

SHORT COMMUNICATION

Suicide mortality in Spain during the COVID-19 pandemic: Longitudinal analysis of sociodemographic factors



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ARTICLE INFO

Keywords:

Suicide
Mortality
COVID-19 pandemic
Spain
Social support

ABSTRACT

The COVID-19 pandemic has compromised public health response across the globe. Several countries reported increasing number of suicides during the pandemic. This study aimed to analyze the suicide mortality series in Spain (2000-2021), with a particular interest in depicting longitudinal trends during the COVID-19 pandemic. Moreover, it intended to identify sociodemographic groups with a higher increase in suicide victims during the pandemic. To do so, suicide cases from the National death index data were used. Weighted annual mortality rate was compared between pre-pandemic and pandemic years. Poisson time series models were used to analyze the trend in suicide mortality, considering sociodemographic variables (sex, age, migration status, marital status, and urbanicity). As a result, weighted mortality rate for 2020 was 8.92 ($CI_{95} = [8.29, 9.57]$) and 9.21 for 2021 ($CI_{95} = [8.56, 9.88]$). Annual mortality from the pandemic years was significantly higher than mortality from the prepandemic ones ($p < .01$). Poisson regression revealed a significant increase of cases during the pandemic months, $RR = 1.05$ ($CI_{95} = [1.02, 1.08]$); being significant for both sexes, and migration groups ($RR > 1.02$, across series). A significantly increased number of suicides was also observed for mid-age adults, large urban areas, and single people ($RR > 1.05$, across series). To sum up, our study supports an increasing number of suicide victims in Spain during the pandemic. We show that the COVID-19 influence on suicide risk factors (e.g., lack of social support networks) plays a critical role in the increasing trend of specific sociodemographic groups.

1. Introduction

Suicide is a major public health concern. Suicide accounted for 1.3% of global deaths in 2019 (World Health Organization, 2021). Mortality rates are 2.3 times higher in men than in women. Moreover, suicide has become the fourth leading cause of death among young people aged between 15 to 29 years old.

In January 2020, a new coronavirus (i.e., SARS-CoV-2 virus) started rapidly spreading, leading to mortality excess and unprecedented number of infected cases, worldwide. The literature provides mixed result on suicide mortality during the pandemic, across the world

(Martínez-Alés et al., 2023), with some studies supporting increases in suicides from May 2020 onwards (Acharya et al., 2022; Travis-Lumer et al., 2023, 2022; Yoshioka et al., 2022); and other studies providing evidence on increasing mortality only in concrete subgroups (e.g., young people, people from ethnic groups, people from populated cities) (Borges et al., 2022; Pirkis et al., 2022). In the case of Spain, annual suicide mortality in 2020 was not significantly higher than the rates from a previous year. However, a significant effect of the COVID-19 pandemic was found in the number of suicides throughout the year (de la Torre-Luque et al., 2022). The study of suicide mortality during the pandemic beyond 2020 deserves particular interest in Spain due to

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<https://doi.org/10.1016/j.euroneuro.2024.02.006>

Received 2 November 2023; Received in revised form 6 February 2024; Accepted 7 February 2024

Available online 14 March 2024

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the excess of mortality in the first year, the recurrence of contagion outbreaks, early strict lockdown, and the impact of COVID-19 measures on suicide risk factors (Bayes-Marin et al., 2022; Bruinen de Bruin et al., 2020; Chajid and Ruiz Coloma, 2021).

The aim of this study was to analyze the trend of suicide mortality in Spain, with a particular focus on the COVID-19 years: 2020 and 2021. This study therefore constitutes an extension of our previous study on suicide mortality in Spain in 2020 (de la Torre-Luque et al., 2022). Moreover, it intended to gain insight into the sociodemographic profile of a suicide victim in Spain during the pandemic. In other words, we were interested in studying how the pandemic would lead to increased number of suicides in specific groups, such as sex, age group, migration status, marital status, and urbanicity). We expect to find a significantly higher mortality rate in the second year of the pandemic (2021) in comparison to the last pre-pandemic ones, in line with the increasing number of cases with suicide-related behavior outcomes in both clinical and community settings (Rodríguez-Jimenez et al., 2023; Valle-Palominio et al., 2023). On the other hand, we hypothesized that there would be an increase in the number of suicides during the pandemic, particularly among younger age people, foreigners not born in Spain and people living in big cities. People from those subgroups may be at higher risk to being exposed to specific risk factors for suicide (e.g., lack of opportunities to strengthen social networks, economic hassle) which become more influential during the pandemic due to measures to reduce the virus spread (e.g., social distancing measures) (Bayes-Marin et al., 2022; Domènech-Abella et al., 2023). To conduct this analysis, we used the whole time series from 2000-2021, and considering the potential effect of a previous crisis with worldwide impact (i.e., the economic crisis covering the period between 2008-2014).

2. Methods

Consolidated data (2000-2021) from the National Death Index, annually released by the Spanish National Institute of Statistics (*Instituto Nacional de Estadística*, INE), were used. More concretely, we used data from cases with a forensically certified death, and codes between X60-X84 and Y87.0, according to the International Classification of Disease version 10 (World Health Organization WHO, 2004). Sociodemographic microdata were also considered: biological sex at birth; age at death; nationality, marital status; and urbanicity of suicide victim's city of living.

To take a static picture of suicide mortality, the age standardized annual mortality rate was first calculated, using the Spanish demographic data released by the INE as the standard population. We then compared annual mortality rate from the two pre-pandemic years with increasing suicide trends (i.e., 2018 and 2019) and the two first years of the pandemic (2020 and 2021) using mixed-effects models (Renshaw and Haberman, 2021). In this sense, we controlled for Spanish province (under random effects) because regional prevention plans were implemented and are already active across the Spanish territory (Castillo Patton, 2022; Sufate-Sorzano et al., 2022). Restricted maximum likelihood methods were used for parameter estimation.

Poisson regression was used on the monthly time series to study the relationship between the number of cases dead by suicide and two time-variant covariates: the economic crisis (from 2008 to December 2013) (Royo, 2020) and the COVID-19 pandemic (since March 2020 to December 2021). To confirm time effects, a model with the aforementioned covariates should show a lower quasi information criterion (QIC) than an unconstrained model (i.e., model without covariates). The risk ratio (RR) was used as a longitudinal covariate effect size estimate. To study the effect of sociodemographic (time-invariant) covariates, we also used separate monthly time series for each subgroup derived from the time-invariant covariate (i.e., sociodemographic factors: sex, age group, migration status, marital status, and urbanicity) category. This month-based approach allows for a more accurate characterization of temporal dynamics of suicide mortality.

All the analyses and graphics were conducted using R software (packages psych, tseries, tsglm, meta, and metafor).

3. Results

Descriptive data of our series are displayed in Table 1. A total of 3,941 people died by suicide in 2020 and 4,003 cases in 2021. Annual age-standardized mortality due to suicide from 2000-2021 is displayed in the Fig. 1. Weighted (controlled by province, $k = 52$) mortality rate was: 7.75 per 100,000 inhabitants ($CI_{95} = [7.03, 8.50]$, Wald's $z = 40.37, p < .01$) in 2018; 8.27 per 100,000 inhabitants ($CI_{95} = [7.57, 9.00]$, $z = 44.07, p < .01$) in 2019; 8.92 per 100,000 inhabitants ($CI_{95} = [8.29, 9.57]$, $z = 53.00, p < .01$) in 2020; and 9.21 per 100,000 inhabitants ($CI_{95} = [8.56, 9.88]$, $z = 52.95, p < .01$) in 2021. We found significantly increasing rates of suicide victims from the pre-pandemic years (2018 and 2019) and comparison to the pandemic ones (2020 and 2021), $OR = 1.001, CI_{95} = [1.00, 1.001]$, $z = 3.12, p < .01$).

Regarding the monthly trend of suicide from 2000-2021, we found that the model with the time-variant covariates fitted better than the unconstrained model (QIC for the unconstrained model = 2622.13; QIC for the model with covariates = 2602.21). This result means that the time-variant covariates explained a higher proportion of the suicide case variance over time. In terms of coefficients, a significant relationship with the increase of suicide cases was found during the economic crisis, $RR = 1.02 (CI_{95} = [1.01, 1.03])$; and during the COVID-19 period, $RR = 1.05 (CI_{95} = [1.02, 1.08])$. The Fig. 2 depicts the series of suicide cases over time. An increasing trend seems to be evident, but particularly from the COVID-19 outbreak in early 2020.

QIC values and risk coefficients are displayed by sociodemographic

Table 1
Descriptive features according to sociodemographic factors.

	Prepandemic 2000-2017	2018- 2019	COVID-19 pandemic	
			2020	2021
Number of suicide deaths	62239	7210	3941	4003
Sex at birth				
Males	47282 (76)	5390 (74.8)	2930 (74.3)	2982 (74.5)
Age				
0-10 years	1 (< 0.1)	0	1 (< 0.1)	0
10-24 years	3428 (5.5)	342 (4.7)	161 (4.1)	201 (5)
25-39 years	12696 (20.4)	1058 (14.7)	563 (14.3)	551 (13.8)
40-64 years	25511 (41)	3524 (48.9)	1935 (49.1)	2016 (50.1)
65 years or older	20603 (33.1)	2286 (31.7)	1281 (32.5)	1235 (30.9)
Migration status				
Native-born	57799 (92.9)	6486 (90)	3562 (90.4)	3490 (87.3)
Foreign-born	4418 (7.1)	723 (10)	377 (9.6)	510 (12.7)
Marital status				
Single	19927 (32.2)	2537 (36.5)	1398 (37.2)	1453 (37.8)
Married/coupled	26812 (43.3)	2642 (38)	1441 (38.3)	1445 (37.6)
Divorced	5882 (9.5)	1045 (15)	539 (14.3)	562 (14.6)
Widowed	9324 (15.1)	731 (10.5)	383 (10.2)	380 (9.9)
Urbanicity				
Rural area	16932 (27.2)	1709 (23.7)	869 (22.1)	984 (24.6)
Small urban area	16361 (26.3)	1926 (26.7)	1012 (25.7)	989 (24.7)
Large urban area	10462 (16.8)	1268 (17.6)	762 (19.3)	746 (18.6)
Province capital	18484 (29.7)	2307 (32)	1298 (32.9)	1284 (32.1)

Note. Raw data (number of cases) and percentage (between brackets) are displayed.

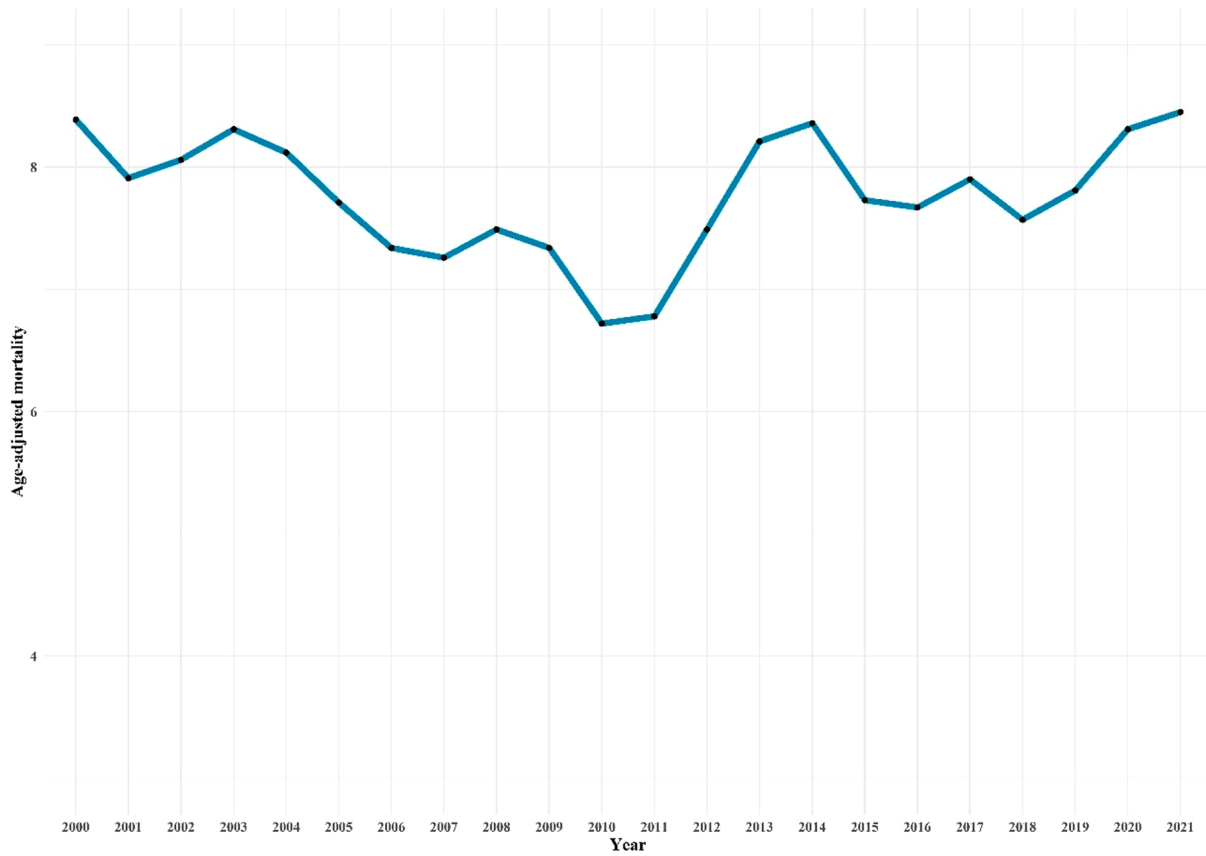


Fig. 1. Age-standardized suicide mortality rate in Spain from 2000-2021.

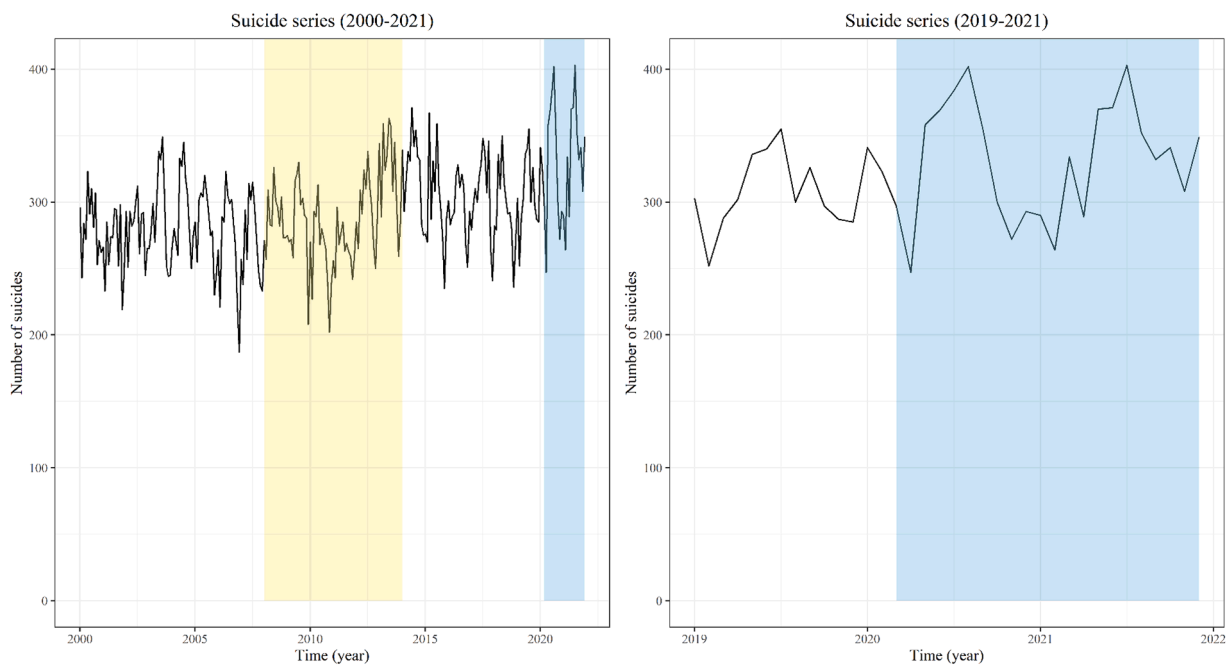


Fig. 2. Time series of monthly suicide cases in Spain from 2000-2021.

Note. At the left side, the whole series (2000-2021) of suicide deaths. At the right side, a zoom-in snapshot of the suicide deaths between 2019-2021, to see more accurately number of cases during the COVID-19 pandemic.

The economic crisis period was shaded in yellow. The COVID-19 pandemic period was shaded in blue.

subgroup on Table S1 (Supplementary material). Considering the sex groups, the model with covariates fitted better to data (QIC unconstrained model = 2486.00 for the male group, and 2001.18 for the female group; QIC covariate model = 2472.95 for male, and 1995.95 for female). For male cases, both covariates were significant: the 2008-2014 economic crisis, $RR = 1.02$ ($CI_{95} = [1.00, 1.04]$); and the COVID-19 period, $RR = 1.06$ ($CI_{95} = [1.02, 1.09]$). Regarding female victims, we found a significant effect of the COVID-19 period, $RR = 1.08$ ($CI_{95} = [1.03, 1.14]$).

Regarding age groups (Fig. 3), the model with covariates fitted better to data only in the case of 40-64 year-old case series (QIC unconstrained model = 2254.15; QIC covariate model = 2213.14). For this age group, both time-variant covariates were significant, pointing to higher number of cases during related periods: 2008-2014 economic crisis, $RR = 1.05$ ($CI_{95} = [1.02, 1.07]$); and the COVID-19 period, $RR = 1.04$ ($CI_{95} = [1.00, 1.08]$).

In terms of migration status, the model with covariates fitted better to the unconstrained model for both the native-born (QIC unconstrained model = 2570.48; QIC covariate model = 2565.73) and foreign-born group (QIC unconstrained model = 1768.30; QIC covariate model = 1741.65). For both groups, we found a significant effect of the COVID-19 covariate (native-born group: $RR = 1.04$, $CI_{95} = [1.01, 1.06]$; foreign-born group: $RR = 1.27$, $CI_{95} = [1.16, 1.40]$). A significant effect of the economic crisis was also observed for the native-born group, $RR = 1.02$, $CI_{95} = [1.00, 1.03]$.

Regarding marital status group (Fig. 3), the Poisson regression also indicated that the model with covariates fitted better than an unconstrained model (mean difference in favor to the unconstrained model = 12.02, $sd = 8.19$). In the case of the single people time series (QIC unconstrained model = 2097.17; QIC covariate model = 2073.77), a significant increase in suicide victims was found across the COVID-19 months, $RR = 1.11$, $CI_{95} = [1.06, 1.17]$. The economic crisis was significantly associated with an increasing trend in mortality for the married and widowed groups ($RR = 1.04$ - 1.09 , across groups).

Finally, the Poisson model with covariates showed a lower QIC than the unconstrained model for two urbanicity groups: the large urban area

(QIC unconstrained model = 1901.39; QIC covariate model = 1885.34) and province capital group (QIC unconstrained model = 2073.57; QIC covariate model = 2062.73). Regarding the large urban area group, we found a significant effect of both covariates, the economic crisis, $RR = 1.04$ ($CI_{95} = [1.00, 1.08]$), and the COVID-19 period, $RR = 1.15$ ($CI_{95} = [1.08, 1.23]$). Similar results were found for the province capital group only in terms of significant COVID-19 period covariate ($RR = 1.09$, $CI_{95} = [1.04, 1.14]$). Time series for these groups are depicted in the Fig. 3.

4. Discussion

This study aimed to provide accurate estimates on suicide mortality in Spain, with a focus on the first COVID-19 pandemic years. Moreover, we were interested in depicting the sociodemographic profile of a suicidal victim in the pandemic. The COVID-19 pandemic has severely compromised health and quality of life of people across the globe. In Spain, the huge excess of COVID-related mortality was observed during the first year of the pandemic. Excess of mortality started showing a decreasing trend from the first months of 2021 onwards, while a steeply increasing number of infected cases was reported. The Spanish government declared a home confinement and national lockdown (March-June/2020), progressively easing restrictions of mobility. However, partial lockdown (e.g., restrictions to move between Spanish communities), mandatory face mask use and social distancing measures were maintained beyond 2021. The COVID-19 pandemic and related restrictions led to critical financial problems, economic hassles, and elevated emotional distress, in Spain.

Data showed an increasing number of suicides in Spain during the first years of the pandemic (2020 and 2021 period), with significantly higher annual rates in comparison to the prepandemic ones (2018 and 2019). Drift effects may be considered to better understand our results as well as the pandemic effects. In this regard, it seems that 2018 may be considered an inflexion peak in suicide mortality in Spain, and increasing rates would be shown thereafter. The pandemic accelerated the increase pace, leading to significantly higher annual mortality rate in comparison to the prepandemic years. At a monthly level, we observed a

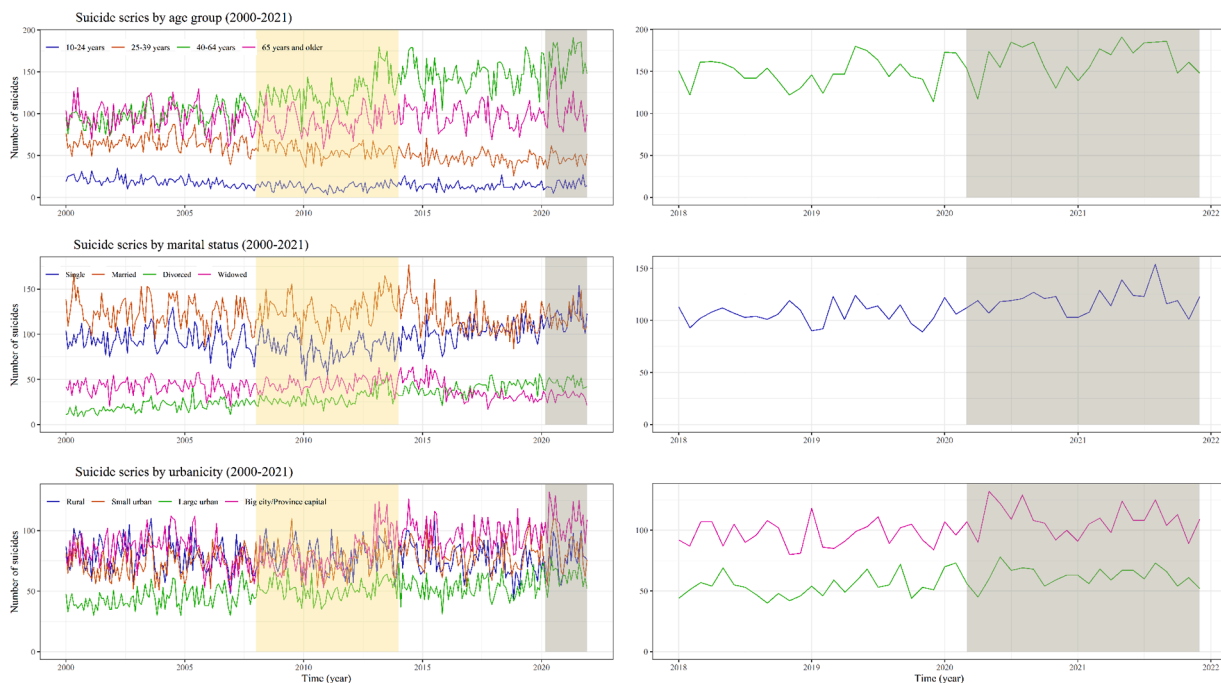


Fig. 3. Monthly suicide cases by age, marital status and city of residence in Spain from 2000-2021.

Note. Left figures correspond to the whole series (2000-2021) of suicide deaths. At the right side, a zoom-in snapshot of the suicide deaths between 2018-2021, to see more accurately number of cases during the COVID-19 pandemic (only groups with significant effects: see legend on the left-side boxes). The economic crisis period was shaded in yellow. The COVID-19 pandemic period was shaded in gray.

steep decrease in mortality during the first months of the pandemic with increasing number of victims thereafter, in line with trends in other suicide-related behavior outcomes (e.g., suicidal ideation and hospital admissions due to suicide behavior) (Rodríguez-Jimenez et al., 2023; Valle-Palomino et al., 2023).

Our study also provides some interesting results on the sociodemographic profile of a suicide victim in Spain during the pandemic years (2020–2021). Thus, we found that both men and women showed an increasing number of suicide victims, as observed by a significant effect of the COVID-19 pandemic months on the suicide time series. Similarly, we found a significant main effect of the pandemic on the number of people who died by suicide, similarly for both native-born and foreign-born individuals. Finally, a group-specific effect was observed for these sociodemographic groups: adults aged 40–64 years, those living in either a large urban area (> 50,000 inhabitants) or a province capital; and single people.

Our results go in line with a main effect of the COVID-19 pandemic on suicide mortality, potentially due to its influence on key risk factors (Acharya et al., 2022; Yoshioka et al., 2022). In this sense, robust evidence supports a main effect of COVID-related economic inequality and job insecurity, regardless of sociodemographic group (Martínez-Bravo and Sanz, 2021). On the other hand, specific groups were proven to be particularly vulnerable to the pandemic effects: particularly, mid-age adults, those from large urban areas and single ones. Social factors may play a critical role to explain this increasing trend during the first years of the pandemic. In this regard, the lack of social support and related subjective outcomes (e.g., loneliness and social isolation) were more present in middle-age adults as well as single individuals, during the pandemic (Domènech-Abella et al., 2023; Martínez-García et al., 2022). Additionally, social distancing measures led to reduced opportunities to make and strengthen social networks in single people. Finally, social distancing measures were more stringent in province capitals and large urban areas, those with limited access to outdoor green spaces. The implementation of social distancing measures definitely led to a drastic reduction in social contacts by physical distancing, home confinements and the temporary closure of many social activities in large urban areas (restaurants, bars, gyms,...) (Holt-Lunstad, 2021).

This study provides an accurate snapshot of the trends of suicide mortality in Spain from 2000, with a particular interest in depicting longitudinal effects of the COVID-19 pandemic. The results come from forensically certified records, processed and curated by the Spanish National Institute of Statistics. Moreover, our weighted-based (province-based) strategy yields more accurate estimates because of the control for the varying suicide prevention plans implemented across the Spanish communities (Castillo Patton, 2022; Sufate-Sorzano et al., 2022). Finally, robust techniques were used to analyze longitudinal trends by specific groups. As a shortcoming, an assortment of sociodemographic and clinical factors are missing, and the sociodemographic profile studied could not provide an accurate picture of people who died by suicide in Spain. Moreover, mortality records from multiple sources (e.g., police reports) could be added to enhance sensitivity in detecting suicide cases, to find a more realistic picture. Even though, studies on case classification yields satisfactory ability to correctly classify on forensic death certification (Swain et al., 2019).

This study stresses a significant increase of suicide victims in Spain during the first pandemic years (2020 and 2021). Prospects are not far promising, according to the preliminary data released for 2022 (National Institute of Statistics, 2022). An increasing trend of suicide mortality would be expected for the upcoming years, due to the pandemic effects on risk factors. It is time to take action for suicide prevention, so as to curb the increasing number of suicide victims observed year by year.

Author contributions

All the authors contributed to this study. ATL, GB and JLAM

conceptualized the research questions. ATL, AP and IPD preprocessed the data and conducted the data analysis. ATL and IPD did the literature review, result interpretation and the discussion, and wrote the original draft. All the authors were involved in review and editing the final manuscript.

Declaration of competing interest

None.

Funding statement

This work was supported by the Instituto de Salud Carlos III-FIS under grant number PI20/00229 and PI19/00236 and cofounded by European Regional Development Fund (ERDF), ‘A way of making Europe’. AP was supported by a fellowship from the Spanish Ministry of Universities, with ref. FPU20/01651. IPD was supported by a fellowship from the Spanish Ministry of Universities, with ref. FPU21/06359y.

Acknowledgement

This work was supported by the Instituto de Salud Carlos III-FIS under grant number PI20/00229 and PI19/00236 and cofounded by European Regional Development Fund (ERDF), ‘A way of making Europe’. A way of making Europe’. AP was supported by a fellowship from the Spanish Ministry of Universities, with ref. FPU20/01651. IPD was supported by a fellowship from the Spanish Ministry of Universities, with ref. FPU21/06359y.

The authors disclose that they do not have any conflict of interest to be declared.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.euroneuro.2024.02.006](https://doi.org/10.1016/j.euroneuro.2024.02.006).

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