	14	13.14	92	6.84
1980	7	1.26	42	9.21	41	17.37	27	24.70	117	8.63
1981	6	1.08	49	10.68	39	16.18	24	21.40	118	8.63
1982	6	1.08	46	9.96	40	16.25	28	24.34	120	8.70
1983	11	1.97	61	13.11	43	17.10	33	27.96	148	10.64
1977 1983	40	1.03	312	9.71	257	15.23	166	21.15	775	8.10

Table 2. Distribution by year and sex, and suicide rates (per 10^5), Canary Islands 1977-1983. Male rates vs female (1977-83) X^2 = 23.047, (*df* = 1), *P* < 0.001; Male rates (1977 vs 83) X^2= 14.843, (*df* =1), *P* < 0.001; Female rates (1978 vs 83) X^2= 1.901, (*df* =1), *P* = n. s.

Year		1977	1978	1979	1980	1981	1982	1983	Means
Population	M	661,100	666,239	671,419	676,638	681,899	687,200	692,542	
	F	659,949	666,303	672,717	679,194	685,733	692,334	699,000	
Suicides	M	57	67	67	83	86	95	112	81.0
	F	33	23	25	34	32	25	36	29.7
Rates	M	8.62	10.06	9.88	12.27	12.61	13.82	16.17	11.88
	F	5.00	3.45	3.72	5.01	4.67	3.61	5.15	4.33
Ratio M/F		1.73	2.91	2.68	2.44	2.68	3.80	3.11	2.73

these two factors were carried out, thus enabling conclusions to be drawn for each one individually. Using the direct method, we calculated for each sex the adjusted rates by marital status in each age group, and likewise, the adjusted rates by age in each category of marital status. Using the indirect method, we calculated the Standard Mortality Rates [5] (SMR) by marital status using as standard rates those of the Canary Islands by age, and by gender. We also standardized marital status using as standard rates those taken by age for each category of marital status in the Canary Islands. In each case, we calculated the statistical significance of the SMR according to Byar's test [6], and the upper (UCL) and lower (LCL) confidence limits, on the assumption that the suicides observed followed a Poisson distribution [7, 8, 9].

Results

Reviewing all the previous proceedings and dockets, as described in the Methods section, we obtained a total of 775 suicides (Table 1), during the period 1977-1983. These were then classified, first by age, then by sex and age and-finally, by marital status, sex and age.

A. By age

The specific rates by age for each of the 7 years, as well as the overall values for the period, appear in Table 1.

B. By sex

In Table 2 we present both the absolute values and the annual and overall rates for the period according to each sex. Also the gender ratio is calculated in each of the 7 years studied.

Interannual variation in the rates is shown in Table 3, in which the extreme two-year and three-year periods are compared.

The specific average rates for each sex broken down by age group are shown in Table 4, along with the actual numbers of suicides over the period.

C. By marital status

The distribution of suicides for the period according to marital status are shown in Table 5, and those for each sex

Table 3. Change in suicide rates (per 10^5) by sex, Canary Islands 1977-1983

Suicide rates		1977-1978	1982-1983	
2-yr period	T	6.78	9.67	(X^2 = 6.501; *P* < 0.05)
	M	9.34	15.00	(X^2 = 8.407; *P* < 0.01)
	F	4.22	4.38	(X^2=0.033; *P* = n.s.)
Suicide rates		1977-78-79	1981-82-83	
3-yr period	T	6.80	9.33	(X^2 = 5.027; *P* < 0.05)
	M	9.56	14.21	(X^2 = 5.767; *P* < 0.05)
	F	4.05	4.48	(X^2 = 0.062; *P* = n. s.)

Table 4. Average suicide rates (per 10^5) by age group and gender, Canary Islands 1977-1983. Male suicide rates by age (1977-83) $X^2 = 59.035$, ($df = 3$), $P < 0.001$; Female suicide rates by age (1977-83) $X^2 = 20.936$, ($df = 3$), $P < 0.001$; Male suicide rates, 0-20 vs 65 + (1977-83) $X^2 = 62.696$, ($df = 1$), $P < 0.001$; Female suicide rates, 0-20 vs 65 + (1977-83) $X^2 = 21.184$, ($df = 1$), $P < 0.001$; Suicide rates 0-20, men vs women (1977-83) $X^2 = 0.227$, ($df = 1$), P = n. s.; Suicide rates 20-45, men vs women (1977-83) $X^2 = 9.884$, ($df = 1$), $P < 0.01$; Suicide rates 45-65, men vs women (1977-83) $X^2 = 9.836$, ($df = 1$), $P < 0.01$; Suicide rates 65 +, men vs women (1977-83) $X^2 = 4.356$, ($df = 1$), $P < 0.05$

| Age-groups | 0-20 | | 20-45 | | 45-65 | | 65 and + | | Total | |
Sex	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate
Males	28	1.40	235	14.44	194	23.82	110	32.64	567	11.88
Females	12	0.63	77	4.86	63	7.22	56	12.50	208	4.33

Table 5. Average suicide rates (per 10^5) by age group and marital status, Canary Islands 1977-1983. Overall suicide rates by marital status (1977-83) $X^2 = 63.671$, ($df = 3$), $P < 0.001$

Marital status Age-groups	Single	Married	Widow-ed	Separated/ Divorced	Not given	Total
n 0-20	39	–	–	–	1	40
Rate	1.02	–	–	–	–	1.03
n 20-45	155	116	8	32	1	312
Rate	17.14	5.19	30.05	66.20	–	9.71
n 45-65	46	171	18	20	2	257
Rate	27.07	12.54	14.59	66.24	–	15.23
n 65 and +	29	82	48	5	2	166
Rate	30.08	19.33	18.79	56.60	–	21.15
n Total	269	369	74	57	6	775
Rate	5.39	9.03	18.21	63.67	–	8.10

in Tables 6 and 7. In each table the data by marital status are also shown for each age group.

In Tables 8 and 9, the results of the direct standardization method are shown, both of the age variable according to marital status, and of the marital status variable according to age. For the latter adjustment we also provide results from the indirect method, using the overall rates for the Canary Island and age as a reference.

Finally, Table 10 summarizes the results of the indirect standardization method by age for marital status, using the rates according to age for each of the categories of marital status in the Canary Islands as standard, with each one being applied to the other categories.

Discussion

In a' previous article we have shown that the suicide figures registered according to our procedure approximate to a time rate for the Canary Islands [10]. Our method of gathering data allowed us to confirm in every case the victim's willingness to die, which is regarded as the most difficult criterion to establish [11].

The official figures published by the I. N. E. and reported to the W. H. O. amount to only about half of those we obtained, indicating the lack of reliability and validity of official suicide data in our country. This deficiency is largely due to the fact that the final results of judicial investigations are not reported to the I. N. E. In contrast to other countries [12], these suicides are classified, depending on the circumstances of the death, as accidents or even natural deaths, and not as undetermined deaths. In fact, despite what has been suggested by some authors [13], we did not include in the study the 24 deaths over the period that we classified as undetermined, as they did not show an epidemiological pattern similar to that of the suicides.

The average specific mortality rates for the period as a whole show that suicides increase with age, rising from 1.03 per 105 in the under-20 age-group to 21.15 per 10^5 in the 65-and-over group ($P < 0.001$), (Table 1).

Moreover, throughout the period studied, all age-groups showed an upward trend in suicide rates. This is particularly pronounced among the under-20 age-group and underlines the developing significance suicide among adolescents (14 to 17 years of age), although the differences over the period are not significant, probably due to the low absolute number of suicides among the under-20 s.

The comparison with the most pronounced statistical significance is that between adolescents and the elderly ($P < 0.001$), in keeping with the increasing trend of suicides as age increases.

There is a clear majority of male cases (567 (73.2 %) vs 208 (26.8 %)). The mean annual number of male suicides dur-

Table 6. Average suicide rates (per 10^5) of males by age group and marital status, Canary Islands 1977-1983. Male suicide rates by marital status (1977-83) $X^2 = 411.4$, ($df = 3$), $P < 0.001$

Marital status Age-groups	Single	Married	Widow-ed	Separated / divorced	Not given	Total
n 0-20	27	–	–	–	1	28
Rate	1.36	–	–	–	–	1.40
n 20-45	124	86	5	19	1	235
Rate	22.60	8.15	93.74	109.18	–	14.44
n 45-65	35	135	8	15	1	194
Rate	52.70	18.77	45.15	137.10	–	23.82
n 65 and +	16	64	26	3	1	110
Rate	64.51	25.23	47.73	72.76		32.64
n Total	202	285	39	37	4	567
Rate	7.71	13.95	49.98	112.37	–	11.88

Table 7. Average suicide rates (per 10^5) of females by age group and marital status, Canary Islands 1977-1983. Female suicide rates by marital status (1977-83) X2= 161.2, (df = 3), P < 0.001

Marital status Agegroups	Single	Married	Widow-ed	Separated / divorced	Not given	Total
n 0-20	12	–	–	–	–	12
Rate	0.65	–	–	–	–	0.63
n 20-45	31	30	3	13	–	77
Rate	8.72	2.55	14.09	42.02	–	4.86
n 45-65	11	36	10	5	1	63
Rate	10.63	5.58	9.46	25.97	–	7.22
n 65 and +	13	18	22	2	1	56
Rate	18.15	10.55	10.95	42.45	–	12.50
n Total	67	84	35	20	2	208
Rate	2.82	4.11	10.66	35.34	–	4.33

ing the period 1977-83 is 81, compared to 29.7 women (Table 2).

The overall value for the period is 8.10 per 10^5. When the specific mean annual rate for males for the period 1977-1983 (11.88 per 10^5) is compared to the female rate (4.33 per 10^5) the differences are statistically significant ($P < 0.001$). In other words, the male mortality rate is 2.7 times higher than the female rate. The high rate of male suicide is an almost universal fact.

Moreover, a statistically significant increase was observed in males over the period, whether comparing the extreme values of the series or the grouping in 2 and 3-year periods (Table 3). A similar pattern occurs when both sexes are considered together, which is to be expected given the greater frequency of suicides in males. For women, on the other hand, the rates remained stable in all the comparisons made (Tables 2 and 3). This upward trend in men, and the stable or even downward trend among women, has in recent years been a frequent finding in various countries: Canada, Norway, Switzerland, Israel, USA, Greece, Hungary, Scotland, Belgium and Japan [17,18,19, 20].

As with the overall figures, the risk also increases with age for each sex (Table 4) and the differences between adolescents and elderly are once more the most significant (P < 0.001). At all ages more men commit suicide than women, with differences which are always statistically significant, except in adolescence. However, the latter cannot be interpreted due to the infrequency of suicides in this age group.

The mean annual specific rates for the period, as shown in Table 5, indicates an increasing frequency in the following categories: single, married, widowed and separated/divorced. This order is the same for men (Table 6) and for women (Table 7).

However, the importance of marital status as a risk factor of suicide is complicated by an interaction between gender and age.

Before continuing it is necessary to appraise the value of the direct and indirect methods of adjustment in this analysis. The direct method gives us rates for each category of marital status for separate comparison, but the differences usually are not submitted to statistical analysis. With the indirect method, on the other hand, statistical significance can be analyzed, since the suicides observed can be compared in each marital status group with expected values from standard rates. The disadvantage is that, since in none of these groups of marital status are the specific suicide rates taken into account by age when calculating the SMR, the relationships between the observed and the expected in each are not comparable with those of the other categories, unless we go on to make an indirect adjustment of all the categories taking each one of them as the standard.

Applying both methods therefore allows us to make a more complete interpretation of the association between marital status and suicide in each sex [21, 22, 23].

Table 8. Direct and indirect standardization for males, by age and marital status

Marital status age-adjusted rates (direct standardization)

Marital status groups Standard population		Single	Married	Widow-ed	Separated/ divorced
0-20	284 953	3.89	0.00	0.00	0.00
20-45	232461	52.53	18.94	217.90	253.81
45-65	116335	61.31	21.83	52.53	159.49
65 and +	48150	31.06	12.15	22.98	35.04
Theoric num. of suicides		148.79	52.92	293.41	448.34
Marital star. stand. rates		21.82	7.76	43.03	65.75
Marital status rates		7.71	13.95	49.98	112.37

Marital status age-adjusted rates (indirect standardization)

Marital status groups Standard rate		Single	Married	Widow-ed	Separated/ divorced
0-20	1.40	3.97	0.03	0.00	0.00
20-45	14.44	11.32	21.78	0.11	0.36
45-65	23.82	2.26	24.48	0.60	0.37
65 and +	32.64	1.16	11.83	2.54	0.19
Theoric num. of suicides		18.71	58.12	3.25	0.92
Marital stat. stand. rates		5.00	19.92	29.19	19.65
Marital status rates		7.71	13.95	49.98	112.37
Adjusted rates		18.32	8.32	20.34	67.91
Standard mortality ratio		154.26	70.06	171.23	571.72
Byar		4.44	5.36	1.04	8.38
		($P < 0.05$)	($P < 0.05$)	(n. s.)	($P < 0.01$)
Poisson UCL 95 %		222.64	95.71	401.37	1262.08
Poisson LCL 95 %		103.82	50.63	67.67	175.60

Age marital status-adjusted rates (direct standardization)

Age-groups Standard population		0-20	20-45	45-65	65 and +
Single	374260	5.10	84.58	197.25	241.45
Married	291787	0.00	23.77	54.76	73.62
Widowed	11148	0.00	10.45	5.03	5.32
Separated/divorc.	4704	0.00	5.14	6.45	3.42
Theoric num. of suicides		5.10	123.94	263.49	323.81
Age standardized rates		0.75	18.17	38.64	47.49
Age rates		1.40	14.44	23.82	32.64

Table 9. Direct and indirect standardization for females, by age and marital status}

Marital status age-adjusted rates (direct standardization)

Marital status groups Standard population		Single	Marri ed	Widow- ed	Separated/ divorced
0-20	270562	1.76	0.00	0.00	0.00
20-45	226457	19.75	5.77	31.91	95.15
45-65	124731	13.25	6.97	11.80	32.40
65 and +	63983	11.61	6.75	7.01	27.16
Theoric num. of suicides		46.37	19.49	50.72	154.71
Marital stat. stand. rates		6.76	2.84	7.40	22.56
Marital status rates		2.82	4.11	10.66	35.34

Marital status age-adjusted rates (indirect standardization)

Marital status groups Standard rate		Single	Married	Widow- ed	Separated/ divorced
0-20	0.63	1.67	0.05	0.00	0.00
20-45	4.86	2.47	8.17	0.15	0.21
45-65	7.22	1.07	6.65	1.09	0.20
65 and +	12.50	1.28	3.05	3.59	0.08
Theoric num. of suicides		6.49	17.92	4.83	0.49
Marital stat. stand. rates		1.91	6.14	10.29	6.17
Marital status rates		2.82	4.11	10.66	35.34
Adjusted rates		6.40	2.90	4.49	24.82
Standard mortality ratio		147.72	67.00	103.60	572.80
Byar		1.05	1.72	0.01	4.16
		(n. s.)	(n. s.)	(n. s.)	(P < 0.05)
Poisson UCL 95 %		283.83	117.04	241.77	1757.66
Poisson LCL 95 %		74.01	34.62	33.64	124.04

Age marital status-adjusted rates (direct standardization)

Age groups Standard population		0-20	20-45	45-65	65 and +
Single	338846	2.21	29.55	36.01	61.50
Married	291907	0.00	7.44	16.30	30.79
Widowed	46895	0.00	6.61	4.44	5.13
Separated/divorc.	8085	0.00	3.40	2.10	3.43
Theoric num. of suicides		2.21	47.00	58.85	100.85
Age standardized rates		0.32	6.85	8.58	14.71
Age rates		0.63	4.86	7.22	12.50

Given an adjusted rate for married persons of 1, the direct method indicates a relative risk in separated males of 8.5, in widowers of 5.5 and in single males of 2.8. Among women (Table 9), the relative risk of the separated/ divorced group is 8, while that of widowed and single women is 2.6 and 2.4 respectively. This already suggests an apparent difference according to sex, since single and widowed women show almost the same risk.

The indirect method of adjustment, applying the rates by age of each sex in the Canary Islands overall (Tables 8 and 9), has the advantage of dealing with more stable rates, based on a larger population. However, used with the smaller populations occasioned by subdivision into each category of marital status and sex, the results in some cases fall short of statistical significance. Our reading of the results is that, in the case of males, being separated/ divorced or single is a risk factor, while being married is protective. As for women, we can say only that being separated or divorced represents a risk factor.

By adding the indirect adjustment to the above (Table 10), a more complete appraisal can be obtained. Males who are separated or divorced show the highest risk, followed by the widowed, then the single group and finally, the married. These differences are significant.' Since the widowed group represents a small population, the differences between them and the separated/divorced group is significant only if the comparison is made over the 7 years of the study.

Divorced and separated women have a higher risk than those of the other three categories. Single women have the next highest rate, in contrast to the findings based on the direct standardization adjustment. Widows form the next category, with differences that are significant over the whole 7 years. Married women show the lowest risk.

In both sexes, statistically significant differences only emerged when periods longer than the normal 1-year period, were compared.

Naturally, having identified marital status as a risk factor, it is also necessary to standardize the respective rates according to age. This controls the potential confusion from the different age distribution for each marital status, and allows us to check if the upward tendency of suicide with age is maintained.

Indeed, it can be concluded that when using the direct standardization adjustment the risk of suicide rises with age for both sexes. Taking the rates for 0-20 years as the

Table 10. Marital status age-adjusted indirect standardization (age suicide rates by marital status categories as standard rates)

Standard mortality rates in men

Marital status groups	Single	Married	Widowed	Separated/ divorced
Marital status rate	7.71	13.95	49.98	112.37
Age suicide rates used as standard	Marital status standard mortality rates			
Overall	154.26*	70.06*	171.23[a]	571.72**
Age rates in single people	100.00	36.47***	85.35[a]	299.23*
Age rates in married	318.52***	100.00	222.80[a]	820.16***
Age rates in widowed	36.32***	19.85***	100.00	159.34[$]*
Age rates in sep./divorc.	28.52***	12.27***	55.91[$]***	100.00

[a] notsignificant; * p < 0.05; ** p <0.01; *** p < 0.001 [$] statistic differences comparing 7 years

Standard mortality rates in women

Marital status groups	Single	Married	Widowed	Separated/ divorced
Marital status rate	2.82	4.11	10.66	35.34
Age suicide rates used as standard	Marital status standard mortality rates			
Overall	147.72 [a]	67.00[a]	103.60,	572.80*
Age rates in single people	100.00	41.48***	70.63[$]*	356.49 [a]
Age rates in married	299.22**	100.00	126.63[a]	847.39*
Age rates in widowed	98.93 [$a]	34.20***	100.00	298.61 [a]
Age rates in sep./divorc.	32.42***	11.43***	28.76**	100.00

[a] not significant; * p<0.05; ** p<0.01; *** p<0.001; [$] statistic differences comparing 7 years

standard (Table 8), in males between the ages of 20-45 the risk increases by a multiple of 10, and between 45-65 by 17, while in those older than 65 the relative risk is more than 23. The relative risk for women (Table 9) between 20-45 is almost 8, between 45 and 65 more than 11, and almost 20 for those older than 65.

Conclusion

In the Canary Islands, as in a large part of the rest of the world, male suicide rates have increased significantly over the period studied, while the rate of female suicide remained stable. The average ratio during the period between men and women is about 3:1.

The risk of suicide increases with age in each sex, with the minimum risk being for persons of less than 20 years of age (1.03 per 105) and the maximum for those of more than 65 years of age (21.15 per 105). This finding, a constant in the literature, is maintained after standardizing for marital status for each sex.

The standardization by age for marital status must also be made separately for each sex. Indirect standardization allows us to evaluate the statistical differences and the confidence interval of the standardized mortality. However, this must be done using as standard rates by age of each category of marital status applied subsequently to the rest, and interpretation is more complete when direct standardization is carried out at the same time.

Risk of suicide is highest for separated and divorced males, followed by widowers, single men and, finally, married men. Women show a different profile, such that the highest rate falls on separated or divorced women, followed by single women and then widows, with married subjects again having the least risk. In each sex the differences between the different categories of marital status are significant.

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