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ORIGINAL ARTICLE

Sex differences in death by suicide versus the rest of external causes of death across the lifespan. A population study

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KEYWORDS
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Abstract
Background and Objectives: Men, compared to women, have higher rates of mortality by suicide and the rest of external causes in all age groups. However, it is unclear if the higher tendency of men to die by suicide, it is largely related to men higher propensity to die by external causes in general. As far as we know, only one study (US population) assessed sex differences in suicide versus other external causes of death, finding important differences across the lifespan. Thus, our study aims to assess, in Spanish population, if there are differences between sexes in death by suicide versus the rest of external causes of death and its variation across lifespan.
Methods: Cross-sectional study of all Spanish residents that died from suicide and rest of external causes between 2016 and 2018, and which consisted of 45,389 fatalities. To assess sex differences in deaths by suicide versus the rest of external causes of death, we built logistic regression models stratifying by age groups.
Results: Compared to women who died by external causes, men who died by external causes had OR (95 % CI) of 1.94(1.85−2.03) of dying by suicide. The OR were 0.78 (0.64−0.96), 0.57 (0.49−0.67), 0.73 (0.64−0.84) and 0.75 (0.65−0.85) for those 25−34, 35−44, 45−54 and 55−64 years respectively. For those 65−74, 75−84 and ≥ 85 years the trend changed, and OR were 1.15 (1.01−1.31), 2.38 (2.10−2.72), and 3.81 (3.28−4.44) respectively.
Conclusions: Men, compared to women, are more likely to die by suicide versus the rest of external deaths. Nevertheless, there are important differences across the lifespan.

Abbreviations: OR, Odds ratios; ICD-10, International Classification of Diseases-10.

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Introduction

Men have higher rates of mortality by external causes (unintentional injuries (transport accidents, falls, accidental drowning and submersion, exposure to electric current, radiation and extreme ambient air temperature and pressure, contact with venomous animals and plants, overexertion, travel and privation among other), suicide, and homicide) compared to women in all age groups.[1] Additionally, death rates from external causes (including suicide) change across lifespan; they increase until early adulthood, then reach a relative stability, and increase exponentially in older adults.[1]

It has been suggested that sex differences in death by external causes, including suicide, could be due to a higher tendency of men for aggressive, risk-taking behaviours and impulsivity.[2–7] Additionally, Yoshida et al. have suggested that men have a greater predisposition to risk behaviours that increase the risk of accidental falls.[8] Moreover, it has been described that men tend to use more violent suicidal methods than women.[9] However, it is relevant to underscore that there may be additional explanations of the increased risk for men to die by external causes related to differences in life conditions, occupational risks or substance use between the sexes.[10–14] On the other hand, it is important to highlight that it has been suggested that "gender differences in suicide are not simply a reflection of gender differences in violent deaths more generally".[3]

We hypothesize that risk taking behaviours, aggressiveness and impulsivity may not be the main explanations for the sex differences across the lifespan, and that other life events that may emerge in older adults could affect men, more than women, for committing suicide, and may not be related to other external causes of death.

As far as we know, only one study, in US population, assessed sex differences in suicide, versus other external causes of death (homicides, deaths by law enforcement acting in line of duty, unintentional firearm-related injury deaths, and deaths where intent might have been due to violence),[3] and its variation through the life course. They assessed that the proportion of suicide deaths versus the rest of violent deaths did not differ for men and women when considering the whole lifespan. Although, there were important differences for specific age groups. Males 60 years and older were more likely than women to die by suicide relative to other external causes of death, and this risk increased steeply with age.[3] They suggested that aggressive, impulsive and risk behaviours tend to temper between the sexes in older age groups,[3] and other life events, that could emerge at older ages (physical comorbidities,[15] retirement,[16] widowhood,[17] social isolation, change of social role and heavy alcohol consumption,[13] among others) could affect men more than women for committing suicide.[3,14,17]

This interesting information, supported by the results in US population,[3] requires a specific analysis for the Spanish population for several reasons. First, some important methods of death by external causes in general, and suicide specifically, like firearms, have restricted access in most European countries, like Spain, and second, the Spanish population has a longer life expectancy and a different age structure, with an older population than the US population, thus the possible differences across the lifespan could be more robustly tested. Moreover, we are going to consider the suicide in the context of all external causes of death, because it has been assessed that men have higher rates of mortality by all external causes (unintentional injury, suicide, and homicide) compared to women in all age groups,[1] while Boozay et al.[3] focused only on violent deaths (homicides, suicides, deaths where individuals were killed by law enforcement acting in the line of duty and also about unintentional firearm-related injury deaths, and deaths where the intent could not be determined, but might have been due to violence).

Thus, our objective is to assess if there is a difference between the sexes in deaths by suicide versus the rest of external causes, and if these possible differences vary across the lifespan.

Material and methods

Data source

The information about deaths by external causes was obtained from the microdata from the Death Statistics by cause of death from the Spanish National Statistics Institute.[18] Microdata were provided anonymised to ensure the confidentiality of the patients. The Spanish National Statistics Institute obtains the information of deaths due to external causes from the Boletín Estadístico de Defunción Judicial (Judicial Statistical Death Bulletin) provided by the Judicial Secretary.

In Spain, since 1999, mortality is coded according to the International Classification of Diseases-10 (ICD-10). External causes of death are identified by the codes V01-Y98 of ICD-10.

To obtain more homogenous estimates we decided to combine the information of three consecutive years without external specific alterations, like COVID-19 pandemic. Thus, the inclusion criteria were Spanish residents that died for external causes between January 1st 2016 and December 31st 2018.

Study variables

The dependent variable, cause of death, was categorized as: death by suicide and death by the rest of external causes.

Death by suicide was defined based on presence of ICD-10 codes X60-X84 and Y87.0.

Death by the rest of external causes was defined based on presence of the rest of codes of Chapter XX (External causes of morbidity and mortality) of ICD-10 with the exclusion of: complications of medical and surgical care (Y40—Y84), drugs, medicaments and biological substances causing adverse effects in therapeutic use (Y40—Y59), misadventures to patients during surgical and medical care (Y60—Y69), medical devices associated with adverse incidents in diagnostic and therapeutic use (Y70—Y82), and surgical and other medical procedures as the cause of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure (Y83—Y84); because it was considered that activities in which it was involved a health professional were not related to aggressive or risk taking behaviours.

Table 1 Sociodemographic characteristics by type of death, globally and stratified by sex (n = 45,389).

	Men		Women		Total	
	Suicide n (%)[a]	Rest external causes n (%)	Suicide n (%)	Rest external causes n (%)	Suicide n (%)	Rest external causes n (%)
Total n	8003	20,333	2880	14,173	10,883	34,506
Age-standardized[b]	11.76	29.66	4.05	19.91	7.79	24.70
Age group						
< 15 years	18 (0.2)	214 (1.1)	15 (0.5)	131(0.9)	33 (0.3)	345 (1.0)
15–24 years	313 (3.9)	724 (3.6)	111 (3.9)	231 (1.6)	424 (3.9)	955 (2.8)
25–34 years	663 (8.3)	1302 (6.4)	187 (6.5)	288 (2.0)	850 (7.8)	1590 (4.6)
35–44 years	1325 (16.6)	2005 (9.9)	448 (15.6)	388 (2.7)	1773 (16.3)	2393 (6.9)
45–54 years	1714 (21.4)	2519 (12.4)	557 (19.3)	601 (4.2)	2271 (20.9)	3120 (9.0)
55–64 years	1326 (16.6)	2159 (10.6)	531 (18.4)	645 (4.6)	1857 (17.1)	2804 (8.1)
65–74 years	986 (12.3)	2449 (12.0)	440 (15.3)	1253 (8.8)	1426 (13.1)	3702 (10.7)
75–84 years	1030 (12.9)	3889 (19.1)	347 (12.1)	3123 (22.0)	1377 (12.7)	7012 (20.3)
≥85 years	628 (7.9)	5072 (24.9)	244 (8.5)	7513 (53.0)	872 (8.0)	12,585 (36.5)

[a] Column %.
[b] Age-standardized rates per 100,000 using the direct method and the standard European population recommended by Eurostat as a reference.

The final category of "death by the rest of external causes" included the codes V01-X59, X60-Y36 and Y85-Y58 of ICD-10 and they are detailed in Supplementary Table 1.

The independent variable was sex (male, female) and all the analyses were stratified by age categories at the moment of death (< 15 years, 15–24 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, 65–74 years, 75–84 years and ≥ 85 years). Previous studies that analysed suicide in Spain used those same age groups.[19] Additionally in Spain the retirement age is 65 years old,[20] thus it was considered that a relevant cut-off point should be set at the retirement age.

Statistical analyses

Of the initial sample comprising 46,470 individuals, we excluded non-residents in Spain (n = 1066), and individuals with missing values in any socio-demographic variable of interest (n = 15). Thus, the final sample for analyses consisted in 45,389 individuals.

Chi-square tests were used to compare the cause of mortality distribution by demographic variables.

To examine the associations between sex and death by suicide versus the rest of external causes, we built a logistic regression models for each of the age categories (< 15 years, 15–24 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, 65–74 years, 75–84 years and ≥ 85 years).

Analyses were performed using STATA software version 15 (StataCorp LP, College Station, Texas 77845 USA).

Research Ethics Committee of the Institute of Health Carlos III approved the study. The data was de-identified prior to any of the authors to obtaining it for use in this study; thus, no formal informed consent was applicable.

Results

Of the 45,389 people included in the analyses 10,883 died by suicide representing the 24.0 % of the external causes of death. The sociodemographic characteristics globally and stratified by sex are presented in Table 1. Those that committed suicide used to be more frequently men and people between 35 and 84 years old (Table 1). It is interesting to highlight that men have higher figures of death by suicide in all age groups and likewise higher figures of death by the rest of external causes in all age groups but in those 85 years and older (Table 1).

In the logistic regression model, we found that, compared to women who died by external causes, men who died by external causes had OR (95 % CI) of 1.94 (1.85–2.03) of dying by suicide (Table 2).

When we stratified the analyses by age groups, until the young adulthood (24 years and younger), men who died by external causes, compared to women who died by external causes, had a non-relevant decreased risk of dying by suicide. The OR were 0.74 (0.36–1.51) and 0.90 (0.69–1.17) for those <15 years and 15–24 years respectively. For those 25–64 years old, these decreased risk was of a higher

Table 2 OR (95 % CI) of dying by suicide for men who died by external causes compared to women who died by external causes[a], stratified by age groups[b]. Spain 2016–2018.

Age groups	OR[c]
All	1.94 (1.85–2.03)
< 15 years	0.74 (0.36–1.51)
15–24 years	0.90 (0.69–1.17)
25–34 years	0.78 (0.64–0.96)
35–44 years	0.57 (0.49–0.67)
45–54 years	0.73 (0.64–0.84)
55–64 years	0.75 (0.65–0.85)
65–74 years	1.15 (1.01–1.31)
75–84 years	2.38 (2.10–2.72)
≥ 85 years	3.81 (3.28–4.44)

[a] Women as reference.
[b] Please note that each row depicts a separate model.
[c] Crude logistic regression model.

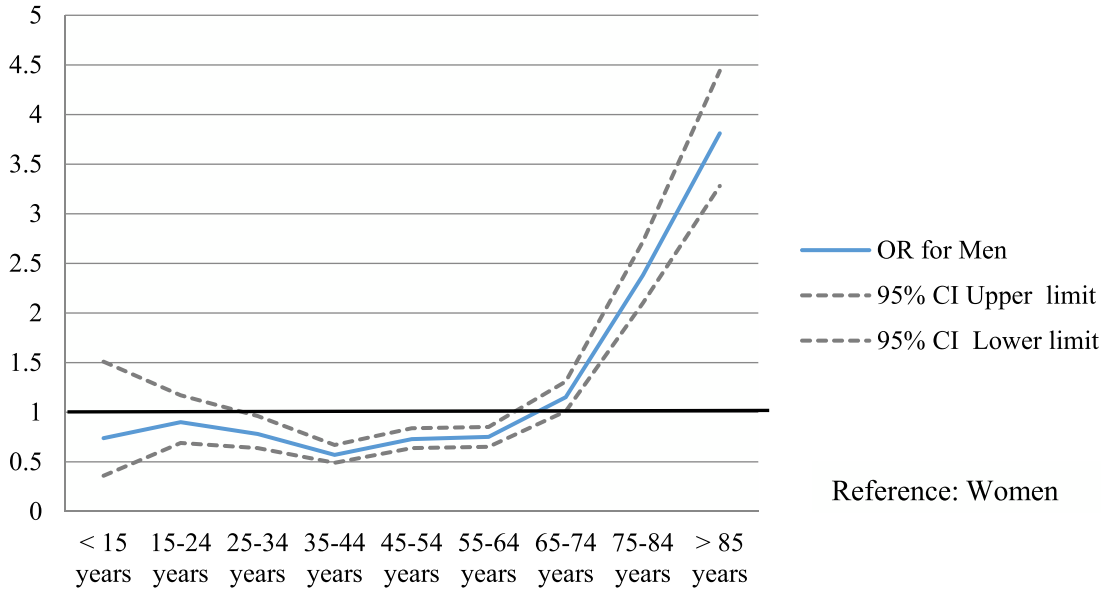

Fig. 1 OR[a] (95 % CI) of dying by suicide for men[b] who died by external causes compared to women who died by external causes, across the different age groups[c]. Spain 2016–2018.
[a] Crude logistic regression model.
[b] Women as reference.
[c] Please note that each age group depicts a separate model.

magnitude. In the models the OR were 0.78 (0.64–0.96), 0.57 (0.49–0.67), 0.73 (0.64–0.84) and 0.75 (0.65–0.85) for those 25–34, 35–44, 45–54 and 55–64 years respectively. Although for those 65 years and older the trend changed, and compared to women who died by external causes, men who died by external causes showed higher remarkable OR of dying by suicide. The OR, by age groups, were 1.15 (1.01–1.31), 2.38 (2.10–2.72), and 3.81 (3.28–4.44) for those 65–74, 75-84 and ≥ 85 years respectively (Table 2 and Fig. 1).

Discussion

Men who died by external causes, were more likely to die by suicide compared to women who died by external causes, although there are important variations through the life-span. Mainly between 25 and 64 years old, men who died by external causes, compared to women who died by external causes, had lower tendency of dying by suicide, nevertheless beyond the age of 64 years, men who died by external causes, showed a higher exponential tendency of dying by suicide. Our results are consistent with those from Bozzay et al. assessing that the sex disparities in suicide rates were not only related to differences between the sexes that remain homogeneous throughout the life span, because the tendency to die by suicide relative to other external deaths was more pronounced at certain developmental stages depending on the sex.[3]

According to our data, in raw numbers, men have higher mortality due to external causes (including suicide) than women, what it is coherent with other studies.[1,3,21,22] Moreover, men have a higher use of alcohol and substances,[13] employment in positions at risk of mortality due to external causes[7,23] and access to lethal means[24,25] that are related to a higher risk of dying by external causes, including suicide.

Additionally, it is important to highlight than, according to our results, for specific age groups (those 85 years and older) in absolute numbers women have higher figures of death by the rest of external causes (excluding suicides) than men. However, these results could be explained by the fact that men have a lower life expectancy. If we would considered the death rates, men 85 years and older would have higher rates of both death by external causes and death by suicide than women 85 years and older (death rates for the rest of external causes in our sample are (5072/1,449,284) *100,000 = 349.97 per 100,000 men and (7513/2,861,993) *100,000 = 262.51 per 100,000 women, and death rates by suicide are (628/1,449,284)*100,000=43.31 per 100,000 men and (244/2,861,993)*100,000=8.53 per 100,000 women). Anyhow the percentage of women 85 years and older that died for the rest of external causes 53.0 % is higher than for men 24.9 % (Table 1). Thus, we cannot rule out that part of the sex differences in death by suicide versus the rest of external causes for those 85 years and older could be partially explained by the higher percentage of women 85 years and older that died for the rest of external causes compared to men.

According to our results men who died by external causes were more likely to die by suicide, compared to women who died by external causes. Although, this general tendency, appears to be mainly due to the high figures of men 65 years and older that die by suicide versus the rest of external causes compared to women. By contrast, in younger age groups men who died by external causes show a slightly lower tendency of dying by suicide compared to women who died by external causes. It is important to highlight that Boozay et al.[3] analysed suicide in the contest of the rest of violent deaths (including only: homicides, suicides, deaths

where individuals were killed by law enforcement acting in the line of duty and also about unintentional firearm-related injury deaths, and deaths where the intent could not be determined, but might have been due to violence); while we analysed suicide in the context of the rest of external causes.

As Boozay et al.,[3] we consider that to analyse these sex differences across the lifespan is important to try to hypothesize possible underlying mechanisms.

Until 24 years old, compared to women who died by external causes, men who died by external causes had a lower tendency of dying by suicide, and this tendency is even more marked for those between 25 and 64 years old. These differences could be explained by the hypothesis that risk taking behaviours, aggressiveness and impulsivity could be more related to die for other external causes than to die for suicide; since risk taking behaviours, aggressiveness and impulsivity, are more frequent in men than in women and mainly in adolescence and in a lesser extent in mid-adulthood.[2,5,26–28]

Compared to women 65 years and older who died by external causes, men 65 years and older who died by external causes are more likely to die by suicide. These results are consistent with Boozay et al.,[3] and a possible explanation, consistent with their hypothesis, could be that in older age groups the aggressiveness, risk behaviour and impulsivity sex gap dims,[2,29] and later life events that emerge in older adults could have more impact on males risk for committing suicide. Other life situations that emerge in older adults, like loss of social roles,[16] retirement,[12,16] social loneliness,[31] widowhood,[17,31] physical comorbidities[15,31] and the consumption of addictive substances (including alcohol),[13,32] among others, could affect men, more than women, for dying by suicide.[3,16,17,30–33] We hypothesize that older males may have lower resilience than women to these adverse circumstances of this life stage.[34] Anyhow, it is important to highlight that our manuscript only provides data about sex differences in death by suicide versus the rest of external causes of death across the lifespan, but is not designed to test the hypothesis that sex differences in suicide risk across the lifespan may not be explained by differences in aggressiveness, risk-taking behaviours and impulsiveness. Finally, our results come from data uniformly collected just prior to COVID-19 pandemic. Would be of interest to use this information as reference of the potential impact of COVID-19 pandemic, across the lifespan, in the sex differences in mortality by suicide versus rest of external causes.

Our study has some limitations. First, although microdata from Death Statistics by cause of death from Spanish National Statistics Institute is a robust database, we cannot exclude that some causes of death had not been correctly categorized. Second, we cannot rule out that our estimates may suffer from potential interactions or some residual confounding from variables not included in our analyses.

The main strength is the large population study that collects all deaths in a whole country.

Conclusions

Compared to women who died by external causes, men who died by external causes were more likely to die by suicide, although there are important variations through the lifespan. Between 25 and 64 years old males who died by external causes, compared to females, had lower tendency of dying by suicide, although for those 65 years and older the trend changed, and men had a higher exponential tendency.

Ethical considerations

Research Ethics Committee of the Institute of Health Carlos III approved the study. The data was de-identified prior to any of the authors to obtaining it for use in this study; thus, no formal informed consent was applicable. The work described has been carried out in accordance with The Declaration of Helsinki.

Declarations of competing interest

None.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.ejpsy.2024.100261.

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