

Suicide mortality trends in Galicia, Spain and their relationship with economic indicators

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Background. Recent research has shown an association between unemployment and suicide, but the mediating factors in this relationship are still unknown. In this study, we investigated the effect of unemployment and economic recession on suicide rates in the Spanish region of Galicia between 1975 and 2012

Method. We analysed age-standardised suicide rates in men and women and in four age groups: less than 25 years, 25–45 years, 45–65 years and more than 65 years and performed a joinpoint analysis to determine trend changes throughout 1975–2012 period. Also we analysed the association between suicide, recession and unemployment by means of a temporal trend model with a Generalised Additive Model.

Results. Suicide rates increased from 145 suicides in 1975 to a high in 1993, with 377 deaths by suicide, representing 1.38% of all causes of death, and thereafter they tend to decrease to 335 suicides in 2012. Joinpoint analyses revealed that suicide rates changed differently across sex and age groups. For men, the annual percentage of change (APC) between 1975 and 1988 (CI 95% 1986–1994) was 5.45 (CI 95% = 3.5, –7.2) but from 1988 the APC became negative [–0.66 (CI 95% = –1.3, –0.1)]. For women, APC between 1974 and 1990 (CI 95% 1986–1992) was 4.86 (CI 95% = 3.2, –6.4) and –1.46 subsequently (CI 95% = –2.2, –0.5). Women aged 24 years or less showed stable suicide rates while men from 45–65 years showed two incidence peaks. When we studied the independent correlation between unemployment, recession and suicide, we found a significant association between unemployment and suicide, but not between recession and suicide for both sexes together and for men while for women there was no significant correlation between suicide and unemployment or recession. Finally, when we studied the effect of the interaction between unemployment and recession on suicide we found economic recession and unemployment interacted with regards to suicide rates ($F = 5.902$; $df = 4.167$; $p = 0.00098$) and after adjusting by sex, the effect was confirmed among men ($F = 4.827$; $df = 2.823$; $p = 0.0087$), but not among women ($F = 0.001$; $df = 1.000$; $p = 0.979$).

Conclusions. Although suicide rates in Galicia are gradually decreasing in the last decades, there are important sex and age differences. Unemployment was related with suicide during economic recession periods according to our results.

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Key words: Economic recession, joinpoint analyses, suicide, unemployment.

Introduction

Concurrent with the recent global economic crisis, there is a raising concern about the consequences of economic downturns on the physical and mental

health of the population, and particularly the effect of recession on suicide mortality rates. Three classical sociological theories tried to explain suicide rates according to the business cycle: Durkheim's U-shaped theory, Ginsberg's procyclical theory and Henry and Short's countercyclical theory (Lester, 2001), but the application of these theories on epidemiological data is far from perfect (Blasco-Fontecilla *et al.* 2012). Therefore, in recent years much has been written about the relationship between suicide, unemployment and recession. In 2009,

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Stuckler *et al.* established a strong correlation between unemployment and suicide, with a 1% rise in unemployment being associated with a 0.79% increase in suicide in European working-age population (Stuckler *et al.* 2009). Since then, there is continuous debate on the subject (Reeves *et al.* 2012, 2013; Ayuso-Mateos *et al.* 2013; Karanikolos *et al.* 2013; Rihmer *et al.* 2013).

The impact of economic recession differs across countries, with different repercussion in gross domestic product (GDP), which is a standard measure of the value of final goods and services produced by a country minus the value of imports during a year (OECD, 2014). A recent study evidences 10 000 additional suicides in Europe and North America following the 2008–2010 economic recession and four diverging trends in suicide mortality: acceleration of increasing rates (USA and Poland), rise from stable rates (Canada), inversion of decreasing rates (most countries, including Spain) and no change at all (Austria and Sweden) (Reeves *et al.* 2014). Previously, another comprehensive study used time trend analysis to compare suicides in 2009 with expected rates before the crisis in four continents and 53 countries (Chang *et al.* 2013). They calculated 4900 excess suicides and attributed most of them to European and American males, particularly young Europeans (15–24 years) and older Americans (45–64 years). Of note, male suicide rates appeared to be associated with unemployment especially in those countries with low unemployment levels before the crisis. The 1997–1998 economic crisis in Asia had a large impact in Japan, Hong Kong and Korea (with 10 400 excess suicides in 1998 compared with 1997), while in Taiwan and Singapore, where the same crisis had a smaller impact on GDP and unemployment, trends in suicide rates did not change (Chang *et al.* 2009). In the crisis related with the dissolution of the Soviet Union in the early 1990s, suicide rates increased in Russia (Gavrilova *et al.* 2000; Pridemore *et al.* 2007) and Latvia (Rancans *et al.* 2001) while a crisis affected Finland in 1990 increasing unemployment but not suicide rates (Hintikka *et al.* 1999). Finally, differences between high and low income countries should also be considered. Whereas in developed countries suicide rates decrease with economic growth, in developing countries the opposite might be true (Suhrcke & Stuckler, 2012).

Spain is a country with historically low suicide rates but, in recent years, it has experienced one of the highest rate increases both in Europe and the world (Ruiz-Pérez & Olry de Labry-Lima, 2006). In the 1981–2008 period the highest suicide rates were found in Spanish southern areas with the lowest GDP in the country, and rural areas in Northern Spain such as Galicia (Álvaro-Meca *et al.* 2013). Suicide rates are particularly high in the same regions among males of working age (Álvaro-Meca *et al.* 2013;

Lopez Bernal *et al.* 2013). Interestingly, although Spain is a country chronically affected by high unemployment rates, a recent epidemiological study has not found a direct association between unemployment and suicide (Ayuso-Mateos *et al.* 2013). Accordingly, the increasing suicide rates from 1975 to 2012 in the southern Spanish region of Andalucía were independent of unemployment rates or changes in antidepressant prescription (Alameda-Palacios *et al.* 2014).

In Spain, Galicia is one of the Spanish provinces with persistently higher suicide rates, only exceeded by the neighbouring region of Asturias (Lopez Bernal *et al.* 2013). The aims of the present study are (1) to study trends of suicide deaths in the Spanish region of Galicia between 1975 and 2012, (2) to detect points of change in suicide trends during this time period, and (3) to investigate the effect of unemployment and economic recession on suicide rates.

Methods

Data collection

We collected data on population and causes of death in Galicia for the period 1975–2012 using metadata provided by the 'Instituto Nacional de Estadística' (INE), the Spanish Statistical Office. The INE updates the defining criteria of death causes according to the International Classification of Diseases. We classified the cause of death as a suicide according to INE specifications.

Data on GDP, employment and unemployment rates were collected from 'Instituto Gallego de Estadística' (IGE), the Galician Statistical Office. GDP per capita data (in annual thousands euros per person) were extracted from Regional Accounting of Instituto Nacional de Estadística; Spanish Statistical Office. We defined economic recession as a period of time with two successive quarterly falls in GDP (Haw *et al.* 2014) and established four economic recession periods in Spain since 1975: 1975–1985, 1992–1993, 2008–2010 and 2011–2013.

Statistical analyses

Rates standardisation

The crude rates were adjusted (standardised) by age in 5-year intervals (0–4, 5–9, 10–14, 15–19, . . . , ≥85 years) and by sex using a standard European population as reference (19 Age Groups – Standard Populations – SEER Datasets). The adjusted rates were used to represent the temporal trends of suicide mortality in fitted regression models. This method of direct standardisation was chosen to control for structural variations in

the Galician population, which is notoriously aged compared with other regions. We calculated stratified crude suicide mortality rates as number of suicides by year divided by total population of that year, expressed as number of suicides/100 000 habitants, and age-standardised suicide mortality rates weighted by the standardising population.

We studied age-standardised suicide rates in men and women and in four age groups according to their expected productivity: less than 25 years (young population), 25–45 years (period of highest productivity), 45–65 years, and more than 65 years (elderly population).

Changes in temporal suicide trends

We used joinpoint regression (Kim *et al.* 2000) to identify points at which suicide trends suffered a significant change and to measure the size of the increase or decrease observed for each interval in terms of annual percentage of change (APC). For each group of age, regression models were fitted with joinpoint = 0 and we chose those best fitting up to four possible joinpoints. Statistical significance was fixed at 0.05% and model choice was based on a permutation test (Rodríguez-Rieiro *et al.* 2009).

Relationship between suicide, recession and unemployment

We analysed the association between suicide, recession (yes/not) and unemployment by means of a temporal trend model. Specifically, we used a Generalised Additive Model (GAM) with non-parametric smoothing functions to control the effect of related variables without pre-setting their relationship with the outcome variable (Hastie & Tibshirani, 1990). These models are commonly used in similar studies using time-series (Iñíguez *et al.* 2003; Likhvar *et al.* 2011a).

We assessed the relation between recession and suicide and unemployment and suicide in models including only these variables:

$$\begin{aligned}
 Y_t &= \text{quasiPoisson}(E) \\
 \log(E(Y)_t) &= \beta_0 + S(\text{time}) + \beta_t(\text{recession}) \\
 \log(E(Y)_t) &= \beta_0 + S(\text{time}) + S_t(\text{unemployment})
 \end{aligned}$$

Associations were measured using a quasi-Poisson GAM regression model, assuming:

$$\begin{aligned}
 Y_t &= \text{quasiPoisson}(E_t) \\
 \log(E(Y)_t) &= \beta_0 + S(\text{time}_t) + \beta(\text{recession}_t) \\
 &\quad + S(\text{unemployment}_t) \cdot \text{recession}_t
 \end{aligned}$$

where Y_t is number of deaths during year t , $E(Y)_t$ is the expected value of number of deaths, $S(\text{time})$ is a smoothing function of time (years), ‘recession’ is a

dichotomous variable indicating if the year (t) is in a recession period, S_t (unemployment) is a smoothing function of unemployment (Sánchez-Cantalejo Ramírez & Ocaña-Riola, 1997), and $[S_t(\text{unemployment}) \text{ recession}]$ is an interaction term between unemployment and recession. We used a quasi-poisson distribution for fitting GAM models to control possible overdispersion. Smoothing was performed using ‘Thin plate regression splines’ (Wood, 2003).

Statistical analyses were conducted using SEER*STAT (SEER*Stat Software), Joinpoint Regression software (Kim *et al.* 2000) and R software for GAM models (The R Project for Statistical Computing).

Results

Suicide deaths from 1975 to 2012 in Galicia

Over the period of study, there were 10 258 suicide deaths in Galicia, 7519 men and 2739 women. Suicide rates increased from 1975, with 145 suicides (0.56% of all deaths), to a high in 1993, with 377 suicides (1.38% of all deaths). Since then, the rates have decreased continuously to 335 suicides in 2012 (1.22% of all deaths) (Fig. 1).

Data on suicide and other causes of death in the period 1975–2012 in Galicia can be seen in supplementary data (Tables S1, S2 and S3).

Trends in suicide rates from 1975 to 2012 in Galicia

The joinpoint analyses show two different periods in suicide mortality rate for men ($p=0.0002$) and for women ($p=0.0002$). A first period of increasing suicide deaths between 1975 and 1988 is followed by a period of stability, with slightly decreasing trends thereafter. For men, the APC between 1975 and 1988 (CI 95% 1986–1994) was 5.45 (CI 95% = 3.5, –7.2) but from 1988 the APC became negative [–0.66 (CI 95% = –1.3, –0.1)]. For women, APC between 1974 and 1990 (CI 95% 1986–1992) was 4.86 (CI 95% = 3.2, –6.4) and –1.46 subsequently (CI 95% = –2.2, –0.5) (Fig. 2).

Joinpoint analyses of age-standardised suicide rates by age groups showed only one point of change in suicide trends for most of the groups, with the two periods described above (first increase and then slow descent). This pattern differed only among young women (less than 25 years), with stable suicide rates along the study period, and men aged 45–65 years, who showed two points of change and three temporal trends: (i) increasing rates from 1975 to 1987, (ii) decreasing rates until 2001, and (iii) increasing suicide rates again since 2001 (Figs 3 and 4).

Table 1 shows data of joinpoint analyses; all of them are significant except for women below 25 years of age.

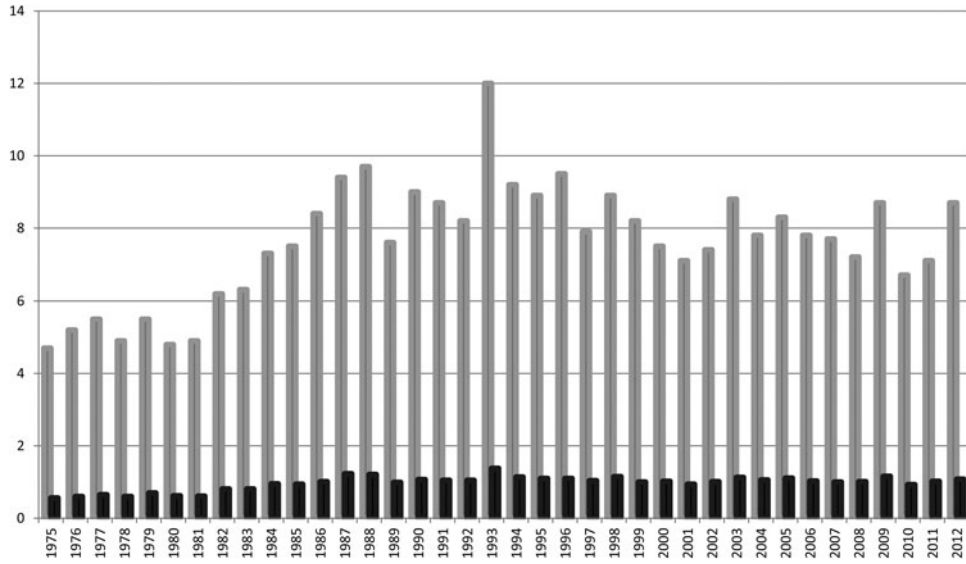


Fig. 1. Age-standardised rates of deaths by suicide in Galicia (grey bars) and percentage over the total causes of death (black bars).

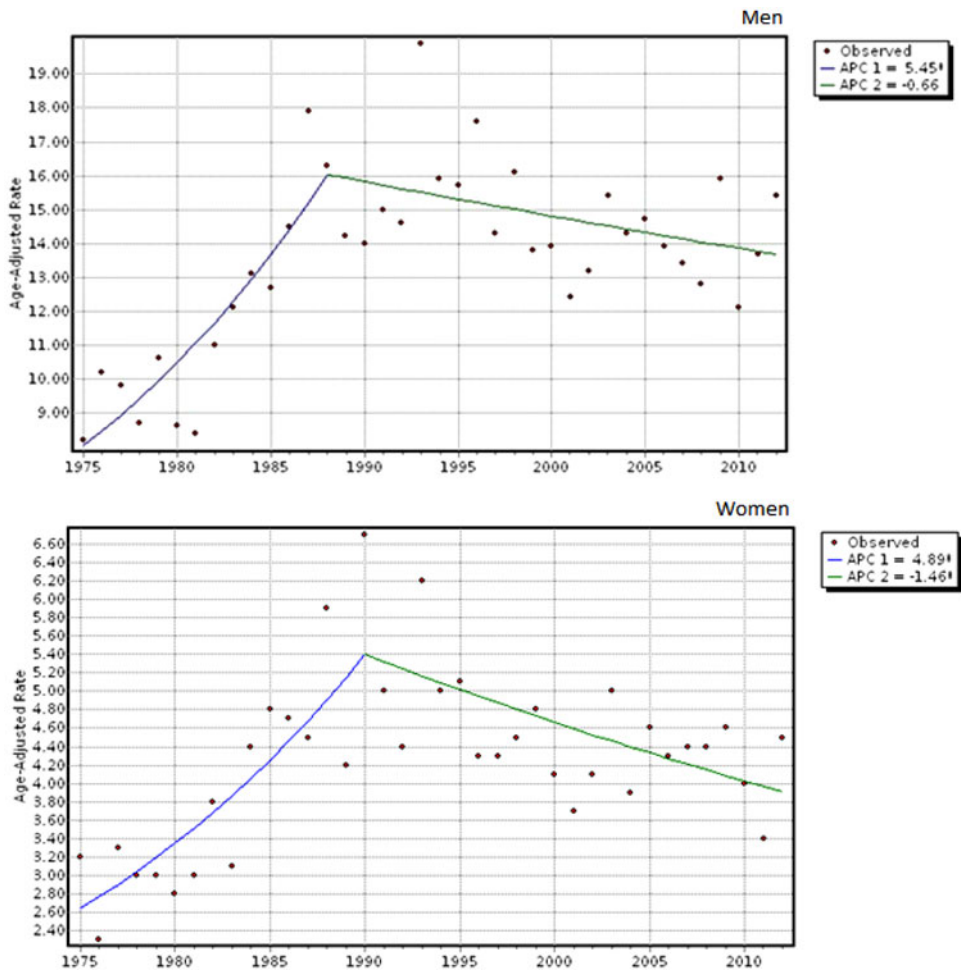


Fig. 2. Jointpoint analyses of age-standardised suicide rates for all ages.

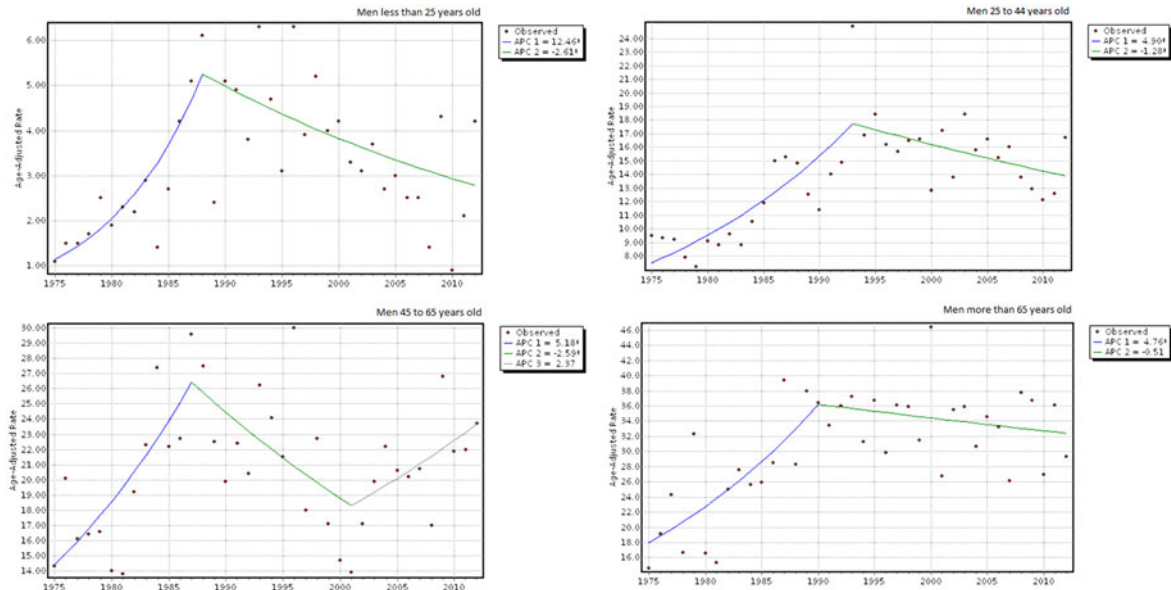


Fig. 3. Joinpoint analyses of age-standardised suicide rates: men.

Relationship between suicide rates, unemployment and recession

First, we studied the independent correlation between unemployment and suicide, and then between recession and suicide. When studying both sexes, we found a significant association between unemployment and suicide ($p=0.002$) but not between recession and suicide (estimate = 0.007; $t=0.501$; $p=0.62$). Similarly, among men there existed a positive correlation between unemployment and suicide ($p=0.01$) but not between recession

and suicide (estimate = 0.007; $t=0.572$; $p=0.57$). Among women, there was no significant correlation between suicide and unemployment ($p=0.487$) or recession (estimate = 0.008; $t=0.335$; $p=0.74$).

Next, we studied the effect of the interaction between unemployment and recession on suicide for both sexes. A significant interaction was found, showing that unemployment was related with suicide during economic recession periods. After adjusting by sex, the effect was confirmed among men, but not among women (Table 2). This interaction is graphically shown in Fig. 5.

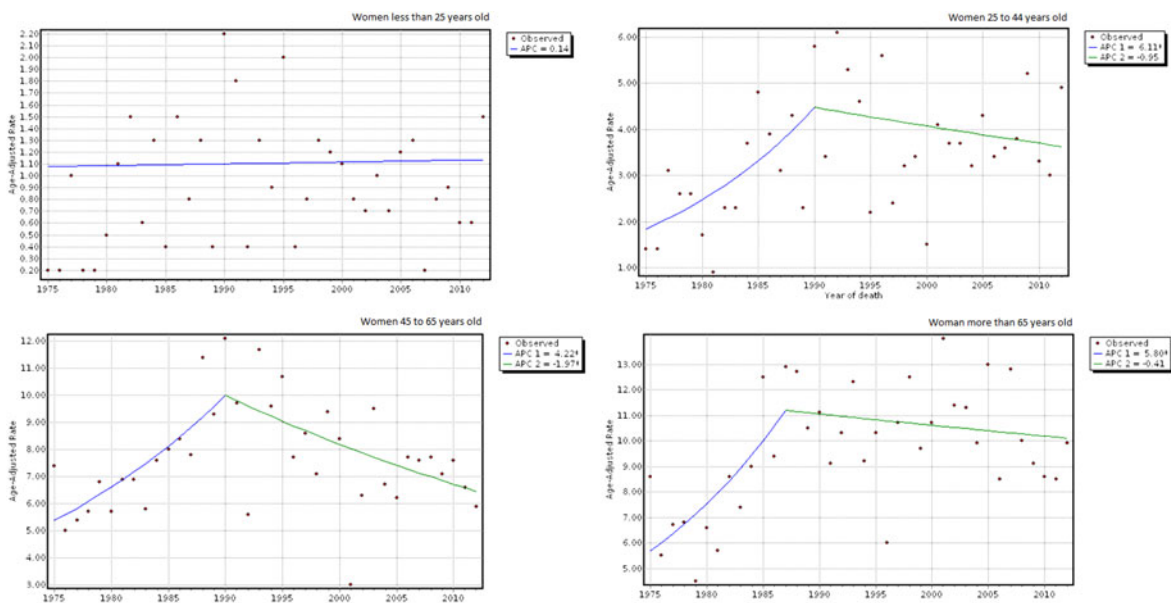


Fig. 4. Joinpoint analyses of age-standardised suicide rates: women.

Table 1. Age-adjusted suicide mortality rate trends in Galicia in four age groups

Group	Time period	APC (CI 95%)	p-value
Men < 25	1975–1988	12.5 (7.0, 18.2)	0.0011
	1988–2012	-2.6 (-4.4, 0.8)	
Men 25–44	1975–1993	4.9 (3.5, 6.3)	0.0002
	1993–2012	-1.3 (-2.3, -0.3)	
Men 45–65	1975–1987	5.2 (2.2, 8.3)	0.0044
	1987–2001	-2.6 (-5.0, -0.2)	
	2001–2012	2.4 (-0.7, 5.5)	
Men > 64	1975–1990	4.8 (2.2, 7.4)	0.010
	1990–2012	-0.5 (-1.5, 0.5)	
Women < 25	1975–2012	0.1 (-1.7, 2.0)	0.388
Women 25–44	1975–1990	6.1 (1.5, 10.9)	0.008
	1990–2012	-0.9 (-2.8, 0.9)	
Women 45–65	1975–1990	4.2 (1.8, 6.7)	0.0095
	1990–2012	-2.0 (-3.2, -0.7)	
Women > 64	1975–1987	5.8 (1.9, 9.9)	0.0017
	1987–2012	-0.4 (-1.4, 0.6)	

APC, annual percentage of change; CI, confidence interval.

Discussion

Main findings

Age-adjusted suicide mortality rates rose in Galicia from 1975 to 1990 and decreased slowly afterwards. Two age groups escaped this tendency, young women remained stable along the study period and men aged 45–65 years, with two points of change and increasing suicide rates since 2001. On the other hand, we found an independent association between unemployment and suicide and a clear interaction between unemployment and recession with regards to suicide rates, in both cases only among men.

Suicide mortality trends

The suicide trends found for the Galician region correspond to a similar pattern in the whole country of Spain according to a recent study (Álvaro-Meca et al. 2013). Adjusted suicide mortality rates rose after the 1975–1985 recession period until 1990, but then

Table 2. Association between unemployment and suicide mortality rates within each group defined by recession

		F	df	p-value
Both sex	Unemployment × no recession	1.631	1.756	0.2072
	Unemployment × recession	5.984	4.167	0.00098
Women	Unemployment × no recession	0.719	1.000	0.403
	Unemployment × recession	0.003	1.000	0.955
Men	Unemployment × no recession	0.922	2.368	0.41611
	Unemployment × recession	5.638	2.823	0.00423

F, F in F test of significance for the smoothed variable; df, estimated residual degrees of freedom; p-value, p-value of F test.

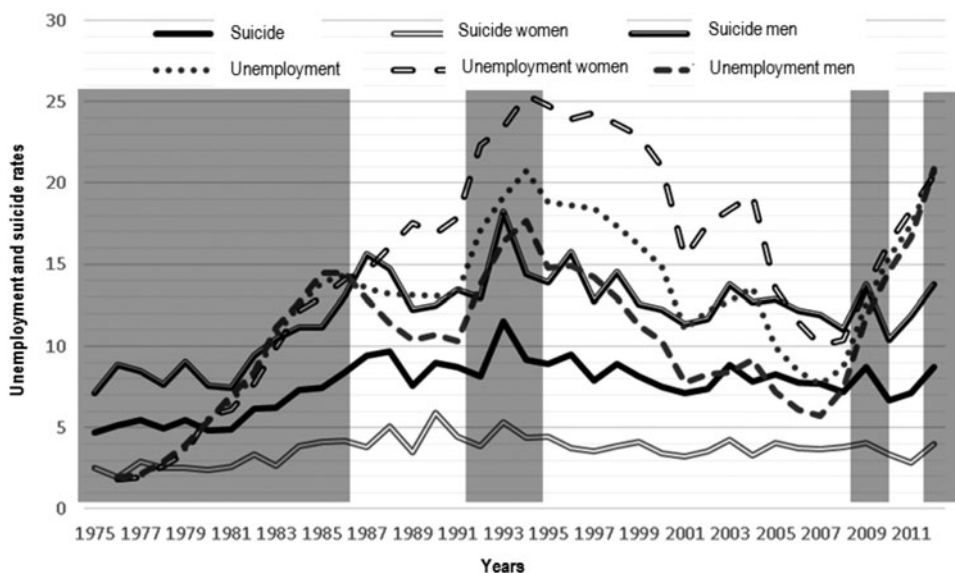


Fig. 5. Suicide and unemployment age-standardised rates by sex (recession periods are shaded).

descended disregarding more recent recession periods in 1992–1993, 2008–2010 and 2011–2012. The same results are described by Ayuso-Mateos *et al.* (2013) for Spain and by Alameda-Palacios *et al.* (2014) in the southern region of Andalucía. On the contrary, Lopez Bernal *et al.* (2013), analysing monthly suicide data for Spain between 2005 and 2010, found an 8.0% steep increase in suicide rates following the 2008 financial crisis despite the underlying downward trend. Suicide rates during the current recession period have also been studied in England (Barr *et al.* 2012), the European Union (Stuckler *et al.* 2009, 2011) and other European, American and Asian countries (Chang *et al.* 2013). Overall, there is a rising trend but findings differ across countries, with increased suicide rates in America and Europe, but not in Asia or Africa (Chang *et al.* 2013).

The underlying decreasing suicide trend in Galicia is consistent with European rates and may reflect health policy changes, such as improved mental health provision or the extended use of antidepressants that have taken place in Spain as well as in the rest of Europe (Lopez Bernal *et al.* 2013). Recently, a suicide prevention program introduced in one of the four provinces of Galicia might have contributed to buffer the impact of the 2008 economic recession (Crespo, 2009; Grupo de trabajo de la Guía de Práctica Clínica de Prevención y Tratamiento de la Conducta Suicida. I. Evaluación y Tratamiento, 2012).

Vulnerable groups

We found higher rates of suicide deaths in men than in women in all age groups, consistently with national (Álvaro-Meca *et al.* 2013) and international (Haw *et al.* 2014) reports. To explain the so-called gender paradox, previous studies have hypothesised that men suffer more shame from unemployment and often seek less help for psychological pain than women (Haw *et al.* 2014). Of note, the first hypothesis agrees with our finding of increased suicide rates among working-age men (45–65 years) during the last two economic recession periods (2008–2010 and 2011–2013). Suicide rates were significantly correlated with unemployment in the group of men from 45 to 65 years but the aggregation of data might have prevented to capture a similar correlation with economic recession. However, other epidemiological studies in Spain suggest that younger men are particularly exposed to suicide risk: men of 15–44 years of age in Andalucía for the same time period (Alameda-Palacios *et al.* 2014), or men of 15–39 years of age in whole Spain from 2005 to 2010 (Lopez Bernal *et al.* 2013).

When we compare our results with other countries, we find similar results in America, the most affected group being composed by men aged 45–64 in most countries, but different results in Europe, where

suicide is most frequent among men aged 15–24 (Chang *et al.* 2013). In contrast, in many Asian countries – Hong Kong, Korea, Taiwan and Singapore – men aged 65 or more had the highest suicide rates from 1985 to 2006, with the exception of Japan, where suicide mortality among males in the 35–64 age group was higher than in older adults after the economic crisis of 1997 (Chang *et al.* 2009).

Unemployment, economic recession and suicide

Although recession by itself was not associated with suicide rates, according to our results unemployment was related with higher male suicide rates, especially during economic recession periods. In Spain, our results contrast with the lack of association between suicide and unemployment in Andalucía (Alameda-Palacios *et al.* 2014). In international studies, researchers have examined the effect of unemployment on suicide rates with different findings. In England, levels of unemployment were strongly correlated with suicides in men and women during the 2008–2010 recession (Barr *et al.* 2012). In 26 European Union countries between 1970 and 2007, Stuckler *et al.* (2009) found, on average, a correlation of 0.12 ($p=0.0018$), between unemployment and suicide rates, varying from -0.13 (Sweden) to 0.59 (Spain). They noted two interesting exceptions across Europe: Finland between 1990 and 1993, and Sweden between 1991 and 1992, where while unemployment rates rose, suicide rates dropped. In USA, a study examining the effect of the 2007 recession showed that for every 1% rise in unemployment there was a 0.99% increase in the suicide rate (Reeves *et al.* 2012). During Asian economic crisis in 1997–1998, suicide rates increased in Japan, Hong Kong and Korea, but not in Taiwan and Singapore, where the economic crisis had a smaller impact on GDP and unemployment (Chang *et al.* 2009). In Australia from 1999 onwards, suicide and unemployment were not related for younger males, concurring to the implementation of a suicide prevention strategy (Morrell *et al.* 2007). Finally, for 2008 global economic crisis, in 54 countries around the world, Chang *et al.* (2013) found an association between the increased suicide numbers after the crisis and the increases in unemployment across countries, particularly male suicides in countries with low levels of unemployment before the crisis.

The relationship between unemployment and suicide is certainly complex. A recent review proposed unemployment, along with other factors such as debt or bankruptcy, psychiatric disorders, alcohol abuse, change in family relationships or social inequalities and loss of social cohesion, as a mediator in the relationship between recession and suicide, conforming an interesting explicative model (Haw *et al.* 2014).

There may be different potential causes for short-term fluctuations and long-term trends in suicide rates. In our data, spikes of suicides and unemployment occurred at the beginning of the 1993 and 2008–2010 recessions (Fig. 3), suggesting that unemployment increase in recession periods is associated with a relatively short upsurge in suicides. Early suicide increases in recession periods have also been reported in other countries and may even predate the rise of unemployment. They could be the result of personal bankruptcy before the official recession (Coope *et al.* 2014). Bankruptcy or failure could be stressed at that moment by the relative deprivation in comparison with a social context not yet in crisis. However, long-term suicide trends are dependent on the evolution of a country's GDP (adjusted for purchasing power parity) that needs to be sustained by adequate public health prevention policies and adequate mental health services (Blasco-Fontecilla *et al.* 2012).

Strengths and limitations

We analysed a whole Spanish region throughout a long period of time, 37 years, by using joinpoint regression, a method which allowed us to identify trend changes and identify underlying factors in corresponding time-periods. This method has been used for trend analysis of other diseases such as cancer (Rodríguez-Rieiro *et al.* 2009; Vidal Lancis *et al.* 2010). Moreover, GAM models performed for the analysis of the association in time series is an accepted methodology and has been previously used in similar studies assessing suicide and other diseases (Dominici *et al.* 2002; Hajat *et al.* 2002; Likhvar *et al.* 2011b).

Our study also has a number of limitations. First, the accuracy of official suicide figures is currently under debate not only in Spain, but worldwide. Undetermined death is the most common alternative in death certificates in cases of probable suicide, and there is a significant downward linear trend in the number of undetermined deaths in Spain (Chishti *et al.* 2003; Värnik *et al.* 2012). During the timeframe of our study, suicide deaths increased while undetermined deaths decreased in Galicia (Tables S1, S2 and S3), which suggests that the quality of suicide data has been improving. Moreover, as in all population studies, we should be cautious not to extrapolate population results on individual people. Another limitation in our study is that we did not have data on important suicide risk factors such as mental disorders, antidepressant prescriptions, alcohol or drug use or marital status. Additionally, our study did not explore differences between provinces or municipalities. Future studies could increase the accuracy of our analysis using disaggregated data of the municipalities, but detailed official statistics are lacking.

Public health implications

Given that suicide is a major public health concern, the risk conveyed by excessive unemployment during recession periods could be reduced by labour-market programs as other authors have proposed (Lundin & Hemmingsson, 2009). Additionally, the development of specific prevention programs focused on vulnerable age group might be necessary, and could extend current interventions (Crespo, 2009; Grupo de trabajo de la Guía de Práctica Clínica de Prevención y Tratamiento de la Conducta Suicida. I. Evaluación y Tratamiento, 2012). Given that men aged 45–65 are a vulnerable population not likely to seek help (Chang *et al.* 2013), targeted screening programs applied on primary health care could help to identify high-risk people in this group.

Although this study has provided information about suicide trends and its relationship with economic indicators in a Spanish region with high suicide rates, further research is needed. Spatial analysis would provide more information about suicide in Galicia, and incorporating clinical variables to these models is necessary to improve our understanding of the relationship between unemployment and suicide.

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Conflict of Interest

None.

Ethical Standard

There are no ethical conflicts regarding this research. We used free public anonymised databases from Spanish Government servers.

Supplementary material

The supplementary materials referred to in this article can be found at <http://dx.doi.org/10.1017/S2045796015000773>

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