

Military rank and AIDS proportionate mortality in the Brazilian Navy

Hierarquia militar e mortalidade proporcional por AIDS na Marinha do Brasil

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Abstract

This study describes AIDS mortality and occupational factors among servicemen in the Brazilian Navy. This is a proportional mortality study of 2,586 servicemen's death certificates (20-72 years of age) recorded from 1991 to 1995. Death certificates and occupational histories came from the Brazilian Navy Insurance System archives. Association was measured using proportionate mortality odds ratios obtained with unconditional logistic regression. AIDS proportionate mortality was estimated at 4.8% (n = 125) and increased during the study period, particularly among servicemen under 50 years of age and those with low rank. As compared to other occupations, there was relative excess AIDS in the "management" (proportionate mortality odds ratio, $PMOR_{age-adjusted} = 2.45$; 95%CI: 1.27-4.71), "secretarial" ($PMOR_{age-adjusted} = 2.49$; 95%CI: 1.22-5.08), and "janitorial" ($PMOR_{age-adjusted} = 2.61$; 95%CI: 1.10-6.16) occupational groups. AIDS proportionate mortality was higher among male than female military members. Higher rates were observed in some occupational groups when the members were low ranking. Power distribution, gender issues, and low socioeconomic status require further investigation using more appropriate methods.

Acquired Immunodeficiency Syndrome; Military Personnel; Mortality

Introduction

AIDS is still a public health problem in Brazil, although a significant decrease in incidence ¹ and mortality ² has been observed in recent years as the result of a strong response by government and society and advances in therapeutic and preventive interventions, such as the implementation of universal free coverage of antiretroviral therapy and the nationwide expansion of condom distribution ². Although AIDS mortality in Brazil is high, only a few publications have focused on this issue with nationwide data ³. According to a report by the National STD/AIDS Division, from 1991 to 1995, 90% of AIDS cases occur among males, mostly between 13 and 49 years of age, and AIDS was the second largest cause of mortality among individuals 20 to 49 years of age ^{1,4}. Recent studies have shown that together with the overall trend in AIDS incidence, there has been a proportional increase among the poor and peripheral urban areas ⁵. The search for more vulnerable groups is an ongoing effort by health authorities to keep the disease under control.

Few studies have reported on work-related risk factors for HIV transmission. Health workers are widely known as having increased risk of contact with contaminated blood, resulting in a high HIV infection rate ⁶. Some occupational groups are recognized as having lifestyle behaviors known as mediating factors for HIV. For instance, bus ⁷ and truck drivers display prevalent

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macho behaviors associated with increased risk of unprotected or commercial sex⁸. There are also reports that military personnel are more likely to have AIDS or HIV infection in both developed and developing countries⁹, because they are engaged more frequently in promiscuous sexual behavior^{9,10} and intravenous drug use⁹, both of which are known risk factors for HIV transmission.

In Brazil, HIV prevalence among seamen and petty officers (first class) was estimated as twice the overall rate for the Brazilian Navy¹¹. From 1985 through 1998, 673 HIV-positive cases were reported in the Navy, mostly among younger individuals¹², but little is known about groups at increased risk. In this study, AIDS proportionate mortality is described in the Brazilian Navy from 1991 through 1995, according to socio-demographic and occupational groups and job titles.

Methods

This is a proportionate mortality study that includes all active, reserve, or retired Naval personnel who died from January 1, 1991, through December 31, 1995, and were residing in Brazil or abroad. The original project was intended to examine the associations between occupation and overall mortality in the Navy. Because AIDS cases were limited to 20 to 72 years of age, the study population was defined within this age range, so deaths at other ages were excluded. The database comes from the Military Personnel Division of the Brazilian Navy, while death information and job histories were obtained from the Social and Life Insurance Service of the Brazilian Navy, responsible for verifying relatives' compensation when a service member dies. The study population includes onshore and onboard Navy personnel and the inactive reserve corps. Withdrawal, desertion, and involuntary discharge are rare in this population. Because Navy recruitment of women is recent in Brazil and there were only a few female deaths recorded, this study includes only the male population.

Information about Naval military deaths is compiled from legal Brazilian death records and stored in the Navy Insurance System as death certificates. Agreement in terms of International Classification of Diseases - 9th Revision codes for the death records and death certificates was examined in a random sample of 106 subjects from the study population. An overall agreement of 89.6% and a kappa index of 0.61 (95%CI: 0.51-0.72) were estimated, thus demonstrating acceptable reliability in the available data. Information from occupational history files was compared, checking missing and homonymous data.

The study variables were age, marital status, calendar year of death, and place of residence according to State and region. The occupational variables were years served in the Navy, naval rank such as: *high* – sergeants and sub-officers, marine guards, lieutenants, captains, and admirals; and *low* – soldiers, seamen, and corporals or petty officers (first class). The occupational groups were defined based on job titles: *combat/weapons* – handling of submarine weapon artillery, missile technicians, minemen, gunner's mates, torpedomen's mate, and infantry; *health care* – physicians, dentists, nurses, pharmacists, psychologists, and x-ray operators; *mechanical/metalworking* – machine and engine operators, aircraft maintenance operators, craft workers, metal workers, boiler operators, among others; *communications/electro-electronics* – internal naval communications, radar and sonar operators, electronics operators in general, aircraft technicians, electricians, radiomen; *management* – naval sciences graduates or Armed corps officers, hydrographers, managers and administrative support staff, musicians, chaplains, storage personnel; *construction/repair* – construction workers, crafts workers, carpenters, damage repair, engineers; *services* – cooks, janitors, barracks workers, barbers. Job titles comprising each occupational group were also evaluated separately. For each category, the referent group was all other occupational groups.

Statistical analysis

Age-standardized AIDS proportionate mortality was estimated using the direct method, with the overall study population as the standard. Measure of association was the proportionate mortality odds ratios (PMOR)¹³ and statistical inference was based on Mantel-Haenszel confidence intervals for an alpha of 0.05. Unconditional logistic regression was also used to assess whether each occupational group was associated with AIDS proportionate mortality, separately, independently of confounding variables and taking effect modifier variables into consideration. Candidate confounders were age, marital status, and place of residence, and effect modification was examined for naval rank, years served in the Navy, and marital status. Modeling was based on backward elimination of terms from a saturated model containing all candidate variables. Confounding assessment was based on findings from previous studies^{5,14} or when deletion of candidates from the saturated model led to changes greater than or equal to 20% in the main association. Effect modifiers were examined using maxi-

mum likelihood ratio tests by considering an alpha of 0.05. Regression diagnosis was conducted using deviance analysis and collinearity checked with Pearson correlation, variance inflation, and conditional index. Data entry and management were done with Epi Info 6.03 (Centers for Disease Control and Prevention, Atlanta, USA) and statistical analysis performed with SAS 8.1 (SAS Institute Inc., Cary, USA). Because these were administrative data, the study protocol was not submitted to the respective Institutional Review Board for examination of ethical issues. However, formal authorization was obtained to use the database.

Results

During the study period, 3,882 deaths were recorded in the Brazilian Navy, but 319 (8.2%) death certificates could not be found, and 977 were out of the age range defined for the study population (20 to 72 years of age), leaving 2,586 deaths for analysis. AIDS cases were younger, mostly unmarried, and had lower socioeconomic status as compared to all other deaths. Unadjusted AIDS proportionate mortality ($PM_{unadjusted}$) was estimated at 4.83%. From 1991 to 1995, AIDS proportionate mortality increased slightly, varying from 3.59% to 5.77% for all ages. However, the younger group (20 to 49 years) showed a much greater increase, from 9.92% to 22.22% (Figure 1). Age-adjusted AIDS proportionate mortality also increased during this time period in the two rank groups, but the increase was higher among low-ranking military men (Figure 2).

Independently of age, the estimates show that unmarried low-ranking servicemen and those with fewer years of duty had a higher proportion of AIDS deaths than the comparison group (Table 1). Data in Table 2 show that AIDS proportionate mortality did not vary substantially across occupational groups, except for "secretarial" personnel, who had twice the AIDS proportionate mortality odds ratio ($PMOR_{unadjusted} = 2.29$; 95%CI: 1.39-3.78) as compared to other occupations.

Based on logistic regression, naval rank was an effect modifier of the association between "management" occupations and AIDS proportionate mortality (likelihood ratio test, $\chi^2 = 5.89_{1df}$, $p = 0.02$); therefore, estimates are presented separately for each rank group. In the low-ranking group, the age-adjusted AIDS proportionate mortality odds ratio ($PMOR_{age-adjusted}$) corresponding to "management" was 2.45 (95%CI: 1.27-4.71), higher than the estimate for the higher-ranking group ($PMOR_{age-adjusted} = 0.73$, 95%CI: 0.36-1.47), a statistically significant difference. However, a

negative association with "combat/weapons" was found in the low-rank group ($PMOR_{age-adjusted} = 0.42$, 95%CI: 0.22-0.81), which is statistically different from the $PMOR_{age-adjusted} = 1.01$ (95%CI: 0.49-2.05) estimated in the high-ranking group. Limited to the low-rank group, AIDS proportionate mortality was higher among "secretarial" ($PMOR_{age-adjusted} = 2.49$, 95%CI: 1.22-5.08) and "janitorial" personnel ($PMOR_{age-adjusted} = 2.61$, 95%CI: 1.10-6.16) as compared to all other occupations (Table 3).

Discussion

The findings from this study suggest that in the Brazilian Navy, males have a high AIDS proportionate mortality that increased from 1991 to 1995, particularly in the younger group and among low-rank servicemen. AIDS proportionate mortality was also more common in the low-ranking group as compared to the higher ranks during the overall study period, and this difference increased from 1992 to 1995. Secretarial personnel, a sub-group of the "management" category, had an elevated proportion of AIDS-related deaths as compared to other occupational groups, and this difference changed according to military rank. Occupations were associated with AIDS proportionate mortality only among low-ranking Navy personnel, which include soldiers, seamen, and petty officers. In this low-ranking group, the proportion of AIDS deaths in the "management" stratum, particularly among secretarial personnel, was higher than in other occupational groups. Janitorial personnel also had increased AIDS proportionate mortality as compared to other occupations in the low-ranking group. However, "combat/weapons" occupations showed lower AIDS proportionate mortality, especially among the lower ranks as compared to the referent group.

AIDS proportionate mortality in the Brazilian Navy was higher than estimated for the overall male population (2%) during the same time period in Brazil³. This is consistent with research findings showing increased prevalence of HIV infection in the Armed Forces of several countries^{9,10}, including Brazil itself¹¹, but no data on AIDS mortality were available for the Navy. Usually, on-duty tasks require long periods of time away from home, living in remote places and frequent travel, which could account for unsafe sexual behavior¹². This is evident in the increased incidence of sexually transmitted diseases among servicemen^{9,10}. Careless sexual practices in this population can be even worse considering the so-called "military barracks culture", where ma-

Figure 1

AIDS proportionate mortality in the Brazilian Navy according to calendar year and age.

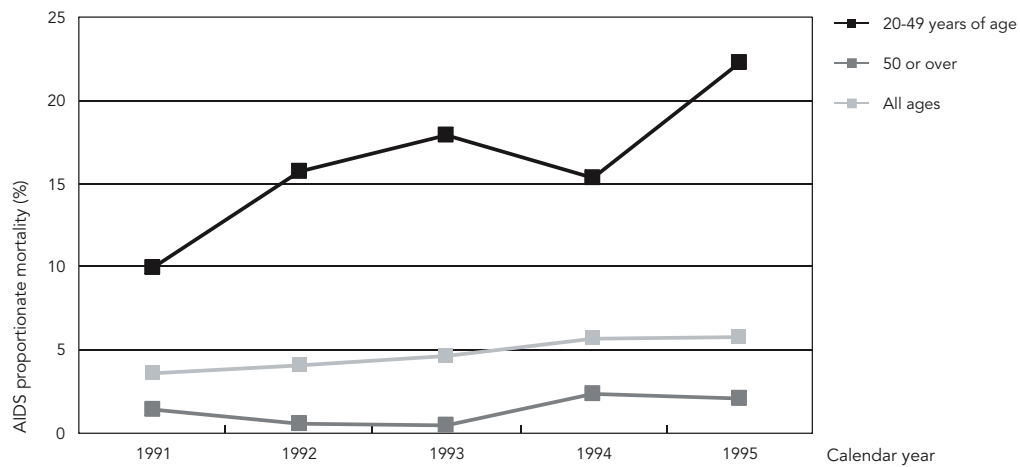


Figure 2

Age-adjusted AIDS proportionate mortality in the Brazilian Navy according to calendar year and naval rank.

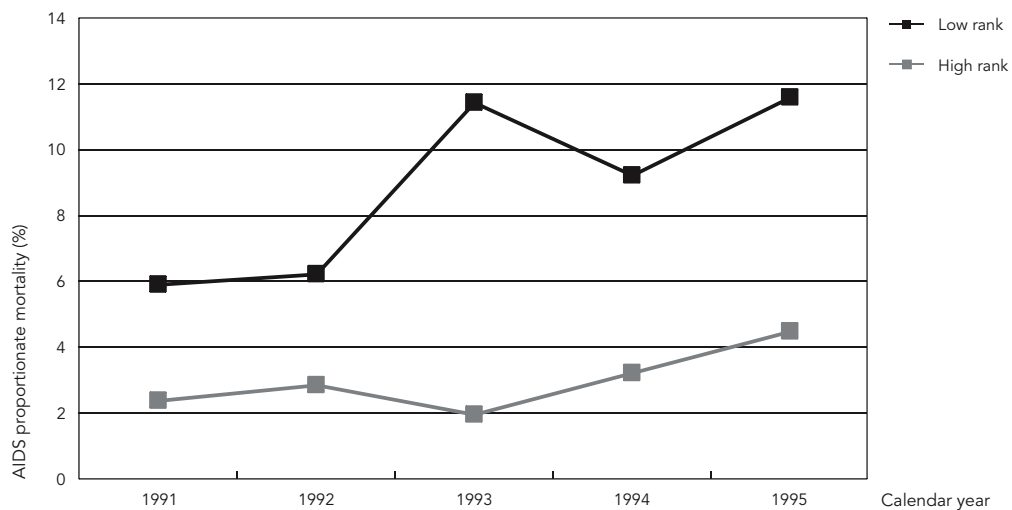


Table 1

Unadjusted and age-adjusted AIDS proportionate mortality according to socio-demographic and occupational variables in the Brazilian Navy, 1991-1995.

Variables	All deaths (N = 2,586)	AIDS deaths (n = 125)	AIDS proportionate mortality (4.83%)	Age-adjusted proportionate mortality (4.80%)
Age in years ($p < 0.001$)				
50-72	29	1,960	0.48	–
20 -49	96	501	19.16	–
Marital status ($p < 0.001$)				
Married	2,021	51	2.52	3.17
Unmarried	565	74	13.10	10.10
Region of residence				
Southeast	1,836	88	4.79	4.64
Northeast	499	23	4.60	5.68
North	80	6	7.50	5.10
Central-west	69	4	5.80	4.43
South	88	4	4.55	7.14
Naval rank ($p < 0.001$) *				
High	1,791	54	3.02	3.85
Low	795	71	8.93	5.30
Service time in years				
0-10	452	40	8.85	3.96
11-25	1,124	55	4.89	4.29
26-53	1,010	30	2.97	3.94

* Naval rank: high = sergeants and officers; low = soldiers, seamen, and petty officers.

cho behavior is praised and reinforced by peer pressure, and feelings of power and invincibility may be an obstacle to preventive sexual behavior^{12,15}. Intravenous illicit drug use has been examined among conscripts, but self-reporting and urine tests have shown reduced prevalence¹⁰.

Like the upward time trend observed in the Navy, AIDS proportionate mortality was increasing among the Brazilian civilian population³ before highly active antiretroviral therapy (HAART) became available free of cost in public health services for all eligible individuals in 1996. The Brazilian trend also reflects the worldwide epidemic pattern during the same time period. The increased AIDS proportionate mortality among young servicemen is also consistent with findings in the general population, showing AIDS as a disease of youth¹ before the more recent trends showing middle-aged and elderly individuals at increased risk of HIV infection. The relative excess of AIDS deaths among single military men as compared to married servicemen in this study is suggestive of homosexual patterns.

In this study, the social inequities in AIDS proportionate mortality in the Brazilian Navy are evident in the inverse association with Naval rank,

reproducing the pattern in the general population, described as impoverishment of the AIDS epidemic¹⁴. Military rank represents social class differences but also strong hierarchical relations of power and dominance¹⁵, typical of military organizations, which may influence the nature and direction of sexual negotiation. It may be of particular interest in same-sex relations, heavily discriminated against and stigmatized in the military setting. This prejudice can be intensified among less-educated, low-ranking military men, thus explaining their increased AIDS proportionate mortality. It is also plausible that other risk factors for AIDS-related deaths described in association with low socioeconomic status in the general population, such as promiscuous behavior, unsafe sex, and low sexual negotiating power¹⁶, may similarly occur in a low-ranking military setting.

It is unclear why the managerial occupational group and those with secretarial or janitorial positions showed an increased proportion of AIDS-related deaths as compared to other occupations in the Navy. Only a few studies have focused on occupational AIDS patterns^{6,14,17}, and research with military populations did not address spe-

Table 2

AIDS proportionate mortality and proportionate mortality odds ratio for the association between occupation and AIDS death in the Brazilian Navy, 1991-1995.

Occupational groups/Job titles	All deaths (N = 2,586)	AIDS deaths (n = 125)	AIDS proportionate mortality (4.83%)	PMOR (95%CI) *
Referent **	–	–	–	1.00
Management	426	27	6.34	1.42 (0.92-2.21)
Secretarial	209	20	9.57	2.29 (1.39-3.78)
Musicians	60	3	5.00	1.04 (0.32-3.36)
Other	107	4	3.74	0.76 (0.27-2.09)
Combat/Weapons	544	23	4.23	0.84 (0.53-1.33)
Infantry	329	17	5.17	1.08 (0.64-1.83)
Artillery	131	3	2.29	0.45 (0.14-1.43)
Weapons	74	3	4.05	0.83 (0.26-2.67)
Mechanical/Metalworking	468	21	4.49	0.91 (0.56-1.47)
Mechanics and motors	348	15	4.31	0.87 (0.50-1.51)
Metallurgy	41	2	4.88	1.01 (0.24-4.23)
Other	77	4	5.19	1.08 (0.39-3.01)
Services	284	15	5.28	1.11 (0.64-1.93)
Cooks	71	2	2.82	0.56 (0.14-2.33)
Janitorial (p < 0.10)	160	12	7.50	1.66 (0.89-3.08)
Barbers	31	1	3.23	0.65 (0.09-4.83)
Communications/Electro-electronic	407	18	4.42	0.90 (0.54-1.49)
Electricians	109	4	3.67	0.74 (0.27-2.05)
Electronics	33	2	6.10	1.27 (0.30-5.39)
Sign operators	71	6	8.45	1.86 (0.79-4.38)
Communications	131	5	0.58	0.77 (0.31-1.92)
Radar operators	23	1	4.35	0.89 (0.12-6.69)
Construction/Repair	366	15	4.10	0.82 (0.47-1.42)
Deck operations	307	10	3.26	0.63 (0.33-1.22)
Other (p < 0.10)	48	5	10.42	2.34 (0.91-6.02)
Health care	91	6	6.59	1.41 (0.60-3.29)
Nurses	51	3	5.88	1.24 (0.38-4.03)
Physicians	25	2	8.00	1.72 (0.40-7.39)
Dentists	8	1	12.50	2.83 (0.35-23.16)

PMOR = proportionate mortality odds ratio.

* 95% confidence interval using Mantel-Haenszel method;

** Referent: all other occupations.

cific occupations^{9,10,11,12,15}. Noticeable, however, is the interaction with low rank, suggestive of an important role of hierarchy in sexual behavior in military institutions that needs to be addressed in future studies. Regarding occupation, a Brazilian study¹⁷ reported increased cumulative AIDS incidence among personal care workers, social scientists, writers, journalists, physicians, dentists, chemists, pharmacists, physicists, teachers, artists, sales personnel, and workers in port services and maritime and river transport. Greater risk of HIV infection has been observed among workers exposed to blood, body fluids, and infected materials, such as surgeons⁶, laboratory workers^{6,17}, and nurses⁶, common occupations in military settings. However, our results do not

show evidence of increased proportionate mortality in such jobs.

One major limitation of this study was the secondary nature of the data source. AIDS death recording could be underestimated due to AIDS-related stigma, which may occur more frequently among those with higher ranks, leading to relatively increased estimates in the low-ranking group. The study's results are also limited by the small number of cases and the lack of work-related sexual or drug use behavior, recognized as major risk factors for HIV transmission. Reserve corps servicemen may be engaged in other occupations, but this information was not available for this analysis. The proportionate mortality odds ratio should be affected by the death pat-

Table 3

Age-adjusted AIDS proportionate mortality odds ratios for the association with occupational groups/job titles according to naval rank.

Occupational groups/Job titles	Naval rank *	
	Low (n = 795) PMOR _{adjusted} (95% CI) **	High (n = 1,791) PMOR _{adjusted} (95% CI) **
Referent ***	1.00	1.00
Management	2.45 (1.27-4.71)	0.73 (0.36-1.47)
Secretarial	2.49 (1.22-5.08)	1.52 (0.66-3.51)
Musicians	3.03 (0.58-15.67)	0.60 (0.08-4.59)
Other	–	0.58 (0.17-1.97)
Combat/Weapons	0.42 (0.22-0.81)	1.01 (0.49-2.05)
Infantry	0.53 (0.27-1.04)	0.81 (0.31-2.13)
Artillery	0.60 (0.08-4.66)	0.82 (0.19-3.49)
Weapons	–	1.97 (0.58-6.63)
Mechanical/Metalworking	0.91 (0.45-1.81)	0.89 (0.42-1.87)
Mechanics and motors	1.04 (0.48-2.27)	0.83 (0.35-2.00)
Metallurgy	–	1.63 (0.36-7.30)
Other	0.86 (0.23-3.22)	0.62 (0.08-4.76)
Services	1.11 (0.53-2.32)	1.80 (0.69-4.72)
Cooks	0.38 (0.05-2.89)	2.56 (0.87-7.53)
Janitorial	2.61 (1.10-6.16)	2.14 (0.70-6.59)
Barbers	1.69 (0.20-14.17)	–
Communications/Electro-electronic	1.19 (0.55-2.58)	0.97 (0.46-2.04)
Electricians	1.99 (0.54-7.35)	0.48 (0.06-3.56)
Electronics	1.57 (0.15-16.82)	0.77 (0.10-5.93)
Sign operators	3.03 (0.75-12.17)	2.01 (0.58-6.98)
Communications	0.30 (0.04-2.35)	1.67 (0.58-4.83)
Radar operators	4.72 (0.31-72.75)	–
Construction/Repair	0.99 (0.44-2.20)	1.41 (0.61-3.24)
Deck operators	0.82 (0.31-2.18)	1.21 (0.46-3.17)
Other	1.78 (0.44-7.23)	2.52 (0.56-11.33)
Health care	2.71 (0.70-10.44)	0.99 (0.29-3.42)
Nurses	2.71 (0.70-10.44)	–
Physicians	–	1.80 (0.38-8.57)
Dentists	–	4.81 (0.46-49.92)

PMOR_{adjusted} = adjusted proportionate mortality odds ratio.

* Naval rank: low = soldiers, seamen, and petty officers; high = sergeants and officers;

** 95% confidence interval using Wald test;

*** Referent: all other occupations.

tern in the population and influenced by competing risks for each cause of death. Nonetheless, the age adjustment enabled better comparability with the referent group. The use of other deaths as the referent group has been questioned¹³, but it can reduce potential bias due to differential quality of information and access to diagnostic resources. The healthy worker effect¹³ was probably reduced in this study because deaths of all enlisted men were considered. Occupational changes following diagnosis were not plausible, since AIDS cases were withdrawn from duty immediately after diagnosis.

This study adds to the knowledge that there exists an excess of AIDS deaths among young low-ranking Brazilian Navy servicemen when secretarial/accounting or janitorial personnel are considered. It is plausible that power relations may affect sexual negotiation in military institutions, which highlights the need to conduct research aimed at a better understanding of the underlying factors for HIV transmission in this work environment, such as gender and education and its relations with the military hierarchy, a sensitive issue that needs to be addressed in further studies.

Resumo

Este estudo descreve a mortalidade proporcional por AIDS associada aos fatores ocupacionais na Marinha do Brasil. Inclui 2.586 certidões de óbitos de militares entre 20 e 72 anos, ocorridos em 1991-1995. Os dados de certidões de óbitos e história ocupacional foram obtidos nos arquivos do Serviço de Inativos e Pensionistas da Marinha. Utiliza-se como medida de associação odds ratio de mortalidade proporcional obtida por regressão logística não condicional. Estimou-se uma mortalidade proporcional por AIDS de 4,8% (n = 125) que aumentou no período, particularmente, entre os menores de 50 anos ou de nível hierárquico baixo. Nesta categoria, encontrou-se excesso relativo na mortalidade proporcional por AIDS nos grupos ocupacionais de "Administração" (odds ratio de mortalidade proporcional, ORMP_{ajustada} = 2,45; IC95%: 1,27-4,71), "Secretaria" (ORMP_{ajustada} = 2,49; IC95%: 1,22-5,08), e "Tatifeiros" (ORMP_{ajustada} = 2,61; IC95%: 1,10-6,16), comparados às demais ocupações. A mortalidade proporcional por AIDS esteve aumentada entre militares do sexo masculino, sendo elevada em algumas ocupações no nível hierárquico baixo. Todavia, distribuição de poder, questões de gênero e nível sócio-econômico necessitam de melhor investigação com desenhos apropriados.

Síndrome de Imunodeficiência Adquirida; Militares; Mortalidade

Contributors

All the authors contributed to the preparation of this article. M. Silva conducted the data collection, analysis, and interpretation and drafted the article. V. Santana collaborated in the analysis and interpretation, scientific design, and critical analysis of the manuscript, and I. Dourado conducted the critical review and analysis of the manuscript.

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