Original Research Article

Differences between activities profiles executed by the police officers in Brazil as a determinant factor for higher rate mortality

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The association between police occupation and deaths has not been well studied. Here, we evaluate the mortality rate and the Years of Life Lost (YLL) within two police corporations in the Brazilian Federal District (BFD). Mortality data were collected from the personnel divisions of both police institutions – Civil (CPBFD) and Military (MPBFD) – between 2004 and 2013 related to professionals who died, comparing with the mortality data of the BFD population; chi-square independence tests were analyzed and statistical tests applied assuming a 5% significance level. Mostly of the deaths occurred among retired police officers (p<0.001) in the MPBFD, whilst active being 2.5 times greater than in the CPBFD; the average of YLL within the MPBFD is the largest (24.4), followed by the BFD (22.3) and the CPBFD (18.2). The MP is responsible for ostensive policing, with a greater exposure to traumatic events; the CP is involved with crime investigations, dealing with documents. Depending of the activities executed, police officer may be considered an unsafe occupation, being the mortality and the YLL greater than the general population. The results suggest the need for further studies which address the morbidity and mortality of the police officers.

Key words: Police officers, occupational mortality, years of life lost.

INTRODUCTION

Police officers serve a vital role in maintaining safety and order in Brazil as in any place in the world. In order to combat crime and violence, these professionals of public security are often exposed to risks and tragic events, along with the challenge to remain resilient (Minayo, 2007). The World Health Organization (WHO, 2016) defines health as a state of complete physical, mental and social well-being, not being restricted to the absence of disease. Thus, lifestyle and the type of work carried out by the police both have an impact on health and consequently on mortality, and therefore should be taken into consideration.

Some international epidemiological studies have examined the association between the police occupation and the health profiles of the law enforcement agents. For example, Richmond et al. (1998) examined the prevalence of five life-style behaviors (alcohol consumption, cigarette smoking, inadequate exercise, perception of being overweight and stress) among New South Wales police officers. The results showed that a sizeable majority (83%) of police officers had at least one unhealthy life-style

behavior with 19% reporting 3-5 unhealthy factors. Charles et al. (2007) investigated the association between shift work and sleep problems among police officers from Buffalo, New York, finding that night shift work was significantly associated with snoring and a loss of sleep. Similarly, other studies (Fekedulegn, 2013; Schernhammer, 2011) concluded that shiftwork is associated with sickness absence, with officers working night shifts having elevated incidences of sick leave. Other studies investigated health disparities among police officers (Hartley, 2011; Violanti, 2006), showing that these professionals have one of the poorest cardiovascular disease profiles of any occupation and present slightly lower flow-mediated dilation, lower carotid intima-media thickness, elevated body-mass index, and higher reported rates of depression and post-traumatic stress disorder. A group of Finnish police was followed for 15 years with the aim of evaluating changes in lifestyle, as well as physical fitness and body composition (Sörensen, 2000). The results revealed that in the last year, 51% of the individuals had become overweight and 27% had developed cardiovascular disease.

Studies conducted in Brazil (Costa, 2007; Minayo, 2011; Minayo, 2010; Jesus, 2014) relate the physical and psychosocial pre-provision health problems in police, especially the relationship between stress and professional activities, as they are among those who suffer the most stress. In the State of Rio Grande do Norte, 47.4% of the military professionals have had certain levels of stress (Costa, 2007). In the State of Rio de Janeiro, 33.6% of the military police officers and 20.3% of the civil police officers have had some kind of mental suffering (Minayo, 2011) and more than 60% of these professionals are overweight, 32% above the Brazilian population average (Minayo, 2010). In the State of Bahia, the cardiovascular risk among military police is high among male police officers who have no habit of regular physical exercise and are in the profession the longest (Jesus, 2014).

However, there are not many papers concerning deaths within the police. As an example, Kyriacou et al. (2006) compared police deaths between New York and London during the twentieth century. It was found that both intentional and unintentional occupational mortality rates were greater in New York due to several socioeconomic, cultural, and occupational factors. Violanti et al. (1998) carried out an updated retrospective cohort mortality study of male police offices in Buffalo, New York, from 1950 to 1990 and the results showed significantly higher than expected mortality rates among various causes. In another study, Violanti and collaborators (2013) compared life expectancy of male police officers from Buffalo, New York, with the U.S. general male population, showing that, on average, the life expectancy of police officers was 21.9 years lower than the U.S. population in general, being more pronounced in younger age categories. Furthermore, the authors found that the years of potential life lost for police officers was 21 times larger than those of the general population. In a more recent paper, Vena et al. (2014) conducted a retrospective cohort mortality study on police

officers from Buffalo, New York, between 1950 and 2005, finding that the mortality rate for white male officers, from all causes of death combined, was significantly higher than expected; for black officers it was lower than expected and female officers had an elevated all-cause mortality. A study conducted by Plani et al. (2003) on South African police officers on duty showed the need to improve personal protection in order to reduce deaths and injuries among their members.

Apropos, we did not find studies about Brazilian police deaths, which are capable of answering the question: "Should police work be considered an unsafe occupation, being that the mortality rate and/or the years of life lost are greater than those of the general population?" Therefore, the purpose of this paper was to evaluate, primarily, the mortality rate and the years of life lost (YLL) by mortality within two police corporations which act within the Brazilian Federal District, in order to contribute to the scientific knowledge on the health and epidemiology of Brazilian police officers.

MATERIALS AND METHODS

The Brazilian Federal District (BFD), located in the central-western part of the country, is one of 27 Brazilian Federal Units and includes the capital, Brasilia. It encompasses an area of 5,800km^2, and in 2015 the population was approximately 2.9 million, with a slight predominance of females (approximately 52%) (IBGE, 2016).

There are two types of police corporation, both part of the country's Public Safety System, which work in the BFD:

• The Civil Police of the Brazilian Federal District (CPBFD): responsible for promoting public safety through the elucidation of criminal offenses and the performance of the function of judicial police, i.e. the taking charge of criminal investigations. The CPBFD is responsible for investigating crimes, gathering clues, carrying out forensic activities, acting immediately after the commitment of crimes; it also issues identity documents, country-wide weapon registrations and criminal records.

• The Military Police of the Brazilian Federal District (MPBFD): accountable for the support of safety and welfare through the prevention and suppression of crimes and violence, i.e. the execution of ostensible policing. It consists of uniformed police officers responsible for preventing criminal conduct and taking care of public order by patrolling streets and neighborhoods.

Data Collection

Data were collected directly from the Personnel Divisions of both institutions for the period between 2004 and 2013. Two tables were provided: one relating to professionals who died after retirement (providing date of birth, gender, date of admission, responsibility, retirement date and date of death) and one concerning those who died during active service (providing date of birth, gender, date of admission,

responsibility and date of death). In addition, the quantities of civil and military police officers in active service at the beginning of each year investigated were obtained from the Ministry of Planning website, Development and Management section (MPDG, 2016).

BFD population mortality data, categorized by age group and year of death (2004-2013), as well as the total number of inhabitants in each studied year, were accessed from the public database of the IT Department of Brazil's universal public health care organization, DATASUS (SUS, 2016). The life expectancies for each age in the studied years were extracted from the mortality table developed by the Brazilian Institute of Geography and Statistics, IBGE (2016), which follows Brazil's mortality patterns.

Methods

Based on collected data, it was possible to calculate, for each category as a function of the year of death, the age first employed, the years of service given (for retired police officers and for active officers), the age at retirement, the years lived after retirement and the age at death (for retired police officers and for active officers). Furthermore, it was possible to ascertain, for each year of interest, the mortality rates and the Years of Life Lost (YLL) for both police corporations and for the BFD population in general. The YLL data were obtained as follows:

$$YLL = \frac{\sum(d_x^n . E_x^n)}{\sum(d_x^n)}$$

Where d_x^n is the total number of individuals who died in each studied age interval; $(x, x + n)$ is the life expectancy for the average age for each age interval considered; and $\sum()$ is the summation over all the age intervals. It is noteworthy that the beginning of all age intervals was $x = 20$ years old, since this is generally the starting age for police officers in the BFD. Moreover, the length of each age interval was $n = 5$ years, so as to coincide with the age categories defined in the BFD mortality tables (Arca, 1988).

Statistical Analysis

Chi-square independence tests were analyzed to compare numbers of deaths for the studied police forces, by gender and period of death. Since the two population variances may or may not be significantly different in the two-sample test for variance, different statistical tests were applied: the two-sample t-test and Welch's unequal variance t-test. All statistical tests were performed assuming a 5% significance level. Data were analyzed using *Origin Pro 9* software.

RESULTS

The first part of Table 1 provides the total numbers of deaths, n, for all police forces acting in the Brazilian Federal

District, which occurred during the decade, investigated (2004-2013). As can be seen, the great predominance of deaths were among males ($p<0.001$), inherent in the Brazilian police forces, which have a prevalence of males. Moreover, deaths occurred mostly among retired police officers ($p<0.001$), with the probability of death in the MPBFD whilst active being approximately 2.5 times greater than that in the CPBFD.

The second part of Table 1 provides the means and standard deviations for some demographic characteristics of dead police officers. With the exception of age at death for active officers, who die at around 42-43 years old, the means of all other characteristics analyzed are statistically significant between the MPBFD and the CPBFD ($p<0.05$). On the one hand, in the MPBFD, the age first employed is 4.5 years younger than that in the CPBFD and the age at retirement is 6.4 years earlier. This is because, on average, members of the MPBFD work 2.2 years less than those in the CPBFD. However, even though members of the MPBFD live for two years more after retirement, for those in the CPBFD, the age of death is 8.2 years older. In addition, the average age of death for the general population of the Brazilian Federal District was 61.6 years (in the period studied), being greater than that of the population of the MPBFD (58.3 years), but smaller than that of the CPBFD (66.5 years).

Table 2 compares the percentages of deaths by age group between both police forces and the general population of the Brazilian Federal District (BFD). It is interesting to note, first, that in both institutions, the proportion of people who die over the age of 80 is much lower than in the BFD (about half); in contrast, the proportion of people who die young (age below 30) is much lower than in the BFD. Moreover, in the MPBFD, the critical age groups are 35-39, 40-44 and 45-49 (2 times, 1.8 times and 2 times more than in the BFD, respectively), i.e. active officers. In the CPBFD, the critical age groups are 65-69 and 70-74 (1.7 times and 2.4 times more than in the BFD), i.e. retired police officers.

The numbers of deaths, mortality rates and years of life lost (YLL) for each population (BFD, MPBFD and CPBFD) are shown in Table 3 as a function of the years investigated. As can be seen, the mortality rates for all populations are approximately constant in the studied period, except for a few outliers. However, the average mortality rate within the MPBFD (4.1/1,000) is lower than that found in the CPBFD (5.8/1,000) which in turn is lower than that found in the BFD (6.9/1,000). On the other hand, the YLL for all groups is, in general, decreasing over the years, with the CPBFD data being more pronounced. Furthermore, the average value of YLL within the MPBFD is the largest (24.4), followed by that of the BFD (22.3) and then the CPBFD (18.2).

The data shown in Figure 1 compare the ages of death among members of the BFD, the MPBFD and the CPBFD by year of death. A slightly greater inclination in the CPBFD data can be seen compared to the others. As mentioned earlier, on average, police officers from the MPBFD die younger than the average population of the BFD, who in

Table 1. Numbers of deaths for the studied police forces by gender and period of death, and means and standard deviations for some demographic characteristics of police officers who died between 2004 and 2013.

	MPBFD (n = 754)		CPBFD (n = 399)		p-value§
	N	**%**	**N**	**%**	
Gender					<0.001
Male	750	99.5	376	94.2	
Female	4	0.5	23	5.8	
Death Period					<0.001
Retired police officers	516	68.4	346	86.7	
Active officers	238	31.6	53	13.3	
	Mean	**SD**	**Mean**	**SD**	**p-value§§**
Age first employed (years)	23.3	3.6	27.8	6.4	<0.001
Years of service					
Retired police officers	21.9	8.0	24.1	7.8	<0.001
Active officers	19.4	8.6	15.7	7.7	0.005
Age at retirement (years)	45.5	8.5	51.9	8.5	<0.001
Years lived after retirement	20.2	13.0	18.2	9.1	0.006
Age at death (years)*	58.3	16.1	66.5	13.6	<0.001
Retired police officers	65.7	12.9	70.1	10.6	<0.001
Active officers	42.2	9.0	43.2	6.4	0.325

All statistical tests were performed assuming a 5% significance level.
§ P-values are from Chi-square independence tests comparing "male" and "female", as well as "retired police officers" and "active officers" in each police force.
§§ P-values are from the two-sample t-test (Welch's unequal variance t-test and the Mann-Whitney test, depending on whether the two population variances are or are not significantly different, respectively) for differences between MPBFD and CPBFD.
* The average age at death for the Brazilian Federal District population was 61.6 years, considering only the population aged over 19 years, for the same period (2004-2013).

Table 2. Police officers' deaths by age group for the studied police forces compared with the general population of the Brazilian Federal District (BFD).

Age Group (years)	BFD* (%)	MPBFD (%)	CPBFD (%)	MPBFD/BFD Ratio	CPBFD/BFD Ratio
20-24	3.7	0.0	0.0	0.0	0.0
25-29	3.8	1.7	0.0	0.5	0.0
30-34	3.9	4.6	0.8	1.2	0.2
35-39	4.4	8.6	2.8	2.0	0.6
40-44	5.2	9.5	6.5	1.8	1.3
45-49	6.1	12.5	7.3	2.0	1.2
50-54	6.8	8.5	5.8	1.3	0.9
55-59	7.7	9.5	4.5	1.2	0.6
60-64	8.4	9.2	6.0	1.1	0.7
65-69	9.4	6.1	15.8	0.6	1.7
70-74	9.9	8.6	23.9	0.9	2.4
75-79	9.7	10.7	14.1	1.1	1.4
≥ 80	21.0	10.3	12.6	0.5	0.6

* Considering only the population aged over 19 years, for the same period (2004-2013).

turn, also die earlier than members of the CPBFD.

DISCUSSION

This study is considered to be a pioneering one, being the first to analyze an historical series of mortality data within the populations of the Brazilian police forces (in this case only in the BFD) comparing the rates and averages of deaths among the two existing police corporations and also within the general BFD population.

These results may be explained by multiple factors, since

Table 3. Number of deaths, mortality rate and years of life lost (YLL) for each population – BFD, MPBFD and CPBFD.

Year	BFD				MPBFD				CPBFD			
	Population*	Deaths*	Rate (1,000)	YLL	Officers	Deaths	Rate (1,000)	YLL	Officers	Deaths	Rate (1,000)	YLL
2004	1,440,599	10,339	7.2	23.1	18,830	70	3.7	24.8	6,738	21	3.1	18.9
2005	1,486,666	10,160	6.8	22.8	18,464	63	3.4	26.1	6,648	61	9.2	20.2
2006	1,533,760	10,445	6.8	22.6	18,056	70	3.9	23.7	6,352	36	5.7	18.7
2007	1,581,550	10,900	6.9	22.6	17,857	74	4.1	25.1	6,258	36	5.8	17.4
2008	1,630,832	11,355	7.0	22.6	17,762	81	4.6	24.2	6,200	32	5.2	19.1
2009	1,682,859	11,493	6.8	22.8	17,745	75	4.2	24.8	6,026	41	6.8	18.6
2010	1,738,568	12,041	6.9	22.0	17,667	85	4.8	24.2	8,252	41	5.0	19.3
2011	1,796,817	12,468	6.9	21.7	18,860	68	3.6	24.8	7,386	35	4.7	15.4
2012	1,856,226	12,523	6.7	21.7	18,795	83	4.4	26.1	7,436	34	4.6	16.0
2013	1,916,651	12,542	6.5	21.5	18,820	85	4.5	20.7	7,389	61	8.3	18.3
Average			**6.9**	**22.3**	**Average**		**4.1**	**24.4**	**Average**		**5.8**	**18.2**
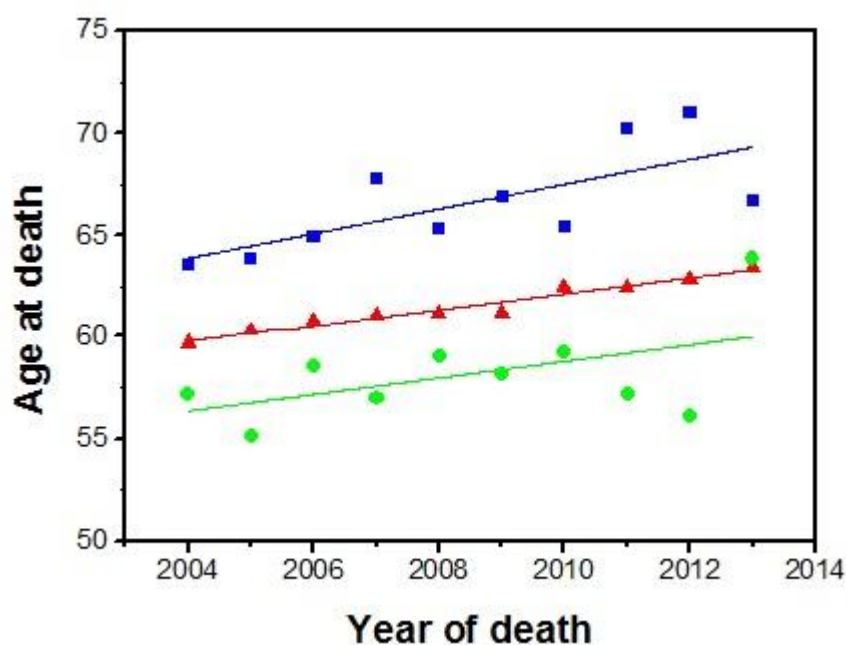
Figure 1. Age at death as a function of year of death. The lines provided are for visual guidance only. Average values: ■ CPBFD - 66.5 years, ▲ BFD - 61.6 years, ● MPBFD - 58.3 years.

the two groups of police officers are involved in distinct work. The MP is responsible for ostensive policing, with a greater exposure to traumatic events, and therefore risks and injuries, physical and psychological. On the other hand, the CP is involved with crime investigations, dealing with documents such as criminal records and identification papers, and is also responsible for criminal forensics. Thus, the differences between the profiles of the activities executed by each kind of police officer, may influence YLL statistics among the MP and the CP.

It is mostly the MP, which has direct contact with violence. The CP carries out more scientific and bureaucratic work, which probably justifies mortality rates closer to those of the BFD population.

Although causes of death are not an objective of this study, Brazilian studies have shown that Brazilian military police experience an increased mortality mainly from physical trauma resulting from the execution of their profession.

Injuries by firearms and trauma have been identified by both the civil and military police of Rio de Janeiro as the most common physical illnesses in their daily work (Minayo, 2011). It isn't only in Brazil, since these differences are observed in other countries with different

developmental profiles. In this regard, a recent North American study showed that police have ready access to weaponry and are considered to be at high risk of experiencing work-related trauma (Stuart, 2008).

In the USA, during the 10 year period of 1988 through 1997, 688 police officers were intentionally killed and almost all of these (633, or 92%) victims died from gunshot injuries. In the general US population, homicides are not among the top ten causes of death, which shows the police's high exposure to trauma (NLEOMF, 2016).

Brazilian studies have also shown that deaths among police officers don't occur only when they are working on the streets. It was shown that when morbidity and mortality were linked to the work of 4,518 military police in the city of Rio de Janeiro, of the deaths and injuries (from all causes) which occurred between the years of 2000 and 2004, 56.1% of them occurred during temporary withdrawals from active service, compared to 43.9% occurring in ostensible service (Souza, 2005).

Apart from death from physical trauma, literature on stress provides evidence that an individual's vulnerability to job stress is influenced by his/her perception of the work environment, administrative support, social support, and the individual's personality with respect to coping behaviors. It has been suggested that psychosocial factors such as stress may increase the risk of cancer, which impacts the life expectancy of police officers (Vena, 2014; Peckham, 2016).

There are social and psychological demands related to police work, such as the pace of daily work, occupational responsibilities, and distressing situations, as well as factors such as poor diet and physical inactivity that can initiate health problems and affect quality of life among police officers (da Silva, 2014; Queiros, 2016). In the same way, a study that compared mortality from heart attacks between police officers and firefighters found no significant difference between these professional groups and the general population. However, the police presented a higher mortality rate from this cause than firefighters. One of the reasons for this suggested by the study was the adversity of the working conditions (Sardinas, 1986).

It is usually police officers who are the first emergency personnel to arrive at the scene of various crimes. This frequent exposure to violent and stressful situations may increase the risk of developing occupational diseases, compared to the general population.

Thus, police officers perform a high-risk job that impacts their quality of life (Lee, 2016). On the other hand, we cannot determine whether a lower life expectancy is associated with the kind of occupation or with lifestyle habits (or the combination of both), even though previous studies have shown that a high level of work-related stress impacts on health in general (Chen, 2006; Ramey, 2003). In a study conducted by Minayo, Assisi and Oliveira (2011), military police officers of Rio de Janeiro were considered highly stressed. They said that they work day and night, spend 12 hours on the street with just one meal and constantly work under pressure. Having to stay alert and

sleep less are factors which contribute to the deterioration of quality of life and health.

In another study on the Brazilian military police in Rio de Janeiro, Post Traumatic Stress Disorder (PTSD) prevalence ranged from 9% to 16% with a demonstrated association between symptoms and the presence of persistent suicidal tendencies (Maia, 2007).

It is also important to consider suicide as a way of losing years of life among police officers. Among the US population, suicide is the tenth most common cause of death, responsible for 1.6% of deaths in 2013 (Xu, 2016). In the study conducted by Violante and collaborators (2011), active officers were shown to be 8.4 times (95% CI = 3.8–18.7) more likely to commit suicide than retired officers (those who had previously resigned). In another study conducted in 2014 in the USA, the authors reported that 23% of a sample of 115 officers had thought of suicide at some time in the past and that 12% met standardized severity criteria reflecting suicidal tendencies (Violanti, 2004).

Alcohol and drug use is another aspect that impacts life expectancy, especially for military police officers. A study on military police officers from Rio de Janeiro found, with the exception of alcohol, tobacco and anxiolytics, a higher prevalence of drug use compared to civil police officers (Souza, 2013).

The presence of multiple risk factors for chronic disease in this occupation provides a compelling reason to study long-term health risks among police officers. A study conducted in New Jersey, USA (Feuer, 1986) has shown that the proportionate mortality ratios for cirrhosis of the liver and digestive diseases increased as duration of police service increased. An inverse relationship was noted between arteriosclerotic heart disease and latency, indicating that police officers most susceptible to heart disease were affected early in their careers.

This study has some limitation. It has been focused on the differences in mortality profiles between two different police corporations in Brazil, but the causes of death were not detailed, which enabled us to discuss only the hypotheses related to the deaths.

Changes in YLL over time and differences among populations may give health planners added criteria in establishing priorities as well as implementing and evaluating programs for the prevention of premature mortality (Arca, 1988).

CONCLUSION

The results indicated that there is a significant difference in mortality between the police responsible for ostensive policing compared with those who carry out investigative and intelligence work. This suggests the need for further studies, which address the morbidity and mortality of these groups with an aim to discover governmental preventative measures in order to provide the police population with assistance in minimizing the adverse consequences of

executing military police work.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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