Cluster of chronic non-communicable diseases and multimorbidity in primary healthcare workers

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ABSTRACT

Objectives: Investigate the aggregation of NCDs and their association with sociodemographic characteristics and occupational aspects in primary healthcare workers. **Methods:** A cross-sectional study analyzed partial data from a cohort profile conducted in Vitória da Conquista (BA) and in São Geraldo da Piedade (MG) in January 2022 with 105 workers of "Estratégia de Saúde da Família (ESF)" who answered a self-report electronic questionnaire. The variables of this research were: sociodemographic characteristics, job aspects, and the presence of NCDs and multimorbidity. Data were analyzed with descriptive statistics, cluster analysis, chi-square test, and binary logistic regression. **Results:** The five NCDs more prevalent were: rhinitis/sinusitis (30,5%), headache/migraine (26,7%), hypercholesterolemia (26,7%), gastritis (19,0%), and hypertension (19,0%). The prevalence of multimorbidity was 26,7%, and 11 cluster combinations were found (34,4%) since the higher score was identified in the aggregation of the five more prevalent diseases. There was an association between the presence of multimorbidity and the sex (the prevalence is 24% smaller for men) and between the presence of multimorbidity and the level of education (the prevalence is 26% higher in people without a college degree). **Conclusion:** The prevalence of multimorbidity was associated with the female sex and with people without a college degree. Furthermore, an association was observed between the five more prevalent NCDs in this study and the level of education.

Keywords: Chronic diseases, Multimorbidity, Healthcare worker, Cluster analysis.

INTRODUCTION

Chronic non-communicable diseases (NCDs) accounted for 74% of the causes of death in the world between 2010 and 2019, according to the World Health Organization. These diseases are characterized by the presence of multiple non-infectious diseases, risk factors, long latency periods, and long-lasting conditions, with functional disabilities, besides their high prevalence in the Brazilian population[2-3].

The presence of two or more chronic diseases in the same individual is characterized as multimorbidity and its occurrence is associated with negative outcomes, with a higher risk of death[4-6]. In Brazil, there has been an inversion in the epidemiological profile in recent decades, with a reduction in infectious and parasitic diseases and a significant increase in the prevalence of NCDs[2,7-8]. This inversion occurs due to changes in the demographic, epidemiological,

and nutritional profiles of the population, as well as greater control of communicable diseases[7-8].

Nowadays, more than 45% of Brazilian adults have at least one NCD[9-10], these data and the changes in the country's epidemiological profile point to the need to intensify the prevention and treatment of NCDs. In this context, Primary Health Care (PHC) is fundamental, as it constitutes the main entrance to the Unified Health System (SUS) and it has the capacity to solve about 80% of the problems that affect the health of the Brazilian population[11-12-13].

The "Family Health Strategy (FHS)", created to strengthen the PHC and consolidate the SUS, has brought positive advances since its implementation, such as the improvement of the work process, the expansion of the universal access to health services, the improvement in the coordination of services, the greater bond and embracement with the community, in addition to the family approach[12,14]. However, such advances have not covered all the needs of the health professionals, who feel overwhelmed

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and face difficulties with the infrastructure of the workplace since around 75% of these places do not have the minimum infrastructure conditions required[15-19].

The occurrence and intensity of multimorbidity among workers vary according to work characteristics, socioeconomic aspects, age, sex, access to a health plan, education level, history of smoking, and residence in an urban or rural area, among others[20].

Regarding the prevalence of multimorbidity among PHC workers, there is a lack of studies, but data suggests that this prevalence exceeds 35%, besides being related to smoking, the accumulation of activities, and work overload[17,21-26].

Therefore, there is a need to better understand the association of these variables and the way they affect health professionals, who are fundamental in the prevention and treatment of NCDs. Thus, this study aims to investigate the aggregation of non-communicable chronic diseases and the association between multimorbidity, sociodemographic characteristics, and occupational aspects of PHC workers.

METHODS

This is an epidemiologic, cross-sectional, and descriptive study with quantitative characteristics. Cross-sectional studies are defined as a type of study capable of observing the factor and effects of a given disease in the same place and historical time[27].

The data analyzed came from a cohort profile entitled "Estudo Longitudinal de Atividade Física e Saúde dos Trabalhadores do Setor Saúde - ELAFS" perfomed in the Brazilian cities of Vitória da Conquista, Bahia (BA), and São Geraldo da Piedade, Minas Gerais (MG), in January 2022.

The sample for this study consisted of 105 FHS workers from the cities mentioned above, consisting of doctors (7,6%), nursing staff (24.5%), dental staff (8.6%), community health agents (42.9%), and other collaborators (16.4%).

This investigation was approved by the Human Research Ethics Committee of the State University of Southwest of Bahia (Protocol No. 3.560.194/2019). The participation was voluntary and all individuals agreed to the informed consent form.

The data collection instrument consists of a specific and self-report electronic questionnaire, it was prepared using Google Forms and it had about 190 questions. Such questions were divided into nine sections: sociodemographic information; general job information, aspects related to health; physical activity; Covid-19; lifestyle; weight and body image; physiological markers. Of these sections, only the first three were included in this study.

Independent variables

The independent variables were sociodemographic characteristics and job aspects, being considered and categorized as follows: sex (male and female); education level (elementary/high school completed and college degree); working hours (≤ 40 hours/week and > 40 hours/week); multiple jobs (yes and no).

Dependent variables

The dependent variables of this study were: the presence of non-communicable chronic diseases (NCDs) and the presence of multimorbidity.

To identify the presence of NCDs, the answer to the question "do you have a medical diagnosis for any of the diseases listed below?" was used with a list of 29 diseases, making it possible to select more than one disease from the following options: allergy/eczema (AE), anemia, angina, arthritis/rheumatism (AR), asthma/bronchitis (AB), câncer, headache/migraine (HM), hypercholesterolemia (HC), intestinal constipation (IC), depression, diabetes, dysphonia, sleep disorders (SD), chronic obstructive pulmonary disease (COPD), kidney disease (KD), gastritis (GA), hepatitis, disc herniation, hypertension/high blood pressure (HBP), myocardial infarction (MI), urinary tract infections (UTI), heart failure (HF), repetitive strain injury (RSI), low back pain (LBP), obesity, rhinitis/sinusitis (RS), tuberculosis, ulcer, and varicose vein. In addition, there was the option "other(s)", in which it was possible to add conditions that were not on the list. Thus, among all pathologies, only those that constituted NCDs were included in this study, such as diabetes mellitus

(DM), cancer, hypercholesterolemia, hypertension, and other NCDs[28].

To assess the presence of multimorbidity, this variable was dichotomized (yes and no). Therefore, the presence of multimorbidity was considered (yes) when at least two chronic diseases occurred in the same person[29].

Statistical procedure

Initially, descriptive statistical procedures were applied (mean, standard deviation, simple and relative frequencies). Thus, the five most frequent NCDs in the population studied were identified and used for the aggregation analysis.

To assess the simultaneity of NCDs, cluster analysis was used. The cluster technique is a multivariate statistical analysis approach, which allows identifying groups with homogeneous characteristics. For this, the most used procedure consists of disaggregating a set of objects into smaller subsets according to their characteristics. Then, mathematical distance calculations are performed to assign the measure of proximity (similarity) to all pairs of objects and between each object and the subgroups. Subsequently, the mentioned processes are repeated interactively, forming subgroups containing members with minimum distances between them[30].

All NCDs combinations were analyzed and the prevalence of each disease was estimated and compared to the ratio between observed and expected prevalence (O/E) for each grouping. The calculation of the expected prevalence for each combination was performed by multiplying the individual probability of each NCDs by the occurrence observed in the study. The presence of a cluster was considered when the prevalence of the combination of NCDs observed (O) was greater than expected (E), that is, when the O/E ratio was greater than 1[31-33].

Pearson's chi-square test was performed to assess the difference between groups. Binary logistic regression was used to assess the association between the presence of multimorbidity and the independent variables. The adjusted analysis controlled all the independent study variables (sex, education, working hours, and multiple jobs). The significance level adopted was 5% (p ≤ 0.05), and the confidence interval (CI) was 95%.

All statistical analyses were performed using the statistical software Statistical Package for Social Sciences (SPSS) ® 22.0.0.

RESULTS

Table 1 presents the sociodemographic profile and the distribution of the most frequent NCDs among PHC workers. Among the participants of this study, there was a predominance of females and most of them reported having completed elementary or high school, working up to 40 hours a week, and having only one job.

The five most prevalent NCDs were rhinitis/sinusitis (30.5%), headache/migraine (26.7%), hypercholesterolemia (26.7%), gastritis (19%), and hypertension (19%), and the prevalence of multimorbidity was 26.7%. The presence of the aforementioned diseases was associated with the variables sex (in the case of HM) and education (with the exception of HM).

From the 32 possible combinations, 11 were clustered (34.4%). The highest cluster score was identified (O/E=48.41). When five diseases were considered. In the analysis of the aggregation of four diseases, the presence of cluster was observed in the combination HM+HC+GA+HBP (O/E=5.59). In the analysis of the simultaneous presence of three diseases, the highest cluster score was observed for the combination HM+HC+HBP (O/E=3,80). For the simultaneous presence of two diseases, the RS+GA (O/E=1.90) and HC+GA (O/E=1.39) combinations prevailed. In the analysis of the presence of one disease (with the absence of the others), no cluster formation was observed. When analyzing the aggregation of the absence of diseases, the presence of a cluster was identified (O/E=1.36).

Table 3 presents the association between the independent variables of this study and the presence of multimorbidity due to chronic diseases in PHC workers. It was found a significant difference in the association between the presence of multimorbidity and sex and level of education, as well as in the association between the aggregation of five NCDs and education. In view of this, the prevalence of multimorbidity was found among women, especially

Table 1

Sociodemographic profile and characteristics of the most frequent chronic non-communicable diseases in Primary Health Care workers.

Variables	Sample	Chronic non-communicable diseases (NCDs)				
		RS	HM	HC	GA	HBP
	N	n (%)	n (%)	n (%)	n (%)	n (%)
Total	105 (100)	32 (30.5)	28 (26.7)	28 (26.7)	20 (19.0)	20 (19)
Sex						
p-value		p=0.162	**p=0.005**	p=0.907	p=0.777	p=0.777
Male	18 (17.1)	3 (9.4)	0 (0.0)	5 (17.9)	3 (15.0)	3 (15.0)
Female	87 (82.9)	29 (90.6)	28 (100.0)	23 (82.1)	17 (85.0)	17 (85.0)
Level of education						
p-value		**p=0.036**	p=0.072	**p=0.025**	**p=0.031**	**p=0.031**
College degree	49 (46.7)	10 (31.2)	9 (32.1)	8 (28.6)	5 (25.0)	5 (25.0)
PE/HS	56 (53.3)	22 (68.8)	19 (67.9)	20 (71.4)	15 (75.0)	15 (75.0)
Working hours						
p-value		p=0.245	p=0.289	p=0.289	p=0.523	p=0.394
≤ 40 h/week	102 (97.1)	32 (100.0)	28 (100.0)	28 (100.0)	19 (95.0)	20 (100.0)
> 40 h/week	3 (2.9)	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.0)	0 (0.0)
Multiple jobs						
p-value		p=0.095	p=0.851	p=0.708	p=0.166	P=0.252
Yes	20 (19.0)	3 (9.4)	5 (17.9)	6 (21.4)	6 (30.0)	2 (10.0)
No	85 (81.0)	29 (81.0)	23 (82.1)	28 (78.6)	14 (70.0)	18 (90.0)

Primary education (PE); high school (HS); rhinitis/sinusitis (RS); headache/migraine (HM); hypercholesterolemia (HC); gastritis (GA); hypertension/high blood pressure (HBP); hours/week (h/week).

those who completed elementary or high school, besides the predominance of the aggregation of five NCDs in females.

Table 4 shows the multivariate analysis of the association between sociodemographic and occupational variables and the presence of multimorbidity due to chronic diseases in the studied population. There was an association between the presence of multimorbidity and sex, which was 24% lower in men. In addition, there was an association between the level of education, the presence of multimorbidity, and the simultaneous presence of five NCDs. As a result, it was found that the presence of multimorbidity and the aggregation of five NCDs are, respectively, 26% and 9% higher in individuals who completed elementary or high school compared to individuals who had a college degree.

In the crude and adjusted analyses of the association between the independent variables with the presence of multimorbidity and the main cluster combinations, associations were observed with sex for multimorbidity and with a level of education for multimorbidity and for the combination with five diseases, in both analyses (Tables 3 and 4).

DISCUSSION

The objective of the present study was to investigate the aggregation of NCDs and the association between multimorbidity, sociodemographic characteristics, and occupational aspects of PHC workers. The results showed that approximately a quarter of these workers had

Table 2
Cluster prevalence of chronic non-communicable diseases in primary healthcare workers.

NCDs	RS	HM	HC	GA	HBP	O (%)	O/E (%)	CI 95%
5	+	+	+	+	+	3.8	**48.41**	48.36-48.46
4	-	+	+	+	+	1.0	**5.59**	5.18-6.01
4	+	-	+	+	+	0.0	0.00	-
4	+	+	-	+	+	0.0	0.00	-
4	+	+	+	-	+	0.0	0.00	-
4	+	+	+	+	-	0.0	0.00	-
3	-	-	+	+	+	0.0	0.00	-
3	-	+	-	+	+	0.0	0.00	-
3	-	+	+	-	+	2.9	**3.80**	3.48-4.13
3	-	+	+	+	-	1.0	**1.31**	0.75-1.87
3	+	-	-	+	+	1.0	**1.69**	1.14-2.24
3	+	-	+	-	+	1.0	**1.09**	0.52-1.65
3	+	-	+	+	-	0.0	0.00	-
3	+	+	-	-	+	0.0	0.00	-
3	+	+	-	+	-	1.0	**1.09**	0.52-1.65
3	+	+	+	-	-	1.9	**1.33**	0.93-1.74
2	-	-	-	+	+	0.0	0.00	-
2	-	-	+	-	+	1.9	0.91	0.51-1.31
2	-	-	+	+	-	2.9	**1.39**	1.06-1.71
2	+	-	-	-	+	1.9	0.75	0.36-1.15
2	+	-	-	+	-	4.8	**1.90**	1.65-2.15
2	+	-	+	-	-	1.9	0.49	0.10-0.87
2	+	+	-	-	-	3.8	0.97	0.70-1.24
2	-	+	-	-	+	0.0	0.00	-
2	-	+	-	+	-	0.0	0.00	-
2	-	+	+	-	-	2.9	0.89	0.57-1.21
1	-	-	-	-	+	5.7	0.99	0.79-1.19
1	-	-	-	+	-	3.8	0.66	0.42-0.91
1	-	-	+	-	-	5.7	0.64	0.46-0.82
1	+	-	-	-	-	9.5	0.88	0.75-1.02
1	-	+	-	-	-	8.6	0.96	0.82-1.11
0	-	-	-	-	-	33.3	**1.36**	1.34-1.38

Chronic non-communicable diseases (NCDs); rhinitis/sinusitis (RS); headache/migraine (HM); hypercholesterolemia (HC); gastritis (GA); hypertension/high blood pressure (HBP); observed prevalence (O); expected prevalence (E); the ratio between observed and expected prevalence (O/E), confidence interval (CI).

Table 3
Association between sociodemographic and occupational variables and the presence of multimorbidity due to chronic diseases in primary healthcare workers.

Variables	Multimorbidity	RS + HM + HC + GA + HBP	HM + HC + GA + HBP	HM + HC + HBP
	N (%)	n (%)	n (%)	n (%)
Total	28 (26.7)	4 (3.8)	1 (1.0)	3 (2.9)
Sex				
p-value	**0.026**	0.354	0.648	0.424
Male	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)
Female	27 (96.4)	4 (100.0)	1 (100.0)	3 (100.0)
Level of education				
p-value	**0.025**	**0.056**	0.347	0.639
College degree	8 (28.6)	0 (0.0)	0 (0.0)	1 (33.3)
PE/HS	20 (71.4)	4 (100.0)	1 (100.0)	2 (66.7)
Working hours				
p-value	0.289	0.727	0.863	0.763
≤ 40 h/week	28 (100.0)	4 (100.0)	1 (100.0)	3 (100.0)
> 40 h/week	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Multiple Jobs				
p-value	0.851	0.757	0.626	0.523
Yes	5	1	0	1
No	23	3	1	2

Primary education (PE); high school (HS); rhinitis/sinusitis (RS); headache/migraine (HM); hypercholesterolemia (HC); gastritis (GA); hypertension/high blood pressure (HBP); hours/week (h/week).

multimorbidity and this prevalence was higher among women and workers with a lower level of education. In addition, the simultaneous presence of five diseases (considering the most prevalent ones) was the combination with the highest cluster score.

Barbosa et al.[24] conducted an investigation with PHC workers in the city of Diamantina-MG and identified a prevalence of multimorbidity of 38.4%, higher than that found in this research. However, the authors did not assess the relationship between the presence of multimorbidity, sex, and education level of the professionals who participated in the study. Still, regarding the significant difference between the prevalence of multimorbidity identified in this study and in the study by Barbosa et al.[24], it can be assumed that specific characteristics of each place can justify such dissimilarity, considering that Christofoletti et al.[34] also identified significant variations in the prevalence of simultaneous NCDs when studying different Brazilian capitals.

In the adult and working populations in Brazil, the prevalence of multimorbidity found in the literature is 22.3% and 20%, respectively. In addition, characteristics such as female sex and low level of education increased exposure to multimorbidity, aligned with the results obtained in this research[20, 35].

The prevalence of multimorbidity in PHC workers is significantly higher than what is observed in the population of Brazilian workers[20, 35]. This points to the need for actions through the development of public policies related to health workers, aiming to reduce complications related to physical and mental health conditions, especially in the intervention of variables that influence multimorbidity.

The greater exposure of women to multimorbidity can be explained by findings in the literature. Studies attest that women seek health services more frequently when compared to their peers, consequently increasing the probability of

Table 4

Adjusted analysis of the association between sociodemographic and occupational variables and the presence of multimorbidity due to chronic diseases in primary healthcare workers.

Variables	Multimorbidity		RS + HM + HC + GA + HBP		HM + HC + GA + HBP		HM + HC + HBP	
	OR	CI 95%	OR	CI 95%	OR	CI 95%	OR	CI 95%
Sex								
Female	-		-		-		-	
Male	**0.76**	**0.61-0.94**	0.94	0.85-1.04	0.98	0.97-1.03	0.96	0.88-1.04
Level of education								
College degree	-		-		-		-	
PE/HS	**1.26**	**1.06-1.50**	**1.09**	**1.01-1.17**	1.01	0.97-1.05	1.02	0.96-1.10
Working hours								
≤ 40 h/week	-		-		-		-	
> 40 h/week	0.86	0.52-1.51	0.99	0.79-1.23	0.99	0.88-1.11	0.99	0.81-1.21
Multiple Jobs								
Yes	-		-		-		-	
No	1.10	0.88-1.37	1.05	0.96-1.16	0.99	0.94-1.04	1.01	0.95-1.13

Primary education (PE); high school (HS); odds ratio (OR); confidence interval (CI); rhinitis/sinusitis (RS); headache/migraine (HM); hypercholesterolemia (HC); gastritis (GA); hypertension/high blood pressure (HBP); hours/week (h/week).

disease diagnoses[10,20,36]. In addition, women report greater awareness of the physical manifestations of diseases, culminating in a greater demand for health services [10]. Still, the survival bias stands out, in which women will be more subject to the accumulation of diseases because they have a longer life expectancy than men and diseases tend to increase with age[36].

About education, previous studies have also shown that a low level of education is associated with a higher presence of multimorbidity[34]. People with few years of education have precarious access to information and health services, which results in less contact with basic notions of protection and prevention of risk factors associated with illness, in addition to less contact with health promotion actions[20], leading to greater vulnerability to disabilities and a lower healthy life expectancy[20,34-35]. However, such information seems to be contradictory, as the studied group should benefit from their own health knowledge, in theory.

Facing such contradiction, there is a need for a better understanding of the possible causes of illness for PHC professionals who did not attend college. In this sense, community health agents (CHA) stand out, the largest portion of the sample in this study, whose minimum requirement for hiring is the need to complete elementary school within a maximum period of three years after hiring[37]. This professional category is composed mainly of women[38], which could explain the higher occurrence of multimorbidity among less educated individuals. In addition, the CHA's work aspects, such as work overload and unavailability of materials and inputs, can contribute to illness[39].

It is necessary to emphasize the incipience of cluster studies analyzing the behavior of the aggregation of NCDs since most trials investigate the aggregation of risk factors for NCDs[31,33-34]. Nevertheless, research was identified that carried out an analysis of the aggregation of NCDs, with a sample composed of Brazilian adults and elderly people, with the diseases studied being DM, dyslipidemia, HBP, and obesity[34]. However, in addition to the dissimilarities in relation to the sample of the present study, the four selected diseases are different from those identified in this research, making it impossible to compare with the results found in this work. Despite this, the authors also identified that the simultaneity of the diseases had a higher prevalence among individuals who had up to eight years of study, as already explained.

The literature also lacks studies that analyze multimorbidity in health professionals, since most studies investigate the prevalence of NCDs in this group without considering the simultaneity of these diseases in the same people. Thus, the prevalences found in this study for each NCDs separately (RS=30.5%; HM=26.7%; HC=26.7%; GA=19.0% and HBP=19.0%) are important by allowing comparisons with other works and studied populations.

A survey carried out by Pereira et al.[22] involving 1762 PHC professionals from the northeast macro-region of Minas Gerais identified the following NCDs prevalences: HBP (6.5%), allergic rhinitis (2.3%), dyslipidemia (0.2%) and migraine/headache (1.2%). Another study conducted by Domingues et al.[40] with 272 professionals from the nursing team of a philanthropic hospital in Pelotas-RS observed the following prevalence of NCDs: HBP (20.6%) and gastritis (2.2%). In the investigation carried out by Kotekewis et al.[41], which included 70 professionals who worked in the surgical center of three hospitals in Londrina-PR, a prevalence of HBP of 2.9% was found.

Concerning the Brazilian adult population, data from the National Health Survey carried out in 2019 indicate that almost half of the individuals are affected by some NCDs[10]. The prevalence of HBP and HC in this group is greater than 15% and 10%, respectively[35]. The prevalence of allergic rhinitis, according to another study, is more studied in children and teenagers, surpassing 26% and 34% respectively; however, its prevalence in the adult population of Curitiba-PR reached 47%[42]. Studies involving chronic GA commonly associate it with its various etiologies[43-45], which results in variations in its prevalence. When researchers reviewed 450 endoscopic reports of patients complaining of dyspepsia and/or dyspeptic symptoms, they observed the presence of GA in 46% of the reports[46]. Regarding migraine, its annual prevalence in Brazil is greater than 15%[47].

By reviewing the results presented by these surveys, it is noticeable that the prevalence of NCDs has considerably high differences. In general, the highest prevalence of NCDs was found in the population of the present study, corroborating the suspicion that PHC professionals are at considerable risk of developing such diseases or having their diagnoses faster than the general population.

To future research contribute to the present work, it should be noted that this study is a cross-sectional study, which makes it impossible to infer the temporal relationships between the part of the intervening variables and the outcome. It is also noteworthy that the absence of some associations observed in other studies may be related to the reduced prevalence of some factors in the focus population or to the small number of participants, which may not represent the characteristics of the population of PHC workers.

Lastly, the self-report of disease diagnoses could be a limiting factor, with values being overestimated or underestimated according to the respondent's knowledge. However, the present investigation involved professionals who work in the health area; thus, it is inferred that they have a better understanding of their health situation. Another limiting factor is the type of study design, as cross-sectional studies are not able to establish a causal relationship between exposure to the factor and the development of the disease. However, it is also important to highlight the most relevant point of this study, which is its originality, in view of the incipience of studies that analyze the behavior of the concurrence of NCDs in PHC professionals.

CONCLUSION

Therefore, when investigating the aggregation of NCDs and the association between multimorbidity, sociodemographic characteristics, and occupational aspects of PHC workers, the association between the presence of multimorbidity and sex was identified, with the prevalence of multimorbidity being lower among men. Besides, an association was observed between the presence of multimorbidity and the simultaneous association of the five main NCDs in this study with the level of education, with these variables being more frequent in individuals who completed only primary or secondary education compared to individuals who have a college degree. At last, it is important to carry out more studies analyzing the multimorbidity and the behavior of the aggregation of NCDs, especially in the group of health professionals, with the aim of correcting the limiting points of this study and, mainly, contributing to the development of health policies focused on the care of PHC workers.

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