

## **How did the Brazilian military use to get sick before Covid-19? An analysis of the hospitalization profile of the active-duty personnel in the Brazilian Army Central Hospital from 1998 to 2018**

**Como os militares brasileiros adoeciam antes da Covid-19? Uma análise do perfil de internação dos militares da ativa no Hospital Central do Exército Brasileiro de 1998 a 2018**

**¿Cómo se enfermaron los militares brasileños antes del Covid-19? Un análisis del perfil de hospitalización del personal militar en servicio activo en el Hospital Central del Ejército Brasileño de 1998 a 2018**

Received: 10/04/2022 | Revised: 10/16/2022 | Accepted: 10/19/2022 | Published: 10/24/2022

**Pedro Henrique Della Garza Oiticica Moreira**

ORCID: <https://orcid.org/0000-0002-8555-7101>

University of Brasilia, Brazil

E-mail: [pedrooiticica@hotmail.com](mailto:pedrooiticica@hotmail.com)

**Rafael Andrade Diniz**

ORCID: <https://orcid.org/0000-0002-7189-6794>

Federal University of Juiz de Fora, Brazil

E-mail: [rafaelandradediniz@gmail.com](mailto:rafaelandradediniz@gmail.com)

**Arthur de Pinho Mendes da Silva**

ORCID: <https://orcid.org/0000-0001-6004-429X>

Federal University of Juiz de Fora, Brazil

E-mail: [arthurpmendess@gmail.com](mailto:arthurpmendess@gmail.com)

**Geraldo Magela da Silva Júnior**

ORCID: <https://orcid.org/0000-0001-8434-641X>

Federal University of Juiz de Fora, Brazil

E-mail: [gera1997.14@gmail.com](mailto:gera1997.14@gmail.com)

**Yan Gomes Nogueira de Sá**

ORCID: <https://orcid.org/0000-0002-6710-6649>

Federal University of Juiz de Fora, Brazil

E-mail: [yan.sa7@gmail.com](mailto:yan.sa7@gmail.com)

**Karolina Bortolini Magevski**

ORCID: <https://orcid.org/0000-0003-1081-1950>

Federal University of Juiz de Fora, Brazil

E-mail: [karolbortolini@gmail.com](mailto:karolbortolini@gmail.com)

**Danilo Bhering Martins**

ORCID: <https://orcid.org/0000-0003-2336-9209>

Federal University of Juiz de Fora, Brazil

E-mail: [daniolob.bhering@gmail.com](mailto:daniolob.bhering@gmail.com)

**Isis de Freitas Espescht**

ORCID: <https://orcid.org/0000-0002-9227-4513>

Federal University of Viçosa, Brazil

E-mail: [isisdefreitasespescht@gmail.com](mailto:isisdefreitasespescht@gmail.com)

**Waneska Alexandra Alves**

ORCID: <https://orcid.org/0000-0002-2893-8768>

Federal University of Juiz de Fora, Brazil

E-mail: [waneska.alves@gmail.com](mailto:waneska.alves@gmail.com)

**Milena de Oliveira Simões**

ORCID: <https://orcid.org/0000-0002-1088-7456>

University of Vale do Rio Doce, Brazil

E-mail: [mih.simoess@hotmail.com](mailto:mih.simoess@hotmail.com)

### **Abstract**

Background: The covid-19 pandemic showed how understanding the epidemiology of specific populations is extremely necessary for adequate health care. For this, it is necessary to know the health-disease profile of the military population (which differs from civilians), but free from the biases that the exceptional events of this catastrophe could

generate. Aims: The study aims to characterize the temporal trend and the profile of hospitalizations of active-duty military admitted to the Brazilian Army Central Hospital from 1998 January 1st to 2018 December 31st (before Covid-19 pandemic). Methodology: Analytical cross-sectional study with non-nominal secondary data from the records of the Hospital Information System of the Brazilian Army Central Hospital. Simple linear regression ( $p < 0.005$ ) and descriptive statistics were performed. Results: 20,292 hospitalizations were recorded in the period, of which 93.2% were for males (no change in time trend) and 6.2% were for female (with a significant increase in the historical series). Among males, the predominant age bracket was “21 to 30 years old” (44.5%), “brown” race (47.3%), “Corporals and Soldiers” ranks (61.8%) and hospitalized by the group of specialties of “Orthopedics, Traumatology, and Rheumatology” (33.9%). For females, the predominant age bracket was “31 to 40 years old” (51.4%), “white” race (55%), “Non-commissioned officers” ranks (58.9%) and hospitalized by the group of specialties “Gynecology and Obstetrics” (43, 1%). Conclusions: During the studied period, among the active-duty military personnel hospitalized, there was a predominance of males, young, Corporals and Soldiers with musculoskeletal impairment.

**Keywords:** Military health; Hospitalization; Health profile; Epidemiology; Cross-sectional studies.

### Resumo

Introdução: A pandemia por covid-19 mostrou como o entendimento da epidemiologia de populações específicas é extremamente necessário para uma assistência em saúde adequada. Para isso, é preciso conhecer o perfil saúde-doença da população militar (que difere da civil), mas livre dos vieses que os eventos excepcionais dessa catástrofe podem gerar. Objetivo: O estudo tem por objetivo caracterizar a tendência temporal e o perfil das internações de militares da ativa internados no Hospital Central do Exército Brasileiro no período de 1º de janeiro de 1998 a 31 de dezembro de 2018 (antes da pandemia de Covid-19). Metodologia: Estudo transversal analítico com dados secundários não nominais dos prontuários do Sistema de Informação Hospitalar do Hospital Central do Exército Brasileiro. Regressão linear simples ( $p < 0,005$ ) e estatística descritiva foram utilizadas. Resultados: No período, registraram-se 20.292 internações, sendo 93,2% do sexo masculino (para as quais não houve alteração na tendência temporal) e 6,2% para o sexo feminino (para as quais houve incremento significativo ao longo da série histórica). No sexo masculino houve predomínio da faixa etária de 21 a 30 anos (44,5%), raça/cor parda (47,3%), círculo dos Cabos e Soldados (61,8%) e conjunto de especialidades Ortopedia, Traumatologia e Reumatologia (33,9%). Para o sexo feminino houve predomínio da faixa etária de 31 a 40 anos (51,4%), raça/cor branca (55%), círculo dos Subtenentes e Sargentos (58,9%) e conjunto da Ginecologia e Obstetrícia (43,1%). Conclusão: No período estudado, dentre os militares internados, observou-se predominância do sexo masculino, jovens, Cabos e Soldados e com acometimentos musculoesqueléticos.

**Palavras-chave:** Saúde militar; Hospitalização; Perfil de saúde; Epidemiologia; Estudos transversais.

### Resumen

Introducción: La pandemia de covid-19 demostró cómo el conocimiento de la epidemiología de poblaciones específicas es necesario para una adecuada atención en salud. Para ello, es necesario conocer el perfil de salud-enfermedad de la población militar (diferente de la población civil), pero libre de los sesgos que pueden generar los eventos excepcionales de esta catástrofe. Objetivo: El estudio tiene que caracterizar la tendencia temporal y el perfil de las hospitalizaciones de militares en servicio activo ingresados en el Hospital Central del Ejército Brasileño (HCE) desde el 1 de enero de 1998 hasta el 31 de diciembre de 2018 (antes de la pandemia). Metodología: Estudio transversal analítico con datos secundarios no nominales de las historias clínicas del Sistema de Información Hospitalaria del HCE. Se utilizó regresión lineal simple ( $p < 0,005$ ) y estadística descriptiva. Resultados: En el período, hubo 20.292 hospitalizaciones, de los cuales el 93,2% eran hombres (no hubo cambio en la tendencia temporal) y el 6,2% eran mujeres (hubo un aumento significativo a lo largo de la serie histórica). Entre los hombres, predominó el grupo de edad entre 21 y 30 años (44,5%), mestizo/color (47,3%), Cabos y Soldados (61,8%) y un conjunto de especialidades Ortopedia, Traumatología y Reumatología (33,9%). En las mujeres predominó el grupo etario de 31 a 40 años (51,4%), raza/color blanco (55%), suboficiales y sargentos (58,9%) y grupo de Ginecología y Obstetricia (43, 1%). Conclusión: En el período estudiado, Entre los militares internados hubo predominio de hombres, jóvenes, cabos y soldados y con trastornos musculoesqueléticos.

**Palabras clave:** Salud militar; Hospitalización; Perfil de salud; Epidemiología; Estudios transversales.

## 1. Introduction

The factors related to the military's activity can influence the individual's health in different ways, determining specific conditions of illness that differentiate them from other professional categories (Dorneles et al., 2017). Among the main factors that contribute to the morbidity of this workforce are stress, which can trigger several psychiatric disorders (with particular attention to a post-traumatic stress disorder, depression, burnout syndrome, and suicide) (Nasioudis et al., 2015;

Chaves et al., 2018; Miao et al., 2018), the physical demands of operational and physical military training associated with the overload of equipment used for long displacements/patrols (leading to acute and chronic musculoskeletal injuries) (Milgrom et al., 1985; Lappe et al., 2001; Teodoro & Rosas, 2000; Torres et al., 2014) and the high prevalence of metabolic and cardiovascular diseases (Hilgenberg et al., 2016). However, while the work activity imposes hostile implications on the health of the military, the requirement of physical and health examinations during the selection, training, and career of professionals can provide positive consequences on their life expectancy, creating a paradoxical effect (Hartal et al., 2015).

The military in Brazil are in the Armed Forces (Brazilian Navy, Brazilian Army and Brazilian Air Force) or in the states' military police / states' military firemen. The Armed Forces are permanent and regular national institutions that are intended to defend the State, guarantee the constituted powers, and, if necessary, law and order (Constituição, 1988). To assist in its mission, the Brazilian Army has a Medical Corps which provides support to combatants and the civilian population in cases of exceptional need. Internally, the Medical Corps also assists military personnel, pensioners, and their dependents through the SAMMED system (Medical-hospital Care System for Military Personnel and their Dependents) (Brazil, 2022).

SAMMED assists approximately 750,000 people, counting on 29 hospitals, four polyclinics and 28 medical posts, besides 6,500 civilian health organizations and 3,500 autonomous health professionals (hired, associated, or accredited) (Brazil, 2022). In this context, the Hospital Central do Exército (Brazilian Army Central Hospital) (HCE) is inserted as the largest, oldest, and most complex military health organization in the system, being responsible for assistance in any kind of specialty.

The Covid-19 pandemic changed how the world sees health assistance and the importance of knowing how to allocate resources based in solid epidemiological data. Because of this, this study aims to understand the sociodemographic and clinical profile and the temporal trend of hospitalizations of the active-duty military personnel hospitalized in HCE from 1998 to 2018 as a way to help understanding the health-sickness process in the Brazilian military (free from the exceptionally negative impacts of Sars-Cov 2 from 2019 onwards).

## 2. Methodology

This is an analytical cross-sectional study carried out using non-nominal secondary data from the HCE hospital records in the period from 1998 January 1<sup>st</sup> to 2018 December 31<sup>st</sup>. The hospital was founded in 1769 and is the largest military health organization of the Brazilian Army, providing 30,000 to 40,000 monthly consultations to the 1<sup>st</sup> Military Region (Rio de Janeiro and Espírito Santo states) or other regions of Brazil in those cases where the local diagnosis and treatment abilities have been exhausted. Currently, with more than two thousand personnel (military and civilian) and 650 hospital beds in an 83,000 m<sup>2</sup> area, HCE also has health teaching and research programs (Nasioudis et al., 2015).

The source of the data was HCE's Hospital Information System (SisHCE). Together with HCE's Internal Monitoring and Control System, SisHCE provides the necessary information for the hospital's management: financial audit, patients evolution, storing data referring to specialties and administrative areas and diagnostic/logistical support.

The study only included the records of active military personnel - as considered by Law 6880 of December 9<sup>th</sup>, 1980. Excluded from the analysis were records of retired military personnel, dependents, pensioners, and military schools' students. The rank of field marshal was not considered in the study because it exists only in periods of war and the group of "special officers" was suppressed because there were no patients discriminated as officer aspirants in the evaluated database and the cadets/students were still in military schools. We also excluded those whose data showed incompatibility between the patient's age and rank (suggesting database error).

The study population was divided according to the "Circles and Hierarchical Scale in the Armed Forces" as follows: "General Officers" (four-stars generals, three-stars generals and two-stars generals), "Senior Officers" (colonels, lieutenant-colonels and majors), "Middle Officers" (captains), "Subaltern Officers" (first lieutenants and second lieutenants), "Non-commissioned Officers" (sergeants major, sergeants first class, sergeants second class and sergeants third class) and "Corporals and Soldiers" (Brazil, 1980).

SisHCE showed 48 medical specialties that were grouped according to the Department of Informatics of the Unified Health System of the Brazilian Ministry of Health based in the convergence of the area of practice, as follows: "Cardiology and Cardiovascular Surgery" (including cardiology, cardiac surgery, vascular surgery, angiology, and hemodynamics); "Orthopedics, Traumatology, and Rheumatology" (including, in addition to the specialties of the same name, hand surgery); "Neurology and Neurosurgery"; "Gynecology and Obstetrics" (including mastology).

Subspecialties of major areas of expertise were incorporated into the same group, according to the competence matrices made available by the Brazilian National Commission of Medical Residency (Brazil, 2022). On the other hand, subspecialties that have "Internal Medicine" and "General Surgery" as prerequisites were not grouped since they represent a vast area of performance as shown in the same competence matrices. Finally, specialties that have particular importance within the military, such as "Psychiatry" and "Plastic and Reconstructive Surgery", were highlighted (Dorneles et al., 2017; Nasioudis et al., 2015; Chaves et al., 2018; Miao et al., 2018; Foz et al., 2021).

The variables analyzed in the study were: 1- sociodemographic: year of hospitalization, age (age bracket), gender (male and female), race/color (white, black, brown, Asian and indigenous) and military rank (generals, colonels, lieutenant-colonels, majors, captains, first lieutenants, second lieutenants, sergeants major, sergeants first class, sergeants second class, sergeants third class, corporals and soldiers); 2- clinical (medical specialties): "Oncology", "Plastic and Reconstructive Surgery", "General Surgery", "Internal Medicine", "Gynecology and Obstetrics", "Hematology", "Neurology and Neurosurgery", "Orthopedics, Traumatology and Rheumatology", "Psychiatry" and "Other Specialties".

For data analysis, were applied descriptive statistical techniques such as frequency analysis, proportion, ratio, and means. To perform the time trend analysis, were applied the simple linear regression model with hospital mortality and hospitalization rates as the dependent variable and the year of hospitalization as the independent variable. The model is defined as  $Y = \alpha + \beta \text{ YEAR}$ , where  $\beta$  is the average annual increment for the period. A  $p$ -value  $< 0.05$  was considered significant. Microsoft Excel® 2016 and Epi Info 7.2TM software were used for data tabulation and analysis.

The study was approved by the Health Research Ethics Committee of the Federal University of Juiz de Fora under opinion number 4.391.924.

### 3. Results

During the studied period, 20,292 hospitalizations were documented, totaling an average of 960.9 per year (ranging from 696 in 2007 to 1,498 in 2018). There were no statistically significant changes regarding the time trend in the historical series when total hospitalizations were evaluated ( $p > 0.123$ ).

Of these hospitalizations, 93.2% ( $n = 18,918$ ) were males, with an average of 900.8 per year (ranging from 650 in 2007 to 1,312 in 2018), with no significant variation in the historical series ( $p > 0.526$ ). Females accounted for 6.2% ( $n = 1,261$ ) of hospitalizations, with an average of 60 per year (ranging from 12 in 1998 to 159 in 2016), with a statistically significant increase observed in their hospitalization records ( $p < 0.001$ ). There was an absence in the filling of the sex record in 0.6% ( $n = 113$ ) of the hospitalizations (Table 1).

**Table 1** – Analysis of the time trend of the number of hospitalizations.

1998 to 2018	Linear trend			
	Linear model	$\beta$ [IC95%]	R <sup>2</sup>	P value
Total hospitalizations	Y = 13,1x + 822,2	13,1 [-3,9 a 30,1]	0,12	> 0,123
Males' hospitalizations	Y = 4,7x + 849,1	4,7 [-10,5 a 19,9]	0,02	> 0,526
Females' hospitalizations	Y = 7,1x - 17,9	7,1 [5,4 a 8,7]	0,80	< 0,00000003

Source: HCE's hospital information system.

Regarding the sociodemographic variables for males, there was a predominance of records: age bracket "21 to 30 years old" (n = 8,417; 44.5%), "brown" (n = 8,941; 47.3%) and "white" races (n = 7,874; 41.6%). Regarding the "military ranks" variable, the largest number of records was observed for "Corporals and Soldiers" (n = 11689; 61.8%), followed by "Non-commissioned Officers" (n = 4440; 23.5%); "General Officers" represented the smallest number of records (n = 98; 0.5%).

The sociodemographic variables for females showed a higher frequency of records for: age bracket "31 to 40 years" (n = 648; 51.4%), "white" (n = 694; 55%) and "brown" race (n = 466; 37%). Regarding ranks, the largest number of records was for "Non-commissioned Officers" (n = 743; 58.9%), with "Corporals and Soldiers" representing the smallest group with records (n = 27; 2.1%); there were no members for the "General Officers" ranks (n = 0; 0%).

As for the medical specialties with the highest numbers of registrations, "Orthopedics, Traumatology and Rheumatology" (n = 6,411; 33.9%) stood out for males, representing the main set sought in all age ranges, ranks and races. This was followed by "General Surgery" (n = 2,418; 12.8%), "Plastic and Reconstructive Surgery" (n = 1,209; 6.4%), "Neurology and Neurosurgery" (n = 1,078; 5.7%), "Internal Medicine" (n = 922; 4.9%) and "Psychiatry" (n = 877; 4.6%) (Table 2). Among "Other Specialties" (n = 6,003; 31.7%), "Cardiology and Cardiovascular Surgery" (n = 6666; 3.52%) stood out.

**Table 2** – Distribution of admissions among males according to medical specialties, demographic and military variables.

Demographic and military variables	Orthopedics, Traumatology and Rheumatology N (%)	General Surgery N (%)	Plastic and Reconstructive Surgery N (%)	Neurology and Neurosurgery N (%)	Internal Medicine N (%)	Psychiatry N (%)	Other Specialties N (%)
<b>Race/Color</b>							
Asian	7 (0,1)	3 (0,1)	1 (0,1)	3 (0,3)	1 (0,1)	1 (0,1)	6 (0,1)
White	2.357 (36,8)	997 (41,2)	488 (40,4)	529 (49,1)	416 (45,1)	333 (38,0)	2.754 (45,9)
Brown	3.293 (51,4)	1.150 (47,6)	602 (49,8)	471 (43,7)	350 (38,0)	470 (53,6)	2.605 (43,4)
Black	752 (11,7)	267 (11,0)	116 (9,6)	75 (7,0)	154 (16,7)	73 (8,3)	638 (10,6)
Uninformed	2 (0,0)	1 (0,0)	2 (0,2)	0 (0,0)	1 (0,1)	0 (0,0)	0 (0,0)
<b>Age bracket</b>							
18 to 20 years	1.523 (23,8)	683 (28,2)	193 (16,0)	211 (19,6)	355 (38,5)	294 (33,5)	1.322 (22,0)
21 to 30 years	3.326 (51,9)	947 (39,2)	613 (50,7)	420 (39,0)	309 (33,5)	297 (33,9)	2.505 (41,7)
31 to 40 years	918 (14,3)	428 (17,7)	216 (17,9)	191 (17,7)	124 (13,4)	189 (21,6)	1.034 (17,2)
41 to 50 years	578 (9,0)	325 (13,4)	169 (14,4)	247 (22,9)	112 (12,1)	96 (10,9)	949 (15,8)
51 years or older	66 (1,0)	35 (1,4)	18 (1,5)	9 (0,8)	22 (2,4)	1 (0,1)	193 (3,2)
<b>Military rank</b>							
General Officers	29 (0,5)	8 (0,3)	5 (0,4)	3 (0,3)	7 (0,8)	0 (0,0)	46 (0,8)
Senior Officers	219 (3,4)	135 (5,6)	84 (6,9)	66 (6,0)	40 (4,3)	26 (3,0)	325 (5,4)
Middle Officers	170 (2,7)	82 (3,4)	49 (4,1)	49 (4,5)	17 (1,8)	19 (2,2)	281 (4,7)
Subaltern Officers	350 (5,5)	150 (6,2)	79 (6,5)	66 (6,0)	49 (5,3)	36 (4,1)	411 (6,8)
Non-commissioned Officers	1.304 (20,3)	579 (23,9)	291 (24,1)	330 (30,1)	182 (19,7)	248 (28,3)	1.506 (25,1)
Corporals and Soldiers	4.339 (67,7)	1.464 (60,5)	701 (58,0)	584 (53,2)	628 (68,0)	548 (62,5)	3.434 (57,2)
<b>Total</b>	6.411 (100,0)	2.418 (100,0)	1.209 (100,0)	1.078 (100,0)	922 (100,0)	877 (100,0)	6.003 (100,0)

Source: HCE's Hospital Information System.

For females, “Gynecology and Obstetrics” was responsible for the largest number of records (n = 544; 43.1%), especially in the 31-40 age bracket (n = 308; 56.6%), being closely related to the statistically significant increase in female

hospitalizations ( $R^2 = 0.80$ ;  $p < 0.001$ ). “Plastic and Reconstructive Surgery” ( $n = 137$ ; 10.9%), “Hematology” ( $n = 91$ ; 7.2%), “Orthopedics, Traumatology and Rheumatology” ( $n = 76$ ; 6.0%), “General Surgery” ( $n = 69$ ; 5.5%) and “Oncology” ( $n = 51$ ; 4.0%) were in the sequence. “Other Specialties” accounted for 22.4% of the records ( $n = 293$ ) (Table 3).

**Table 3** – Distribution of admissions among females according to medical specialties, demographic and military variables.

Demographic and military variables	Gynecology and obstetrics N (%)	Plastic and reconstructive surgery N (%)	Hematology N (%)	Orthopedics, Traumatology and Rheumatology N (%)	General Surgery N (%)	Oncology N (%)	Other Specialties N (%)
<b>Race/Color</b>							
Asian	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)
White	250 (46,0)	78 (56,9)	59 (64,8)	40 (52,6)	40 (58,0)	48 (94,1)	179 (61,1)
Brown	247 (45,4)	50 (36,5)	16 (17,6)	33 (43,4)	26 (37,7)	1 (2,0)	93 (31,7)
Black	47 (8,6)	9 (6,6)	16 (17,6)	3 (3,9)	3 (4,3)	2 (3,9)	21 (7,2)
<b>Age brackets</b>							
18 to 20 years	0 (0,0)	1 (0,7)	0 (0,0)	2 (2,6)	5 (7,2)	0 (0,0)	10 (3,4)
21 to 30 years	215 (39,5)	48 (35,0)	8 (8,8)	34 (44,7)	20 (29,0)	1 (2,0)	88 (30,0)
31 to 40 years	308 (56,6)	74 (54,0)	40 (44,0)	32 (42,1)	38 (55,1)	13 (25,5)	143 (48,8)
41 to 50 years	21 (3,9)	14 (10,2)	43 (47,3)	8 (10,5)	4 (5,8)	13 (25,5)	48 (16,4)
51 years or older	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	2 (2,9)	24 (47,1)	4 (1,4)
<b>Military rank</b>							
General Officers	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)
Senior Officers	18 (3,3)	6 (4,4)	24 (26,4)	10 (13,2)	6 (8,7)	29 (56,9)	48 (16,4)
Middle Officers	28 (5,1)	8 (5,8)	24 (26,4)	4 (5,3)	4 (5,8)	2 (3,9)	17 (5,8)
Subaltern Officers	101 (18,6)	40 (29,2)	15 (16,5)	25 (32,9)	15 (21,7)	2 (3,9)	65 (22,2)
Non-commissioned Officers	394 (72,4)	81 (59,1)	28 (30,8)	35 (46,1)	36 (52,2)	18 (35,3)	151 (51,5)
Corporals and Soldiers	3 (0,6)	2 (1,5)	0 (0,0)	2 (2,6)	8 (11,6)	0 (0,0)	12 (4,1)
<b>Total (%)</b>	544 (100,0)	137 (100,0)	91 (100,0)	76 (100,0)	69 (100,0)	51 (100,0)	293 (100,0)

Source: HCE’s Hospital Information System.

As for “Infectious Diseases”, when both genders were evaluated, there was low demand, especially in 2017 and 2018, which had only three and four hospitalizations, respectively. There was a decrease in records for this specialty ( $R^2 = \sim 0.67$ ) over the years as well as with the progression of the age brackets, representing approximately 8.0% of records among “18 to 20 years old” and reaching only 3.9%, 2.0%, 1.0% and 0.5% of hospitalizations performed in patients in the age brackets “21 to 30”, “31 to 40”, “41 to 50” and “51 years old or older”, respectively. “Oncology”, in turn, showed higher incidence in older age brackets, reaching, for females, 47.1% of hospitalizations in “51 years old or older”.

#### 4. Discussion

A constant temporal trend was identified with no significant changes in the number of hospitalization records of active-duty military personnel in HCE between January 1<sup>st</sup>, 1998 and December 31<sup>st</sup>, 2018. Interestingly, there was an

important discrepancy between records by gender, and while the total and male time trend showed stability (since males accounted for 93.2% of records, it deviated the total), the historical series for females showed a statistically significant increase ( $p < 0.001$ ) over the years.

The fact that only 6.2% of the admissions were of women is justified by the lower number of women in the Brazilian military, which in 2015 was only 3.2%. The discrete presence of women is explained by the relative modernity of their entry as career military personnel, with the first graduating class in 1992 (Rocha, 2018). In addition, the Brazilian Army pyramidal structure means that most of the military personnel are “Corporals and Soldiers” (as observed in the admissions profile), which, due to the norms for Brazilian military service, are mostly males (Zellmer & Lima, 2020).

The increase in female records over the years studied is mainly due to the gradual increase in the joining of the female segment in the Brazilian Army. Initially linked only to the auxiliary services, the segment currently also has military personnel in the war line, with the first female combatants having graduated in 2018 (Zellmer & Lima, 2020).

Demographically, for males, the distribution between “browns” (47.3%), “whites” (41.6%) and “blacks” (11%) corroborated the data of the Brazilian Institute of Geography and Statistics (IBGE) (2022) for the resident population in Brazil in 2019 (46.8% browns, 42.7% whites and 9.4% blacks). Observing what is found for the female segment, however, the situation changes to 55% “whites”, 37% “browns” and 8% “blacks”. One possible explanation is, again, the different profiles of military service for females and males. Most women join as commissioned officers or non-commissioned officers through auxiliary military schools that require previous professional qualifications; men, for the most part, will make up the ranks as enlisted through obligatory military service, not requiring previous specialized education (Zellmer & Lima, 2020). A better comparison, then, for the female segment, would be with the rate of entry into higher education in 2018 according to IBGE (2022) - with 53.2% whites and 35.4% blacks or browns.

The age ranges showed in the records by sex also varied according to the characteristics of the military service for each segment. While the majority of male records were for “21 to 30 years old” (44.5%), the majority of records for females were for “31 to 40 years old” (51.4%). Again, mostly, men join as combatants, either through compulsory military service, presenting themselves in the year they turn (IBGE, 2022), or through military academies, with a joining age limit of 24 years old (Brazil, 2022). Most women, however, join through auxiliary military schools, with some previous professional training, and the joining age limit can be as high as 40 years old (Zellmer & Lima, 2020; Brazil, 2022).

As for the variables by rank, the pyramidal structure meant that most of the male hospitalization records were at the bottom (“Corporals and Soldiers” totaled 61.8%), decreasing as the rank rises (“General Officers” totaled 0.5%) (Leirner, 1997). In concerning the female segment, the presence of the extremes was small or absent (2.1% of “Corporals and Soldiers” and no records for “General Officers”), with the majority of the records present in the “Non-commissioned Officers” and “Subaltern Officers” ranks (58.9% and 20.9%, respectively). One explanation for this lies in the legislation for compulsory military service, which disenfranchises women in peacetime, causing the few in the “Corporals and Soldiers” ranks to be temporary specialist corporals. The fact that there are no female generals is justified by the interstice time between ranks and by the fact that the first non-temporary women officers joined, in specialties that allowed them to attain these higher ranks, only in 1997, making the most graduated women in the Brazilian Army being, today, “Senior Officers” (Brazil, 2022).

Regarding the clinical variables, for males, the predominance of “Orthopedics, Traumatology, and Rheumatology” (33.9%) agreed with the scientific literature, which points to a higher incidence of musculoskeletal disorders in the military populations (Torres et al., 2014; Bravo et al., 2016; Pereira, 2020). Once joining the military, they are subjected to physical tests and training, military training and missions that demand high from the musculoskeletal system, together with the



mechanical overload of the weight of the equipment used for long periods during their activities; this set favors the appearance of musculoskeletal problems, acute and chronic (Lappe et al., 2001; Teodoro & Rosas, 2000; Pereira, 2020).

Following were “General Surgery” (12.8%), a broad set of specialties and, therefore, without much specificity, and “Plastic and Reconstructive Surgery” (6.4%) - also expected due to the need for reconstruction after accidents and/or injuries, having a significant incidence in the literature (Heppell, 2004). It is noteworthy that the study analyzed hospitalizations and not attendances, making surgical specialties to be favored due to their inherent relationship with postoperative hospitalization.

Despite the consistency so far, the low percentage (3.52%) of records for “Cardiology and Vascular Surgery” did not match the scientific literature since the prevalence of cardiovascular diseases among Brazilian active military personnel was supposed to be high (Medeiros & Mialski, 2020). Three possible explanations for this are: the study evaluated admissions and not consultations, overestimating acute effects over chronic ones; the institutional organization of HCE, to improve interdisciplinarity, redistributed patients among specialties (such as “Internal Medicine” with 4.9%); and the hospital created only in 2010 the “Cardiovascular Surgery” service until then referring patients to civilian hospitals (information given by the hospital command).

As for the female gender, it is essential to discuss how the time trend of the historical series also increased considerably the number of records by “Gynecology and Obstetrics”, being the most incident set of specialties in the female segment (61.2%). It is interesting to note that 56.6% were in the age bracket “31 to 40 years old”, correlating with the fertile age and the increase in the number of women who have been getting pregnant increasingly later, especially those with higher education (Deatsman, 2016).

For women, “Plastic and Reconstructive Surgery” also presented a high incidence (10.9%), but “Orthopedics, Traumatology, and Rheumatology” presented only 6.0% of the records, a much lower percentage than that seen in males, staying behind “Hematology” (7.2%). This discrepancy may be explained by the inherent differences in the military career between the genders, with females having a predominant role in auxiliary services and, therefore, non-combatants, moving away from the activities of greater risk for musculoskeletal aggravations (Rocha, 2018; Zellmer & Lima, 2020). In addition, it is necessary to evaluate that the number of male records was much higher than that of female records (approximately 15 to 1), making the impact of an isolated record on the percentage much greater for women.

Infectious diseases presented results that brought attention to both genders since in the historical series there was an evident decrease in the records over the years, even though the military is a group at risk for infectious diseases (Ho et al., 2014). Again, the main hypothesis is that it was a result of the dilution of the patients to other clinics in consequence of the multisystemic characteristics of the infectious process. It is important to be understood, particularly in regarding this specialty, that the study shows the clinical distribution before the Covid-19 era as a way to understand this profile without its bias.

The number of records for “Oncology” increases in older age brackets, even though overall its incidence was low (3.4%), which may have occurred because the study was limited to active military personnel, excluding the retired ones, and thus included only 1.8% of men and 2.4% of women in the “51 years of age or older” age bracket. This corroborates the findings in the literature for the increasing risk of oncological diseases with age advancing (INCA, 2019).

It is necessary to emphasize the relevance of the profile found by the fact that HCE is the largest military hospital in Brazil and receives patients referred from all over the country, thus being the most appropriate health organization to conduct a representative and accurate study. In addition, a considerable sample size and a twenty-year historical series ending in the last year before the Covid-19 pandemic (from 1998 to 2018) were evaluated, thus preventing the results from being affected by the disease. These findings may serve as relevant material for epidemiological surveillance both in contexts where coronavirus is disregarded and in post-pandemic contexts as a mean of identifying its impact on this working class.

Every line of research begins with observation for later analysis and hypothesis development and testing. Additionally, regarding the health of the active military of the Brazilian Army, this basic literature has not yet been consolidated - and this is where the importance of observational studies lies. This is a professional category that requires differentiated attention and understanding its factors of illness is vital for the formulation of policies that lead to improvements in the soldier's health, and, in consequence, in the national security. In dealing with hospitalizations specifically, the study focuses on an event of great impact on federal resources allocation.

More than that, any individual study of a particular national armed force is of great importance for understanding the military sciences as a whole. The military profession has intrinsic similarities regardless of the nation (especially when troops are moved geographically) and, by comparing and evaluating how other countries are affected and deal with certain challenges, it is possible to absorb good ideas and reject what has not worked (as the pandemic has demonstrated).

The study has, however, the limitation of using secondary data. In turn, the long period studied can also be a biasing factor for the analysis of clinical variables since the hospital underwent inevitable protocol updates, interfering in the distribution of admissions and leading to inclusion, exclusion or association of services. Throughout this time there were also changes in the legislation for the military career, which may lead to a bias in the selection of records since the methodology was based on what was in force at the end of the historical series (2018). Finally, despite the characteristics of HCE, any generalization of the results obtained for the Brazilian military as a whole should be done with caution since the country comprises very distinct regions within their own epidemiological scenarios.

## 5. Conclusion

It is concluded that the hospitalization profile of active military personnel in Brazilian Army Central Hospital is predominantly male, young, "Corporals and Soldiers", of "brown" race and with affections related to "Orthopedics, Traumatology and Rheumatology". However, there has been a significant increase in the number of hospitalizations for females over the years, with their own profile, being predominant women in middle age, "Non-commissioned Officers", "whites" and more frequently hospitalized in "Gynecology and Obstetrics".

The study allows us to better understand the factors that lead to hospitalization - an event of gravity and financial importance - of the Brazilian Army military and thus help to develop base literature on the subject - still scarce. This is essential for the subsequent elaboration of hypotheses and consequent intervention with adequate health policies that will have a direct and indirect impact in the Brazilian soldier's health and also in the global military sciences in general.

Therefore, it is suggested that other observational epidemiological studies be carried out in other Brazilian Army's facilities (and even other national forces) to improve the robustness of the literature on the subject. It's also suggested that analytical studies should be done, based on these, to develop hypotheses and proposals for intervention in the healthcare of the military personnel.

## References

Brazil. Lei nº 6.880, de 9 de dezembro de 1980. (1980). Dispõe sobre o Estatuto dos Militares. [http://www.planalto.gov.br/ccivil\\_03/leis/16880.htm#:~:text=LEI%20N%C2%BA%206.880%2C%20DE%209%20DE%20DEZEMBRO%20DE%201980&text=Disp%C3%B5e%20sobre%20o%20Estatuto%20dos%20Militares.&text=Art.,dos%20membros%20das%20For%C3%A7as%20Armadas](http://www.planalto.gov.br/ccivil_03/leis/16880.htm#:~:text=LEI%20N%C2%BA%206.880%2C%20DE%209%20DE%20DEZEMBRO%20DE%201980&text=Disp%C3%B5e%20sobre%20o%20Estatuto%20dos%20Militares.&text=Art.,dos%20membros%20das%20For%C3%A7as%20Armadas).

Brazil. Ministry of Education. (2022). Matrizes de Competências Aprovadas pela CNRM. <http://portal.mec.gov.br/publicacoes-para-professores/30000-uncategorised/71531-matrizes-de-competencias-aprovadas-pela-cnrm>.

Brazil. Ministry of Defense. (2022). A História da Mulher no Exército. [https://www.eb.mil.br/web/ingresso/mulheres-no-exercito/-/asset\\_publisher/6ssPDvxqEUR1/content/a-historia-da-mulher-no-exercito?inheritRedirect=false&redirect=https%3A%2F%2Fwww.eb.mil.br%3A443%2Fweb%2Fingresso%2Fmulheres-no-exercito%3Fp\\_id%3D101\\_INSTANCE\\_6ssPDvxqEUR1%26p\\_p\\_lifecycle%3D0%26p\\_p\\_state%3Dnormal%26p\\_p\\_mode%3Dview%26p\\_p\\_col\\_id%3Dcolumn-1%26p\\_p\\_col\\_count%3D1](https://www.eb.mil.br/web/ingresso/mulheres-no-exercito/-/asset_publisher/6ssPDvxqEUR1/content/a-historia-da-mulher-no-exercito?inheritRedirect=false&redirect=https%3A%2F%2Fwww.eb.mil.br%3A443%2Fweb%2Fingresso%2Fmulheres-no-exercito%3Fp_id%3D101_INSTANCE_6ssPDvxqEUR1%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-1%26p_p_col_count%3D1).

- Brazil. Ministry of Defense. (2022). Como ingressar - Militar de Carreira. <http://www.eb.mil.br/web/ingresso/militar-de-carreira>.
- Brazil. Ministry of Defense. (2022). Fundo de Saúde do Exército - FUSEX. <https://www.eb.mil.br/web/interno/fusex>.
- Bravo, D. S., Barbosa, P. M. K., & Calamita, Z. (2016). Absenteísmo e envelhecimento no contexto ocupacional do Policial Militar. *Rev Bras Med Trab*, 14(2), 134-42. doi: 10.5327/Z1679-443520161915
- Chaves, M. S. R. S., & Shimizu, I. S. (2018). Síndrome de burnout e qualidade do sono de policiais militares do Piauí. *Revista Brasileira de Medicina do Trabalho*, 16(4), 436-441. doi: 10.5327/Z1679443520180286
- Constituição da República Federativa do Brasil de 1988. (1988). [http://www.planalto.gov.br/ccivil\\_03/constituicao/constituicao.htm](http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm)
- Deatsman, S., Vasilopoulos, T., & Rhoton-Vlasak, A. (2016). Age and fertility: a study on patient awareness. *JBRA assisted reproduction*, 20(3), 99-106. doi: 10.5935/1518-0557.20160024
- Dorneles, A. J. A., de Lima Dalmolin, G., & de Souza Moreira, M. G. (2017). Saúde do trabalhador militar: uma revisão integrativa. *Revista Enfermagem Contemporânea*, 6(1), 73-80. <https://doi.org/10.17267/2317-3378rec.v6i1.1220>
- Fox, J. P., Markov, N. P., Markov, A. M., O'Reilly, E., & Latham, K. P. (2021). Plastic surgery at war: a scoping review of current conflicts. *Military Medicine*, 186(3-4), e327-e335. doi: 10.1093/milmed/usaa361
- Hartal, M., Kreiss, Y., & Yavnai, N. (2015). Relative longevity among retired military personnel: a historical-cohort study. *Military Medical Research*, 2(1), 1-6. doi: 10.1186/s40779-015-0057-y
- Heppell, P. S. J. (2004). Plastic surgery. *BMJ Military Health*, 150(1), 41-51. <https://militaryhealth.bmj.com/content/150/1/41>
- Hilgenberg, F. E., Santos, A. S., de Carvalho, A., Silveira, E. A., & Cominetti, C. (2016). Fatores de risco cardiovascular e consumo alimentar em cadetes da Academia da Força Aérea Brasileira. *Ciência & Saúde Coletiva*, 21, 1165-1174. <https://doi.org/10.1590/1413-81232015214.15432015>
- Ho, Z. J. M., Hwang, Y. F. J., & Lee, J. M. V. (2014). Emerging and re-emerging infectious diseases: challenges and opportunities for militaries. *Military Medical Research*, 1(1), 1-10. <https://doi.org/10.1186/2054-9369-1-21>
- IBGE. (2022). Biblioteca. <https://biblioteca.ibge.gov.br/>
- INCA - Instituto Nacional do Câncer José Alencar Gomes da Silva. (2020). *ABC do câncer: abordagens básicas para o controle do câncer*. Rio de Janeiro: Instituto Nacional do Câncer – INCA. [https://www.inca.gov.br/sites/ufu.sti.inca.local/files//media/document/livro\\_abc\\_6ed\\_0.pdf](https://www.inca.gov.br/sites/ufu.sti.inca.local/files//media/document/livro_abc_6ed_0.pdf)
- Medeiros, R. G. D., & Mialski, L. A. F. D. O. (2020). Medidas preventivas para doenças cardiovasculares em militares da ativa do Exército Brasileiro. <http://bdex.eb.mil.br/jspui/handle/123456789/7628>
- Miao, X. R., Chen, Q. B., Wei, K., Tao, K. M., & Lu, Z. J. (2018). Posttraumatic stress disorder: from diagnosis to prevention. *Military Medical Research*, 5(1), 1-7. doi: 10.1186/s40779-018-0179-0
- Milgrom, C., Giladi, M., Kashtan, H., Simkin, A., Chisin, R., Margulies, J., ... & Stein, M. (1985). A prospective study of the effect of a shock-absorbing orthotic device on the incidence of stress fractures in military recruits. *Foot & ankle*, 6(2), 101-104. doi: 10.1177/107110078500600209
- Nasioudis, D., Palaiodimos, L., Dagiasis, M., Katsarou, A., & Nturos, E. (2015). Depression in military medicine cadets: a cross-sectional study. *Military Medical Research*, 2(1), 1-5. doi: 10.1186/s40779-015-0058-x
- Lappe, J. M., Stegman, M. R., & Recker, R. R. (2001). The impact of lifestyle factors on stress fractures in female Army recruits. *Osteoporosis international*, 12(1), 35-42. doi: 10.1007/s001980170155
- Leimer, P. D. C. (1997). Meia-volta, volver: um estudo antropológico sobre a hierarquia militar. *Revista de Antropologia*, 41(1), 71-111. <https://doi.org/10.1590/S0034-77011998000100008>
- Pereira, F. J. C. (2020). Lesões musculoesqueléticas em militares do Exército Brasileiro: epidemiologia e prevenção. <http://bdex.eb.mil.br/jspui/handle/123456789/5500>
- Rocha, S. (2018). A presença das Mulheres nas Forças Armadas Brasileiras: Uma análise da sua inserção e os desafios atuais. *Revista de Iniciação Científica em Relações Internacionais*, 6(11), 109-125. <https://doi.org/10.22478/ufpb.2318-9452.2018v6n11.41274>
- Teodoro, H. C., & Rosas, R. F. (2000). Prevalência de lesões musculoesqueléticas no treinamento físico militar do 63º batalhão de infantaria de Tubarão/SC. <https://docplayer.com.br/110682713-Universidade-do-sul-de-santa-catarina-henrique-cargnin-teodoro.html>
- Torres, A. S., Ferrari, D. M., Cirolini, V. X., Valente, A. M. D. S., & Muniz, A. M. D. S. (2014). Análise do impacto do tênis e coturno fornecidos pelo Exército Brasileiro durante a marcha. *Revista Brasileira de Educação Física e Esporte*, 28, 377-385. <https://doi.org/10.1590/1807-55092014000300377>
- Zellmer, G. N., & Lima, L. C. X. G. (2020). O ingresso do segmento feminino no Exército Brasileiro. [https://bdex.eb.mil.br/jspui/bitstream/123456789/7604/1/ART\\_ZELLMER\\_LUANA%20XAVIER\\_CFO.pdf](https://bdex.eb.mil.br/jspui/bitstream/123456789/7604/1/ART_ZELLMER_LUANA%20XAVIER_CFO.pdf)