

Incidence of suicide among military police officers in South Brazil: An 11-year retrospective cohort study☆☆☆

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ABSTRACT

Background: Suicide is known to be the leading cause of death among police officers (PO) worldwide. However, most studies were conducted in developed countries, with no data from Brazil. The present study aimed to evaluate the incidence and the sociodemographic profile of suicide among a military PO subpopulation in South Brazil.

Methods: This retrospective cohort evaluated 31,110 military PO with available data on cause of death from 2006 to 2016. Participants were monitored for an average of 18.8 ± 9.6 years following the date of entry into the military police.

Results: Mean age at the end of the follow up time was 41.4 ± 9.1 years, with 90.7% males. A total of 650 participants died (2.1%), with 43 suicides (6.6% of all deaths) - cumulative incidence of 138/100,000. Bivariate analysis revealed a significant association ($p < 0.05$) between suicide and age (HR = 0.70, 95%CI = 0.66–0.74), females (HR = 1.67, 95%CI = 1.08–2.60) and enlisted military rank (HR = 14.9, 95%CI = 2.05–108.5). Multivariate models showed an independent association between suicide and age (HR = 0.71, 95%CI = 0.67–0.74) and enlisted military rank (HR = 9.96, 95%CI = 1.30–76.3).

Conclusions: The incidence of suicide among military PO in South Brazil was high, compared to the national suicide rate. Younger age and lower military rank were independent predictors of suicide in this subpopulation.

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1. Introduction

Suicide is the cause of 1.4% of all annual deaths worldwide [1]. Deaths due to suicide results in several social problems, since it influences the risk of suicide attempt to the relatives and friends [2,3], and impacts on a high disability adjusted life years (DALYs) [4]. This burden of disease can be associated to the age period that most of these deaths occur, between 15 and 35 years, especially in low and middle-income countries [1]. The investigation of suicide is fraught of challenges as a result of the multifactorial nature of suicidality, the complex cultural meaning of suicide and the research practices common to the field over the past decades [5]. Some consistent risk factors for suicide have been described: mental disorders, past suicide attempts, social isolation, family conflict, physical illness, and occupation [6]. Police are among the occupations at most risk for suicide, RR = 1.52 (95% CI 1.28–1.80), along with

'elementary' occupations (laborers, cleaners), machine operators and ship's deck crew, and agricultural, forestry and fishery works [7].

Findings from a systematic review showed that police officers (PO), as well as other first responders (e.g. firefighters, paramedics, emergency medical technicians), may be at elevated risk for suicidal thoughts and behaviors [8]. The police labor activity has major peculiarities related to the daily exposure to both acute and chronic severe stressful situations [9]. In addition, a few studies indicated that combat exposure, a type of severely stressful life event, is a robust risk factor for lethal suicide behavior among war veterans [10–12]. However, there is a scarcity of studies involving military individuals who are not from the Army, such as military PO. Thus, suicide research focusing on this vulnerable population is essential, especially in developing countries at high levels of urban criminality, including the presence of organized crime, such as Brazil [13], which is ranked in the 79th position in the Human Development Index (HDI) [14]. Suicide and homicide rates usually shown an inverse correlation, while suicide rates and HDI shown a positive correlation [15]. In Brazil, 47,135 inhabitants died by homicide (rate = 24.3/100,000) in 2012, although there are laws to regulate and restrict civilian access to firearms [16]. There is a lack of epidemiological studies involving suicide rates among Brazilian PO, who are probably highly exposed to violence in their daily lives.

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Suicide was found to be an important cause of mortality among PO in some studies [17,18]. A meta-analysis found a median suicide rate of 18.2/100,000 [19] in this susceptible population. However, most studies included in that review were conducted in developed countries, with no data from Brazil [19]. Accordingly, there is scarce scientific reports on the suicide rates among Brazilian PO [20]. Although Brazil's suicide mortality rate increased by 29.5% in 26 years (1980–2006), the national rate (4.9 per 100,000 inhabitants on average) is still considered low compared to worldwide suicide rates. With an average of 9.3 deaths per 100,000 inhabitants, South Brazil presented the highest rates of suicide in the country [21]. Nevertheless, it should be noted that underreporting may occur in poorer countries, which may underestimate the informed suicide rates [1]. Considering the social, economic and cultural peculiarities of Brazil, it may be supposed that suicide rates may differ among PO in Brazil, compared to other areas of the world.

Thus, the aim of this study was to evaluate the 11-year incidence of suicide among military PO based on deaths registered in the state of Rio Grande do Sul, Brazil. In addition, the present study analyzed the mortality by other causes than suicide (e.g. deaths related to police work activity, cancer, cardiovascular disease, etc.) to compare their frequencies in the target population, and to analyze associations between some risk factors (sociodemographic and occupational characteristics of participants) and each specific cause of death.

2. Material and methods

The study protocol was reviewed and approved by the Committee of Ethical Affairs of the Vale do Taquari University - Univates (#1676090 - CAAE#56999616.7.0000.5310) and by the Research Institute of the Military Police of Rio Grande do Sul, Brazil. The privacy and confidentiality of the personal information of the research participants were protected. All data were de-identified before the analysis. Present observational study conforms to the STROBE guidelines.

The target population of this retrospective cohort study comprised military PO from the state of Rio Grande do Sul, in South Brazil. All active military PO of any age and sex were eligible and included in the study, whereas military retirees were excluded from the study sample. Collected data was retrieved from the military police files, provided by the Department of Intelligence and by the Administrative Department of the Military Police of Rio Grande do Sul (State population in 2016 = 11,286,500 inhabitants), Brazil, from January 2006 to June 2016.

As sociodemographic data we included age, sex, military rank and time of military police work (years). Mortality was ascertained by annual searches in the military files. Cause of death was determined by ICD10 codes, according to the death certificate of each individual. Deaths caused by intentional self-harm (codes X60–X84) were considered as "suicide". "Deaths related to police work activity" included homicide (assault, codes X85–Y09) or traffic accidents (codes V02–V04, V09.0, V09.2, V12–V14, V19.0–V19.2, V19.4–V19.6, V20–V79, V80.3–V80.5, V81.0–V81.1, V82.0–V82.1, V83–V86, V87.0–V87.8, V88.0–V88.8, V89.0, V89.2). All other deaths were considered natural causes or other external cause of morbidity, categorized as "other deaths". Information on the workplace of the participants was available, but this data was not included since the database considered only the baseline workplace. There was no information on the changes throughout working time, which are common in the PO career. The institutional database had no additional data on other potential confounders for suicide.

Survival analysis was carried out by bivariate and multivariate Cox regression models, estimating the relationship (hazard ratios [HR] and 95% confidence intervals [CI]) between sex, age, military rank (dichotomized as enlisted and officers), time of military police work (dichotomized as <10 and ≥10 years) and risk of incident suicide, death related to police work or other causes of death. All variables associated with incident suicide in the bivariate analysis with a *p*-value < 0.25 were considered potential confounders and were

included in the subsequent multivariate models, where the value for the rejection of the null hypothesis was set at $p \leq 0.05$. The statistical approach was carried out with bivariate and multivariate regression models, allowing the analysis of the interaction between exposures, co-variables and the outcome (suicide). The multivariate model evaluated the association between military rank (enlisted) and suicide, adjusting for age, sex and time of police work or time to death.

In addition, the Kaplan–Meier method was used to estimate survival function for each exposure variable (age, sex and military rank) in relation to suicide and the time of military police work. The outcome was death (suicide versus all other deaths or alive). Log-rank testing was used to compare the survival curves at the 5% significance level. These analyses were conducted with the IBM SPSS statistical package (version 20; SPSS Inc).

3. Results

Table 1 shows the characteristics of the study sample ($N = 31,110$ individuals) according to suicide and death outcomes. The mean age at the end of the follow up time was 41.4 ± 9.2 years (min 20 y, max 85 y), with 90.7% men. Most participants were enlisted (81.5%), and the mean working time in the military corporation was 18.8 ± 9.6 years. A total of 650 participants died in the study period, with 43 suicides (6.6% of total deaths), 16 deaths related to police work (2.4% of total deaths) and 591 deaths due to other reasons (90.9% of total deaths). The median age of participants who died by suicide was 36.0 years (min 20 y, max 51 y), with an interquartile range of 15 years. The mean annual rate of mortality by suicide was 12.5/100,000, with a cumulative incidence of 138 suicides/100,000 PO during the studied period. The age-standardized suicide rates were different for the individuals with <40 years old (mean annual rate of 18.5/100,000 and cumulative incidence of 222 suicides/100,000 PO) than for those with 40 years or more (mean annual rate of 7.3/100,000 and cumulative incidence of 87 suicides/100,000 PO). The mean annual incidence of suicide was higher for females (18.8/100,000) than for males (11.9/100,000), with a female-to-male ratio of 1.58.

Table 2 expresses the bivariate and multivariate models for the association between the characteristics of participants and incident suicide. In the bivariate analysis, age (HR = 0.70; 95%CI = 0.66–0.74), females (HR = 1.67; 95%CI = 1.08–2.60) and enlisted military rank (HR = 14.9; 95%CI = 2.05–108.5) were significantly associated with incident suicide. Multivariate model revealed that age (HR = 0.71; 95%CI = 0.67–0.74) and lower military rank (enlisted) (HR = 9.96; 95%CI = 1.30–76.3) were independent predictors of suicide in this population. Sex was not associated with suicide in the adjusted model (HR = 1.04; 95%CI = 0.67–1.62).

Fig. 1 shows the Kaplan–Meier survival curves for suicide in relation to age (A), sex (B) and military rank (C). Log-rank tests (Mantel-Cox) revealed a significant association ($p < 0.001$) between suicide and age, sex (females) and lower military rank (soldier).

4. Discussion

Similarly to the observed in other countries [19], present results suggest that South Brazilian military PO are at high risk for suicide, especially among women (mean annual rate of 18.8/100,000 in females vs. 11.9/100,000 in males). To the best of the authors' knowledge, this study is novel on describing the incidence and profile of suicide among this subpopulation. Despite the inherent methodological limitations, present results provide the opportunity to alert about the vulnerability of this profession in Brazil, indicating the need for specific prevention programs.

The mean annual incidence of suicide among Brazilian PO in Rio Grande do Sul was 12.5/100,000, which is 3-fold higher than the mean annual rate of the Brazilian general population (5.1/100,000, average from 2006 to 2015 based on 190,755,799 inhabitants, data from the

Table 1Characteristics of the study sample according to suicide and death outcomes. Results expressed as mean \pm standard deviation or N (%).

| Characteristics | Alive | Suicide | Death related to police work | Other deaths | Total |
|---------------------|----------------|----------------|------------------------------|----------------|----------------|
| Age | 41.4 \pm 9.2 | 35.7 \pm 8.8 | 35.7 \pm 6.4 | 44.0 \pm 8.9 | 41.4 \pm 9.2 |
| Sex | | | | | |
| Male | 27,579 (90.5) | 37 (86.0) | 16 (100.0) | 574 (97.1) | 28,206 (90.7) |
| Military rank | | | | | |
| Soldier* | 11,471 (37.7) | 30 (69.8) | 11 (68.8) | 178 (30.1) | 11,690 (37.6) |
| Sergeant* | 13,309 (43.7) | 12 (27.9) | 4 (25.0) | 331 (56.0) | 13,656 (43.9) |
| Lieutenant** | 4275 (14.0) | 0 (0.0) | 0 (0.0) | 64 (10.8) | 4390 (13.9) |
| Captain** | 511 (1.7) | 1 (2.3) | 0 (0.0) | 2 (0.3) | 514 (1.7) |
| Major** | 433 (1.4) | 0 (0.0) | 1 (6.2) | 7 (1.2) | 441 (1.4) |
| Lieut. Colonel** | 305 (1.0) | 0 (0.0) | 0 (0.0) | 7 (1.2) | 312 (1.0) |
| Colonel** | 156 (0.5) | 0 (0.0) | 0 (0.0) | 2 (0.2) | 158 (0.5) |
| (*) Enlisted | 24,780 (81.4) | 42 (97.7) | 15 (93.8) | 509 (86.1) | 25,346 (81.5) |
| (**) Officers | 5680 (18.6) | 1 (2.3) | 1 (6.2) | 82 (13.9) | 5764 (18.5) |
| Time of police work | | | | | |
| <10 years | 18.8 \pm 9.6 | 13.5 \pm 8.9 | 12.6 \pm 7.5 | 21.3 \pm 8.6 | 18.8 \pm 9.6 |
| Total | 8782 (28.8) | 19 (44.2) | 8 (50.0) | 78 (13.2) | 8887 (28.6) |
| Total | 30,460 (97.9) | 43 (0.1) | 16 (0.1) | 591 (1.9) | 31,110 (100) |

last national Census in 2010) [22] and higher than the mean rate of the general population in the state of Rio Grande do Sul (10.5/100,000, average from 2006 to 2015, based on 10.693.929 inhabitants) [22]. Compared with previous studies realized in other states (São Paulo and Rio de Janeiro) our results are similar [23–25]. In addition, present study revealed that suicide deaths among PO are 2.75 times more frequent than deaths related to occupational military police work in this subpopulation. The present findings are consistent with previous studies [9,26] showing that suicide among PO was two times higher than other external causes of death, such as traffic accidents and homicides, including those killed in the line of duty.

Since there is no consensus whether the prevalence of suicide ideation among PO is higher than the general population [18], recent advances in suicide theory related to the ideation-to-action framework may explain the high rate of suicide found in the present study. It includes three theories/models: interpersonal theory by Joiner [6], the integrated motivational-volitional model by O'Connor [27], and the three-step theory by Klonsky [28]. The interpersonal theory of suicide points the acquired capability for suicide, which consists in elevated physical pain tolerance and lowered fear of death, as a main factor causing the progress from ideation to attempts. As a part of the military training, elevated physical pain tolerance is necessary to this job. Moreover, combat exposure during police work and training may also lead to acquired capability [6]. Finally, it is supposed that lowered fear of death is a primordial characteristic to join this profession. Consequently, in response to repeated exposure to physically painful and fear-inducing experiences, the capability for suicide increases through habituation and strengthening of opponent process [6]. Corroborating our findings, this theory was tested in the United States National Guard, and the results indicate that it can be useful for conceptualizing suicide risk in military personnel [29]. The integrated motivational-volitional theory regards, as key factors to the progression from ideation to attempt, the capability and access to means [27]. Both are present among PO, with the aggravating fact that these professionals can take guns to their homes. Regarding low belongingness and perceived burdensomeness, we hypothesized that Brazilian PO are at increased risk for experience these two psychological constructs. The low investments in public

security can evoke the sense of loneliness among them. In this context, the populations's liability to enhance security and hate for not find results can generate perceived burdensomeness among PO.

Moreover, the Three-Step Theory (3ST) views the progression from ideation to attempts as facilitated by dispositional, acquired, and practical contributors to the capacity to attempt suicide [28]. Someone as a police, with both knowledge of and access to lethal means, such as a firearm, could act on suicidal thoughts much more easily than someone without knowledge of and access to lethal means [30]. According to a French study, in more than half of suicide cases, police officers used their service weapon to commit suicide [31]. In addition, evidence indicates that states with higher self-reported gun ownership have higher rates of firearm suicide as well as overall suicide [32]. These patterns are not due to an association of gun ownership with mental health or suicidal thoughts; in fact, there is no relationship of gun ownership to either mental health or suicidal thoughts, and the relationship between gun ownership and suicide persists after controlling for these variables [33].

The literature also indicates that environmental factors such as traumatic experiences are associated with elevated risk for suicide [34]. Combat exposure, which involves exposure to the fear of one's own possible death, as well as killing others, represents a relatively direct pathway, according to the interpersonal theory of suicide [6]. In fact, most of PO experienced at least one traumatic event during their first year on the job, and those who experienced on-duty traumatic events were more likely to report symptoms of posttraumatic stress disorder (PTSD) [35]. In Brazil, the PTSD prevalence among PO was comparable to those reported for North America and Dutch [36]. One of the few psychiatric disorders associated with ideation-to-action (attempt) progress is PTSD [30].

Noteworthy, present results showed a clear independent association between lower military rank and suicide, possibly because these individuals are in the front line of combat, thus more exposed to PTSD related to the labor activity. Given this association, further research should investigate the association of PTSD with suicide, especially among PO.

Young individuals represents the predominant age group of suicide deaths in lower and middle income countries, including Brazil [1],

Table 2

Bivariate and Multivariate models for the association between the characteristics of participants and incident suicide. Hazard Ratios (HR) and Wald Chi-Square, Cox Regression with time to event (time of police work or time to death) (N = 31,110).

| Variables | Bivariate | | | | | Multivariate | | | | |
|--------------------------|-----------|------|-------|-------|---------|--------------|------|-------|-------|---------|
| | 95% CI | | | | | 95% CI | | | | |
| | Wald | HR | Lower | Upper | p-Value | Wald | HR | Lower | Upper | p-Value |
| Age (\geq 40 years) | 182.2 | 0.70 | 0.66 | 0.74 | <0.001 | 173.5 | 0.71 | 0.67 | 0.74 | <0.001 |
| Sex (female) | 5.23 | 1.67 | 1.08 | 2.60 | 0.022 | 0.03 | 1.04 | 0.67 | 1.62 | 0.872 |
| Military rank (enlisted) | 7.11 | 14.9 | 2.05 | 108.5 | 0.001 | 4.89 | 9.96 | 1.30 | 76.3 | 0.027 |

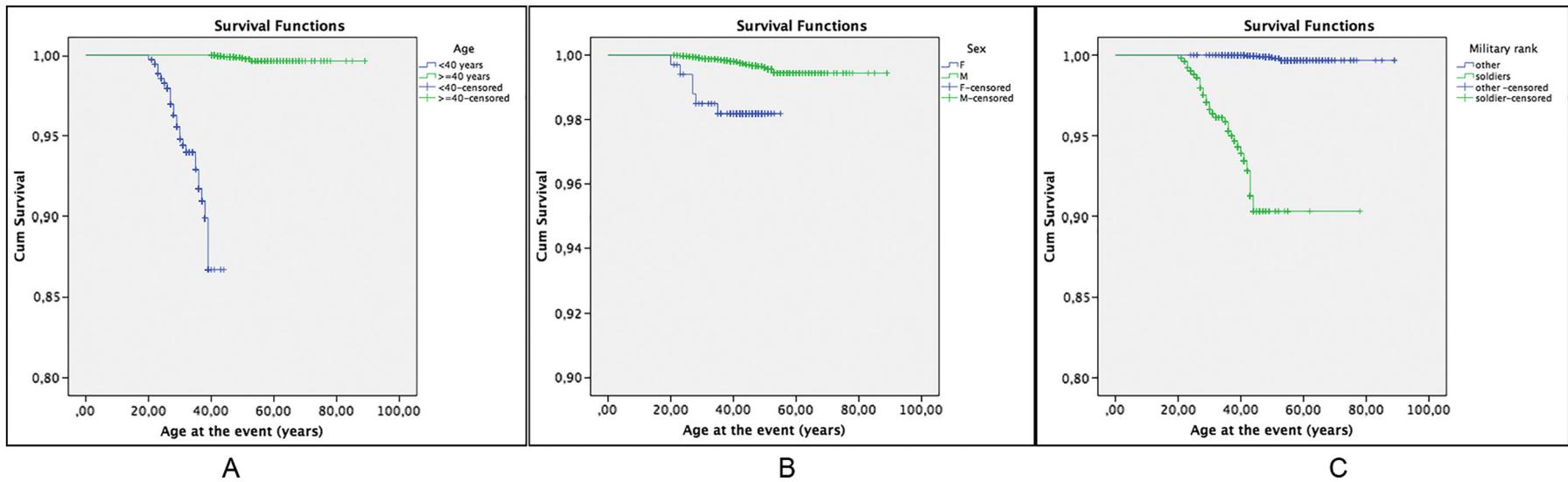


Fig. 1. Kaplan–Meier survival curves for suicide in relation to age (A), sex (B) and military rank (C) (N = 31,110). Log-rank tests (Mantel-Cox) revealed a significant association ($p < 0.001$) between suicide and age <40 years, sex (females) and lower military rank (soldier).

which agree with the present findings. Although a small proportion of the study population was elderly, the predominant age group of suicides among PO comprised younger adults (20–39 years), indicating that age was an independent risk factor for suicide in this subpopulation. Once again, it is plausible to hypothesize that this association occur because younger PO are usually those who perform the direct combat to criminality, being more exposed to PTSD.

Interestingly, bivariate Cox regression model and Kaplan–Meier survival curves revealed a significant association between suicide and sex, suggesting that females were at higher risk of suicide compared to males in the present sample (HR = 1.67; 95%CI 1.08–2.60). However, sex differences became non-significant after the adjustment for age and military rank in the multivariate model (HR = 1.04; 95%CI 0.67–1.62), which reveals that younger age and lower military rank are stronger risk factors for suicide among these PO. Anyway, this finding is relevant because male sex was not a risk factor for suicide in this subpopulation. In contrast to our findings, the ratio between suicide rate and gender strongly indicates higher mortality among men in Brazil [21] and in other low- and middle-income countries [1]. In this particular, Stuart H. expect that women who work in male-dominated professions experience greater job stress and burnout [18]. However, previous studies suggest that male and female PO experience similar organizational stressors [37]. Brazilian studies showed greater job stress among female PO due to two main factors as: double working day (domestic work and PO work) and gender discrimination [38,39]. Even after nearly 30 years of the female presence in the Brazilian police forces, there is a need for organizational and managerial changes from the perspective of gender, with investments in preventive measures that can reduce the consequences of stress [39]. Further research is needed to explore suicidality among female workers in male-dominated professions. Lastly, since only six women died by suicide during the study period (14% of suicides deaths and 0.2% of the total female sample), we should use caution in interpreting female data.

It is unlikely that job-related stressors alone are sufficient to produce suicidality in otherwise healthy individuals; it is more likely that they interact with a number of personality factors and coping styles to increase risk [40,41]. In a cross-sectional study, military personnel who experienced self-injurious thoughts and behaviors, especially suicide attempts, prior to joining the military are more likely to attempt suicide while in the military [42]. However, although psychological tests are routinely performed during the selection process to join the police forces, it is difficult to detect candidates with high vulnerability to suicidal behavior, since that suicide risk depends on multiple factors and the available instruments showed a wide range of accuracy [43].

Present findings should be interpreted with caution, considering the limitations of this investigation, mainly related to the retrospective study design and the lack of data on potential confounders. First, absolute numbers of police suicides vary by year, lending instability to any population comparisons. Second, limited retrospective data did not allow the investigation of the place and the method of suicide. Workplace changes are common in this profession, and we did not include the city of death. Rural and urban environments shown different suicide rates [44]. Also, among 27 Brazilian states, Rio Grande do Sul shows the 9th highest rate of urbanization (85.1%). Thus, these factors may have interfered in our results and should be taken account in further studies comparing these rates between states. This information could be valuable to guide specific suicide prevention strategies. Third, only 9.5% of the sample was female, and the outcome occurred a few times (six suicides), inflating the relative rate. However, it is a common challenge in suicidology, since that, even in high-risk populations, suicide have a low-base rate, thus thousands of participants have to be followed to obtain reliable results [5]. Forth, we did not include suicide data among former military police. Further research should explore this topic since that is a controversial issue [45]. In addition, our study used the cut-off of 10 years for dichotomization of the variable “time in the military police service”, which was based on the following criteria: 1 -

the data distribution, which reveals that nearly 30% of the study sample (percentile 30) had ≤ 10 years of police service; 2 - the plausibility on the topic background, since low- and middle-income countries have found that suicide risk is higher in the early ages [1]; 3 - of all 43 cases of suicide in the present sample, only 3 cases occurred in subjects with 2 years or less of service, so this cut-off would not allow proper regression analysis. Although the analysis could not be carried out with short periods of time in military service (such as 2 years or less), we believe the present results reinforce the need for a different suicide prevention strategy for that group in the first years of work. Fifth, we did not included civilian police officers in our study. Besides the military police, Brazil has a civil police force that can carry a weapon, including outside of work. However, we do not have Civil Police data, since that a formal requirement is need to access it. One study found that military officers showed more psychiatric symptoms among military officers, when compared with civilian officers [46]. Anyway, further studies should explore these probable differences between them. Sixth, suicide is usually underreported in death certificates by legists [47], therefore suicide rates may be higher than documented. Finally, available database did not allow to analyze other known risk factors for suicide, such as family history of suicidal behavior or psychiatric symptoms and baseline risk of suicide (e.g. posttraumatic symptoms, suicide ideation or plan, and previous suicide attempt), which could be useful to estimate the risk of suicide in this subpopulation. Further studies should analyze a wider variety of potential predictors of suicide such as mental health problems and/or psychiatric diagnoses, past suicidal behavior, and family history of suicide attempts. In order to close the various data gaps mentioned in this limitations section, more detailed information about the method of suicide, including the source of weapon if this method was used (military vs. private weapon), location of suicide, etc. Finally, a multicenter study, including others states and other polices (e.g. civil) would be recommended. On the other hand, the present study has some methodological strengths related to the longitudinal design, the sample size and the internal validity, since all military PO from the target population were included and followed up for more than a decade. In addition, the statistical approach was carried out with bivariate and multivariate regression models, as well as survival curves, allowing the analysis of the weight and the interaction between variables.

The World Health Organization published a report, in 2014, recommending that suicide prevention should be taken as a priority in national public health policies worldwide. Since the frequency of suicide among PO is higher than the general population, the military police institutions in Brazil have been researching the topic and developing strategies to deal with this reality [20]. However, the government security policies still follow prioritizing and investing in resources that do not focus in the appreciation and humanization of the PO work.

Therefore, present results indicate the need for expansion and fortification of institutional preventive strategies, especially related to mental health policies, in order to early detect and treat PO at high risk for suicide, preventing premature death among the exposed servers. “Together for Life” [47], “U.S. Air Force Suicide Prevention Program” [9], “Preventing Law Enforcement Officer Suicide: A Competition of Resources and Best Practices” [9] are examples of suicide prevention programs to military officers around the world. To the author’s knowledge, a specific program for this purpose is lacking in Brazil. Ultimately, there may be no more effective approach to suicide prevention than to reduce access to lethal means, as a fire gun [30]. Reducing the access to firearms after service shown to be an effective policy in Israel and Switzerland [48,49]. This caution should be adopted mainly for specific PO detected at increased risk of suicide (e.g. PTSD, previous suicide attempt, suicide ideation, nonsuicidal self-injury) [47,50].

The present study unveiled a high incidence of suicide among PO from South-Brazil. Particularities of this profession, such as permanent access to fire guns and frequent combat exposure, can explain in

part this predisposition, according to recent developments in suicide theories. Most importantly, the present findings suggest that this subpopulation is vulnerable for suicide, strongly indicating the need of specific prevention programs.

5. Conclusions

The incidence of suicide among military PO in South Brazil was high, compared to the national suicide rate. Younger age and lower military rank were independent predictors of suicide in this subpopulation.

Conflict of interest

None.

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