

## Original Article

Suicide Mortality Across Broad Occupational Groups in Greece:  
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## ABSTRACT

**Background:** Several studies have investigated the relationship between specific occupations and suicide mortality, as suicide rates differ by profession. The aim of this study was to investigate suicide mortality ratios across broad occupational groups in Greece for both sexes in the period 2000–2009.

**Methods:** Data of suicide deaths were retrieved from the Hellenic Statistical Authority and comparative mortality ratios were calculated. Occupational classification was based on the International Classification of Occupations (ISCO-88) and the coding for Intentional self-harm (X60–X84) was based on the international classification of diseases (ICD-10).

**Results:** Male dominant occupations, mainly armed forces, skilled farmers and elementary workers, and female high-skilled occupations were seen as high risk groups for suicide in a period of 10 years. The age-productive group of 30–39 years in Greek male elementary workers and the 50–59 age-productive group of Greek professional women proved to have the most elevated number of suicide deaths.

**Conclusion:** Further research is needed into the work-related stressors of occupations with high suicide mortality risk and focused suicide prevention strategies should be applied within vulnerable working age populations.

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## 1. Introduction

Research has shown that mental illness and experience of social stressors and adverse life events increase suicide risk considerably [1–3]. The burden of suicide and suicidal behavior across nonpsychiatric groups with high suicide risk and the associated cost to societies has further indicated the importance of preventive actions towards the possible causes [4,5]. Unemployment, employment, and specific occupations have been linked to suicide and suicidal behavior, in a variety of studies [6–10]. Sex has been found to play an important role in occupation-related suicide risk and self-harming behaviors, but the overrepresentation of men in many occupational categories may act as a barrier in evaluating the association of stressful working environment and suicide for each sex [7,11–18]. For instance, males in professions that are deemed as masculine such as the armed

forces, construction work, and agriculture have an elevated suicide risk; whereas in sex equal professions such as physicians and professionals, females have a higher suicide risk [7,11,19–22]. While health care professionals and police personnel have an elevated suicide risk, higher mortality from suicide has been reported for labor and agricultural related occupations [14,20,23–25]. Professional groups with an easier access to lethal means of suicide such as medical doctors, police, military personnel, and farmers have demonstrated a higher suicide rate when compared to other occupational groups [19,26–28]. It seems that methodological limitations cause some inconclusive results on the same professional groups among studies [29,30].

Age and sex constitute the main factors that should be taken into account into estimates of suicide risks related to each profession [30], but other factors like psychiatric morbidity, client-dependent professions, and skill level/seniority of occupations

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provide a more clear focus for suicide prevention strategies within occupational groups [21,30–32].

The aim of this study was to investigate suicide mortality ratios across broad occupational groups in Greece for both sexes among the 15–39 years, 40–49 years, and 50–59 years age groups for the period 2000–2009.

## 2. Materials and methods

The occupational coding in our study was based on the International Standard Classification of Occupations (ISCO), version 2008 [33]. All 10 (2-digit) categories according to ISCO-88 were studied for both sexes: (0) armed forces (unclassified persons); (1) managers, executives, and directors (members); (2) professionals; (3) technologists and associate professionals; (4) clerks; (5) service and market sales workers; (6) skilled agricultural and fishery workers; (7) craft and related trades workers; (8) plant and machine operator assemblers; and (9) elementary occupations (Table 1). Tables S1 and S2 show male and female population distribution by occupational group. The Hellenic Statistical Authority (ELSTAT) collects demographic and occupational information from different census schedules and from vital status forms. Data on the working population were collected by ELSTAT quarterly each year starting in 1998, through the labor force survey. The labor force survey follows a two-stage stratified sampling scheme covering the total country.

The number of deaths due to suicides was recorded by the Forensic Medicine and Criminal Investigation Authorities. Monitoring causes of death is part of the Vital Statistics Survey, which is a census survey and it covers all the deaths, which occur all over Greece. In cooperation with the Regional Statistical Offices of ELSTAT, personal statistical data on vital events (births, deaths, marriages, registered partnerships) are collected on a monthly basis from the Civil Register Offices all over Greece. Data on the causes of death are compiled on the basis of death certificates filled in by medical practitioners or forensic pathologists. Vital statistics data, after having been collected from the Civil Register Offices, undergo the necessary quality checks, and then they are processed and tabulated. As regards sudden deaths, where the cause of death is not specified and more research is needed, the data on the causes of death are collected through the Forensic Medicine Authorities. The survey produces statistical results on a yearly basis. As far as it

concerns the Legal Framework, the survey is fully harmonized with the European statistical practice. It is governed by Law 344/76 concerning the “Registration of vital events” which lays down the obligations of the Civil Register Offices to collect and then to transmit the data, as well as by Law 3832/2010 on the “Hellenic Statistical System”.

Methodology, validation, and survey results can be found on the ELSTAT official website [34]. Concerning the calculation of suicide rates by age and occupation group, national statistics were used for the denominator. The three past Greek censuses (1981, 1991, and 2001) were also used for exploring differences in the age compositions between groups [35]. The causes of death are coding based to the 9<sup>th</sup> Revision of the International Classification of Diseases (ICD-9) of the World Health Organization (WHO) and nowadays the coding e.g., for intentional self-harm (X 60–X84) is based on the international classification of diseases (ICD-10) [36].

Our analysis was performed for three working-age groups: 15–39 years, 40–49 years, and 50–59 years. In the official ELSTAT database were registered and assigned in occupational groups 1,618 deaths in the age group of 15–59 years (Table S3), out of a total of 3,661 deaths in all age groups, during the study period. The ratio of standardized cumulative incidences of each group (i.e., the number of deaths per year, sex, and occupational group divided by the corresponding occupational group) to the total incidence (i.e., irrespectively of occupational group) was defined as the comparative mortality ratio (CMR). The exact 95% confidence intervals (CI) were calculated assuming a Poisson distribution of the observed number of cases (Open Epi – Rollins School of Public Health, Emory University, Mid-P exact CI). The statistical analysis was performed with SPSS version 19 (IBM Corp., Armonk, NY, USA).

## 3. Results

Males in armed forces, clerks, skilled agricultural and fishery professions, and those in elementary occupations had the highest number of suicides in the 10 year period (Table S3). Males aged 50–59 years in armed forces (and unclassified) and young men aged 15–39 years in elementary occupations exhibited the highest CMRs (Table 2). Young female managers, executives, and director and

**Table 1**

Occupational categories based on the International Standard Classification of Occupations (ISCO; version 2008)

| 2-Level | Category of professions                 | Subclasses of professions  |
|---------|---|--|
| 1 (1)   | Unclassified persons                    | Armed forces, other unclassified persons   |
| 3 (3)   | Managers, executives, directors         | Employers, directors, managers, & executives of public administration, big & small public & private enterprises & organizations  |
| 7 (4)   | Professionals                           | Scientists (mathematicians, physicians, biologists, architects, engineers, lawyers, teachers, & relevant professions), & persons that practice scientific, artistic & relevant professions |
| 4 (4)   | Technologists & associate professionals | Technologists & technicians of sciences (natural, health, engineering etc.) & relevant professions. Specialists on sales, stock broking, agents, services, & relevant professions          |
| 2 (2)   | Clerks                                  | Clerks, employees of service of customers  |
| 3 (2)   | Service workers & market sale workers   | Occupied in the benefit of personal services. Occupied in the benefit of services of protection. Models, salesmen, & those practicing in relevant professions                              |
| 7 (1)   | Skilled agricultural & fishery workers  | Specialized farmers (any type of culture), specialized cattle breeders, bird-breeders, foresters, wood-cutters, fishermen, & relevant professions  |
| 8 (4)   | Craft & related trade workers           | Miners, construction workers, metal workers, welders, mechanics, workers in food industry, craftsmen in typo, wood, furniture, textile, clothing, & relevant professions                   |
| 8 (3)   | Plant & machine operators & assemblers  | Machine or equipment operators & assemblers in industry (metal, chemical, wood, printing, textile, food, drink, tobacco etc.), professional drivers, & relevant professions                |
| 3 (3)   | Elementary occupations                  | Unskilled workers in agriculture, fishing, etc. Unskilled workers in mines, manufacturing, transportation, etc. Peddlers etc.  |

**Table 2**

High comparative mortality ratios (and 95% confidence intervals) due to intentional self-harm by occupational group in males from 2000 to 2009

| Occupation                             | Age group (y) | 2000             | 2001               | 2002               | 2003             | 2004             | 2005              | 2006             | 2007               | 2008             | 2009              |
|--|---------------|------------------|--------------------|--------------------|------------------|------------------|-------------------|------------------|--------------------|------------------|-------------------|
| Armed forces (unclassified persons)    | 15–39         | 2.65 (0.71–6.63) | 3.79 (1.23–8.70)   | 5.68 (2.08–12.20)  | 1.65 (0.19–5.67) | 2.29 (0.62–5.75) | 0.53 (0.02–2.70)  | 1.65 (0.33–4.67) | 1.21 (0.14–4.16)   | 3.24 (1.19–6.96) | 1.03 (0.12–3.55)  |
|  | 40–49         | *                | *                  | 5.17 (0.59–17.76)  | 1.55 (0.06–7.83) | 1.39 (0.06–7.01) | *                 | 1.20 (0.05–6.09) | 1.24 (0.05–6.28)   | *                | 1.27 (0.05–6.41)  |
|  | 50–59         | *                | 11.36 (0.46–57.50) | 25.97 (2.97–89.24) | *                | *                | 7.63 (0.31–38.62) | *                | 10.75 (1.23–36.94) | *                | 5.18 (0.21–26.22) |
| Clerks                                 | 15–39         | 2.86 (1.64–4.64) | 1.42 (0.57–2.91)   | 1.61 (0.59–3.47)   | 0.94 (0.25–2.34) | 2.30 (1.10–4.20) | 1.66 (0.72–3.25)  | 1.44 (0.58–2.93) | 2.40 (1.10–4.53)   | 1.11 (0.36–2.55) | 1.99 (0.91–3.75)  |
|  | 40–49         | 2.06 (0.83–4.21) | 1.38 (0.45–3.17)   | 3.27 (1.57–5.99)   | 2.05 (0.99–3.75) | 1.72 (0.69–3.51) | 1.92 (0.77–3.91)  | 1.81 (0.83–3.41) | 2.77 (1.48–4.73)   | 2.32 (1.16–4.14) | 2.58 (1.29–4.60)  |
|  | 50–59         | 3.34 (1.44–6.53) | 2.67 (1.08–5.46)   | 5.97 (2.87–10.92)  | 2.81 (1.22–5.50) | 2.98 (1.20–6.08) | 0.68 (0.08–2.33)  | 2.61 (1.13–5.11) | 3.07 (1.33–6.00)   | 0.63 (0.07–2.17) | 2.32 (1.06–4.39)  |
| Skilled agricultural & fishery workers | 15–39         | 2.75 (1.73–4.16) | 1.59 (0.79–2.83)   | 1.49 (0.64–2.92)   | 2.80 (1.63–4.48) | 1.05 (0.34–2.41) | 2.64 (1.45–4.42)  | 2.88 (1.61–4.74) | 2.20 (1.01–4.15)   | 1.48 (0.59–3.01) | 2.51 (1.30–4.36)  |
|  | 40–49         | 2.70 (1.44–4.61) | 0.84 (0.23–2.09)   | 0.79 (0.16–2.24)   | 2.21 (1.21–3.70) | 1.67 (0.72–3.26) | 0.49 (0.06–1.69)  | 1.40 (0.56–2.85) | 2.16 (1.08–3.85)   | 1.00 (0.32–2.30) | 2.05 (1.02–3.65)  |
|  | 50–59         | 1.52 (0.70–2.87) | 1.42 (0.65–2.68)   | 0.68 (0.14–1.93)   | 3.07 (1.93–4.65) | 2.72 (1.31–4.97) | 1.18 (0.38–2.71)  | 2.21 (1.10–3.94) | 1.17 (0.38–2.68)   | 1.50 (0.60–3.06) | 1.80 (0.93–3.13)  |
| Elementary occupations                 | 15–39         | 3.12 (1.50–5.70) | 4.29 (2.29–7.32)   | 2.75 (1.10–5.60)   | 2.68 (1.23–5.05) | 2.14 (0.78–4.60) | 4.76 (2.67–7.84)  | 2.10 (0.84–4.28) | 2.89 (1.25–5.65)   | 3.81 (2.09–6.38) | 1.90 (0.82–3.71)  |
|  | 40–49         | 3.64 (1.34–7.83) | 3.39 (1.24–7.29)   | 3.15 (1.02–7.24)   | 2.24 (0.82–4.82) | 3.02 (1.11–6.49) | 1.14 (0.13–3.93)  | 1.44 (0.39–3.60) | 0.82 (0.09–2.80)   | 2.73 (1.10–5.56) | 1.46 (0.39–3.65)  |

\* No deaths by suicide registered to the Hellenic Statistical Authority.

Data are presented as CMR (95% CI).

CI, confidence interval; CMR, comparative mortality ratio.

**Table 3**

High comparative mortality ratios (and 95% confidence intervals) due to intentional self-harm by occupational groups in females from 2000 to 2009

| Occupation             | Age group (y) | 2000              | 2001              | 2002              | 2003               | 2004              | 2005              | 2006              | 2007             | 2008             | 2009              |
|------------------------|---------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|-------------------|------------------|------------------|-------------------|
| Members                | 15–39         | *                 | 7.94 (0.91–27.27) | *                 | *                  | 8.26 (2.23–20.70) | *                 | *                 | *                | *                | *                 |
| Professionals          | 50–59         | *                 | 2.39 (0.10–12.08) | *                 | 2.00 (0.08–10.14)  | 2.26 (0.09–11.42) | 5.26 (0.60–18.08) | 4.26 (1.15–10.67) | *                | 1.29 (0.05–6.55) | *                 |
| Clerks                 | 15–39         | 0.38 (0.02–1.93)  | 2.74 (0.55–7.75)  | 1.33 (0.15–4.56)  | 1.33 (0.27–3.77)   | 0.99 (0.11–3.39)  | 1.09 (0.22–3.09)  | 0.52 (0.02–2.64)  | 1.89 (0.51–4.72) | 2.96 (0.80–7.41) | 1.17 (0.13–4.01)  |
|                        | 50–59         | 4.56 (0.52–15.65) | 2.82 (0.11–14.29) | 6.37 (0.26–32.23) | 10.18 (2.75–25.49) | 3.02 (0.12–15.29) | 3.53 (0.14–17.88) | 1.52 (0.06–7.68)  | *                | *                | 2.02 (0.08–10.20) |
| Elementary occupations | 50–59         | *                 | *                 | *                 | *                  | *                 | *                 | *                 | *                | *                | 6.05 (1.22–17.13) |

\* No deaths by suicide registered to the Hellenic Statistical Authority.

Data are presented as CMR (95% CI).

CI, confidence interval; CMR, comparative mortality ratio.

middle-aged clerks and professionals had an elevated suicide ratio during the whole study period (Table 3).

In specific years and age groups, very high CMRs were monitored for both males and females, as presented in Tables 2 and 3. Supplementary data are provided with all CMRs and 95% CIs for males and females in all occupational groups (Tables S4 and S5).

#### 4. Discussion

Greek suicide mortality ratios across occupational groups are presented for the first time. Suicide was high for males in elementary occupations, for those employed in armed forces (and unclassified jobs), clerks, and skilled agricultural and related professions. Female managers, professionals, and clerks also exhibited high suicidal death burden. Young and middle aged men in the armed forces, young female managers, middle aged female clerks and professionals, and all productive ages in males in agricultural, elementary and clerk occupations constitute the age pattern of those who had an elevated suicide ratio during the whole study period. The yearly pattern is even more concrete but difficult to explain. Previous studies have explored the effect of occupation and income inequalities on suicide deaths by sex [37,38]. In line with previous epidemiological studies, our findings suggest that Greek men, mostly in male dominant occupations, have a higher suicide risk compared to Greek women [39].

Multiple suicide risk factors have been identified within the armed forces, as they have been characterized as a suicide risk population [8,26,40,41]. The current findings, as with other studies, indicate a higher suicide risk among young military personnel (15–39 years) and for seniors and highly ranked military personnel (50–59 years) [42–44]. An earlier Greek study on suicide mortality has indicated an elevated number of deaths in Greek rural areas and pinpointed the gradual increase of suicide mortality with age of skilled agricultural workers and other males in the farming industry [45]. Mental health literacy regarding help-seeking behaviors in combination with the easy access to suicide means, and inequalities on access in primary health care, may explain the high number of suicide across all the age groups in the Greek skilled agricultural workers [27,46].

A recent meta-analysis has indicated those in elementary occupations as having the highest risk of suicide [7]. We found a high number of suicide deaths in a 10-year period, especially for the younger age group of elementary professionals, and since unskilled workers represent a large population group, focused suicide prevention policies should be implemented [21,47].

Clerks have also been found to have an elevated number of suicide deaths across most male and female age groups. While previous studies assigned clerks as a low suicide risk group compared to other occupational categories [20,30], clerks comprised a highly inhomogeneous group with a higher ratio of severe and chronically ill, both physically and mentally, persons. Furthermore, client-dependent professions have specific stress factors that could possibly lead to a higher risk of suicide and mental health issues [30,48].

It is worth mentioning the high suicide risk in the highly-skilled demanding positions, like professionals, in the age group of 50–59. In light of the sex distribution of mental health illness Sanne et al [49] explored the differences of anxiety and depression in different occupation groups, stratified by sex. Males working in low-skilled occupations were found to have higher levels of depression and anxiety, whereas females showed higher depression levels in the professional group [49]. The association of depression with a greater suicide risk could be seen as a probable justification for our findings. On the contrary, female managers in the youngest age

group proved to have a high number of suicides, a finding that may be excused by cultural-dependent factors [7].

As with similar suicide mortality studies based on national statistics, the study findings should be interpreted with caution, as no causal relationships could be given for probable occupational stressors and suicide risk. Future studies with individual linkage data, in order to explore the influence of other factors such as mental illnesses to suicidal deaths are needed. There is always the possibility of misclassification when death certificates are registered in ELSTAT databases but in deaths due to intentional self-harm this should be negligible, if it occurs at all. Underreporting is nearly impossible but discrepancies from the corresponding data of other agencies may occur on account of different methodologies used or other underlying factors, such as the need for time-consuming research by the Forensic Medicine Services in order to investigate the conditions resulting in the death, deaths caused by late effects after a failed suicide attempt, etc. By contrast, in this study, it is possible that in a number of cases, data on occupation were missing, and so they were not classified under the broad occupational categories. In order to minimize this effect we excluded from age groups those older than 60 years, where the different pension schemes would strengthen this effect. In any case, the possible lack of classification would not be anticipated to be differential between the different broad occupational categories.

To date this is the first Greek study presenting national data of suicide mortality among broad occupational groups. The study highlights the occupational, sex, and age differences in suicide and provides valuable data of tailor made suicide prevention strategies. Male dominant occupations, mainly armed forces, skilled farmers, and elementary workers, and female high-skilled occupations were seen as high risk groups in a period of 10 years. The much discussed protective factor of employment in terms of suicidal behavior and mental health should also be explored in light of the Greek financial recession. Attention should also be given to focus suicide prevention strategies within vulnerable working age populations.

#### Conflicts of interest

The authors declare that they have no conflicts of interest.

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#### Appendix A. Supplementary data

Supplementary data related to this article can be found online at <http://dx.doi.org/10.1016/j.shaw.2015.09.004>.

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