

Accident and social security benefits granted to cancer patients in Brazil, 2008-2014

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Abstract *This article aims to describe the distribution of cancer among the benefits granted by the General Social Security Registry, from 2008 to 2014, in Brazil. Ecological study using data given by the National Social Security Institute. The proportion of accidental (work-related) and social security (general) benefits granted by cancer in Brazil was determined, among the benefits granted for all causes, and a spatial analysis was conducted to assess the geographical distribution of these proportions, with the states Brazilians as a unit of analysis. Cancer was the reason for granting 533,438 benefits (2.9% of the total benefits granted for all causes), with a predominance of females in social security benefits (53.7%) and males in accidental benefits (71.6 %). The highest proportions of social security benefits for cancer occurred in North and Midwest regions. In 19 of the 26 Brazilian states (including all states in the southern region) and in the Federal District, there was no granting of accident benefits for cancer. The analysis of the occurrences of cancer that generated benefit concessions suggests a disproportionality in granting of social security benefits in relation to accident workers, mainly in North, Northeast and South regions of Brazil.*

Key words *Neoplasms, Social Security, Occupational Health*

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Introduction

Cancer is a public health problem that affects approximately 19.3 million people worldwide (age-adjusted incidence rate of 201.0 cases per 100,000 population) and causes almost 10.0 million deaths (100.7/100,000) each year, according to estimates for 2020. In Brazil, for the same year, it was estimated that there would be 592,212 new cases (241.3/100,000 in men and 198.2/100,000 in women) and 259,949 deaths¹.

The diagnosis and treatment of cancer demand human and technological resources that generate financial costs to the Brazilian Health System². Furthermore, when the diagnosed individual is a worker protected by Social Security, the need for leave from work (duly evaluated by the medical expert from the National Institute of Social Security – INSS) generates the granting of social security or accident benefits³.

The association between occupational exposures and cancer is well established for various tumor locations. The International Agency for Research on Cancer (IARC) classifies 38 agents present in work environments and 12 exposure circumstances (industries and occupations) as known carcinogens (group 1) and 41 agents and 6 exposure circumstances as likely to cause cancer (group 2A)⁴. Thus, the global cancer burden attributable to occupational exposures has been estimated to be between 2% and 5% since the 1980s. For lung cancer, which is the most prevalent occupational cancer, this population attributable fraction (PAF) to occupational exposure is as high as 25%, with occupational exposures to asbestos, silica, and diesel engine emissions being the major contributing factors⁵⁻⁶.

Most countries have invested in estimating workers exposed to carcinogens and in surveillance systems for exposures. However, failure to quantify the true burden of work-related cancer cases is a global problem. To reduce this information gap it is necessary to invest in other strategies such as identification of suspected work-related cancer cases and improvements in surveillance systems⁷.

In Brazil, since 2004, there is a module “work-related cancer” in the Notification of Diseases Information System, but the number of cases reported is incipient considering the large number of workers in the country and the annual number of cancer cases⁸, which makes it unfeasible to use these data for epidemiological surveillance purposes. In this context, the databases of the General Register of Social Security (GRSS) are

alternative forms of information on cancer illness and its relationship to work, allowing the analysis of variables that are not usually obtained in cancer registries. However, these data are still little used for research purposes. Thus, considering that for surveillance purposes, cancer requires studies of its epidemiological distribution, not only in the general population, but in specific populations, such as the economically active population, the objective of this paper is to describe the distribution of cancer among benefits granted by the GRSS, in the period from 2008 to 2014, in Brazil, comparing the proportions of accident (work-related) and social security (general) benefits.

Methods

This is a descriptive study of ecological type, concerning the pattern of granting of benefits by the GRSS for malignant neoplasms, in men and women who are members of that health system, in the period from 2008 to 2014, in Brazil. The data were made available in aggregate by INSS, in physical media, after being requested through the Electronic System of the Citizen Information Service (<https://falabr.cgu.gov.br/publico/Manifestacao/SelecionarTipoManifestacao.aspx?ReturnUrl=%2f>), created based on law no. 12.527, of November 18, 2011, which regulated the constitutional right of access to information⁹.

Four types of benefits were selected for the study: social security sickness benefit (B31), social security disability retirement (B32), accidental disability benefit (B91) and accidental disability retirement (B92), for all malignant neoplasms (C00 to C97), other causes and unclassified causes, according to the International Classification of Diseases (ICD-10). The benefits of the sickness aid type (B31 and B91) are granted to the insured when he/she is unable to exercise his/her routine activity for a period exceeding 15 consecutive days. The disability pensions (B32 and B92) are granted to insured people who are considered incapable and unrehabilitated for subsistence activities and will be paid while they remain in this condition. Accident benefits (B91 and B92) differ from social security benefits (B32 and B92) by the fact that the insured has suffered an accident at work, and by the provisional stability that the accident benefit establishes for the worker after returning to work (3). It should be noted that according to article 20 of Law 8,213/91, diseases arising from a certain activity, or arising or aggravated by work or conditions of its per-

formance, are considered work-related accidents. Thus, work-related cancer must also be classified as an accident¹⁰.

The following variables were entered: sex (male and female), clientele (urban and rural), and affiliation (unemployed; employed; specially insured; self-employed; domestic worker; optional; individual taxpayer and opting for Law 6.184/74). In regard to filiation, some definitions are applicable, except for the unemployed and employed status, which do not require further details. Specially insured: an individual that, individually or in family economy regime, develops activities as a rural producer, artisan fisherman or similar, spouse or partner, as well as a child over 16 years of age that proves to have an active participation in the rural activities of the family group; Temporary workers: all those who render services to several companies, but are contracted by labor unions and labor management agencies; Domestic workers: those who provide services in the home of another person or family, as long as this activity is not for the employer's profit; Optional: people over 16 years old, who have no income of their own, but decide to contribute to Social Security; Individual taxpayers: those who work for themselves (autonomously) or who render services of a casual nature to companies, without an employment relationship¹⁰.

Data Analysis

The proportional distributions of the benefit grants in the selected period were calculated. For this purpose, the numerators were the number of benefits of each kind (B31; B32; B91 and B92) granted according to ICD-10 groups (malignant neoplasms – C00-C97 – and other causes), sex, clientele, and affiliation.

Furthermore, the following were used as numerators: (a) number of benefits of each type granted by each ICD-10 code, referring to malignant neoplasms (C00-C97), according to sex, for Brazil, from 2008 to 2014; (b) number of benefits of each type granted for malignant neoplasms, for each Brazilian state, from 2008 to 2014.

The appropriate denominators in this study were: (a) the number of benefits, of each type, granted for all causes, from 2008 to 2014, in the states and in Brazil, according to each variable of the study; (b) the number of benefits, of each type, granted for malignant neoplasms, from 2008 to 2014, in Brazil, according to sex.

Spatial analysis methods were used to assess the geographic distribution of the proportions of

social security and accident benefits granted for cancer, among the benefits granted for all causes, by Region and Brazilian state, in the period from 2008 to 2014. The QGIS program, version 2.18.15, was used for this step.

Ethical aspects

This study was submitted to the Research Ethics Committee of the National School of Public Health of the Oswaldo Cruz Foundation and was exempted from registration in the CEP-CONEP System.

Results

In Brazil, in the period between 2008 and 2014, a total of 17,875,518 social security and accident benefits were granted to insured members of Social Security for all causes of diseases, of which 9,929,530 were for males (55.5%) and 7,945,988 for females (44.5%) (Table 1).

Cancer was the reason for the granting of 533,438 benefits, which represented 2.9% of the total benefits granted. Of these, 248,293 (46.5%) were granted for men and 285,145 (53.4%) for women. We found a 100 times greater number of social security sickness benefits (B31) (443,714), compared to accident-related sickness benefits (B91) (4,263). Regarding sickness benefits (B31), the highest number of grants for all causes was found among men (52.6%) and for cancer among women (55.1%). In accident benefits for sickness aid (B91), the relationship is reversed with a greater number of benefits granted for cancer for males (71.6%) compared to females (28.4%) (Table 1).

Table 2 shows the proportional distribution of benefits generated by cancer, according to clientele, affiliation, and age. For accident benefits, one can observe a higher proportion of concessions for cancer for rural clients (1.70%) compared to urban clients (0.12%). In relation to affiliation, for welfare aid, "domestic worker" (4.11%), "optional taxpayer" (5.55%) and "individual taxpayer" (5.44%) stand out. In aid for accidents at work, the affiliation with the highest proportion of concessions for cancer was that of the "specially insured" (1.71%). In the analysis of the distribution by age group, it is possible to see that as the age increases, the proportion of the distribution of benefits by neoplasm also increases. However, it is important to note that the analysis of this variable presents some limitations

Table 1. Proportional distribution of social security and accident benefits for cancer and other causes, according to sex, Brazil – 2008 to 2014.

Types of benefits	All-cause benefits			Cancer benefits		
	Total	Male N (%)	Female N (%)	Total	Male N (%)	Female N (%)
Benefits (B31+B32+B91+B92)	17,875,518	9,929,530 (55.5)	7,945,988 (44.5)	533,438	248,293 (46.55)	285,145 (53.45)
Social security benefits (B31+B32)	15,571,103	8,289,151 (53.2)	7,281,952 (46.8)	528,370	244,666 (46.31)	283,704 (53.69)
Social security sickness benefit (B31)	14,230,429	7,485,816 (52.6)	6,744,613 (47.4)	443,714	199,222 (44.90)	244,492 (55.10)
Social security disability retirement (B32)	1,340,674	803,335 (59.9)	537,339 (40.1)	84,656	45,444 (53.68)	39,212 (46.32)
Accident benefits (B91+B92)	2,304,415	1,640,379 (71.2)	664,036 (28.8)	5,068	3,627 (71.57)	1,441 (28.43)
Accident and sickness benefit type (B91)	2,228,582	1,583,366 (71.0)	645,216 (29.0)	4,263	3,027 (71.01)	1,236 (28.99)
Accident and disability retirement type (B92)	75,833	57,013 (75.2)	18,820 (24.8)	805	600 (74.53)	205 (25.47)

The number of beneficiaries not classified by sex (unknown) was 997,691 (5.6%).

Source: Authors.

such as the lack of homogeneity in the width of the age groups presented and the nonclassification of benefits granted for the age groups < 20 years and > 64 years (Table 2).

Table 3 presents the proportional distribution of the 10 main neoplastic locations that motivated the concession of social security and accident benefits in Brazil, according to sex. For welfare benefits (B31), in men, the main locations were prostate cancer (17.9%), followed by cancers of the stomach (6.2%), colon (6.2%), bronchus and lung (4.3%), rectum (4.1%), esophagus (3.8%), other malignant neoplasms of the skin (3.4%), testicles (3.2%), larynx (3.2%), and Brain (3.2%). In women, the cancers were breast (42.4%), cervix (10.4%), thyroid gland (6.4%), colon (4.4%), ovary (3.4%), rectum (2.3%), stomach (2.3%), bronchus and lungs (2.2%), uterine body (2.1%), and other malignant skin neoplasms (1.7%). The pattern of concessions for accident sickness benefits (B91) shows important differences in relation to social security benefits (B31). In men, malignant neoplasms of the skin (56.7%), take the first place of the concessions, followed by cancers of the bronchus and lungs (8.1%), myeloid leukemia (7.3%), stomach (6.7%), bladder (3.5%), larynx (3.4%), lymphoid leukemia (3.0%), pancreas (2.1%), bones (1.42%), and unspecified leukemia

(0.9%). Some cancers present in this list, such as hematological, bladder, pancreas, and bone cancers, did not appear in the B31 grant types. In women, the same pattern is found, this time cancers of the skin (62.3%), bronchus and lungs (6.4%), stomach (4.9%), and myeloid leukemia (4.8%) gain prominence in B91 grants. Additionally, this ranking includes pancreatic (1.5%), bladder (1.5%), and sinus (1.1%) cancers that did not appear in the B31 as the top ten types that generated the most grants.

Retirement benefits resemble some cancer grants, with the insertion or substitution of some neoplastic locations in the ranking of the top 10 most granted, in both sexes. In the social security disability benefits (B32), more or less the same types of cancers are observed as in the social security sickness benefits (B31) up to the 5th position (prostate, bronchus and lungs, stomach, colon, and rectum, for men), reversing one or another location in the ranking. In women, the difference is observed for cancer of the thyroid gland, which occupies the 3rd position in the ranking of social security sickness aid and does not appear in social security disability retirements. The other types are similar. Among those generated by accidental disability (B92), these are close to those generated by accidental disability

Table 2. Proportional distribution of social security and accident benefits, by cancer and other causes, according to clientele, affiliation and age, Brazil – 2008 to 2014.

Variable	All causes N	Cancer N (%)
Clientele		
Social security benefits (B1, B32)		
Urban clientele	13,937,642	468,616 (3.36)
Rural clientele	1,633,461	59,754 (3.66)
Workplace accident benefits (B91, B92)		
Urban clientele	2,153,749	2,501 (0.12)
Rural clientele	150,666	2,567 (1.70)
Affiliation		
Social security benefits (B31, B32)		
Unemployed	2,293,246	65,010 (2.83)
Employed	8,149,850	221,559 (2.72)
Specially insured	1,628,287	59,580 (3.66)
Freelance worker	37,312	495 (1.33)
Domestic worker	530,530	21,811 (4.11)
Optional	385,939	21,408 (5.55)
Individual taxpayer	2,541,672	138,308 (5.44)
Opting for Law 6.184/74 ¹	4,267	199 (4.66)
Workplace accident benefits (B91, B92)		
Unemployed	154,848	637 (0.41)
Employed	1,988,157	1,849 (0.09)
Specially insured	150,542	2,567 (1.71)
Freelance worker	10,868	15 (0.14)
Age		
20 to 29 years of age	3,355,766	29,230 (0.87)
30 to 39 years of age	4,419,731	73,265 (1.66)
40 to 49 years of age	4,639,105	148,392 (3.20)
50 to 59 years of age	4,018,003	203,237 (5.06)
60 to 64 years of age	856,671	57,914 (6.76)

¹ Law No. 6.184 of December 11, 1974, provides for the integration of civil servants in the staff of mixed economy companies, public companies, and foundations, in which the optants will be assured by the labor and social security legislation (40). For the age variable, the 586,242 (3.28%) benefits granted for the age groups < 20 years and > 64 years were not classified. The quantity of beneficiaries not classified according to affiliation was 477,477 (2.67%).

Source: Authors.

(B92), but with the insertion in B92 of larynx cases that gain greater prominence, in men, and the cases of multiple myeloma in both sexes.

Figure 1 presents the spatial distribution of the proportion of social security benefits (B31 and B32) granted for cancer, among the total benefits (social security and accident benefits) granted for all causes, in each state, during the period from 2008 to 2014. All states in Brazil granted cancer social security benefits. It can be seen that the proportions varied from 2.24% to 42.46% (range 40.22%; interquartile range 7.65%), among the states. The following states were above the 75th percentile: Rondônia (42.46%), Mato Grosso

(22.87%), Tocantins (14.69%), Acre (12.50%), Amapá (12.50%), and Amazonas (11.76%); and the states below the 25th percentile were: Rio Grande do Norte (2.24%), Pernambuco (2.79%), Paraná (2.86%), Minas Gerais (2.90%), São Paulo (3.02%) and Espírito Santo (3.21%). This analysis reflects a great discrepancy between the regions of the country. In the North region the proportion of benefits varied from 10.00 to 42.46% (range 32.46%); in the Southeast region the proportion varied from 3.33% to 2.90% (range 0.43%).

The analysis of the proportions of accident benefits (B91 and B92) granted for cancer, among the total benefits (social security and ac-

Table 3. Proportional distribution of the top 10 cancer locations that generated benefit awards, according to sex and type of benefit, Brazil – 2008 to 2014.

Men		Women	
ICD-10	N (%)	ICD-10	N (%)
Social security sickness benefit (B31)			
C61 - Prostate	35,762 (17.95)	C50 - Breast	103,605 (42.38)
C16 - Stomach	12,361 (6.20)	C53 - Cervix	25,340 (10.36)
C18 - Colon	12,325 (6.19)	C73 - Thyroid gland	15,742 (6.44)
C34 - Bronchi and lungs	8,581 (4.31)	C18 - Colon	10,770 (4.41)
C20 - Rectum	8,267 (4.15)	C56 - Ovary	8,408 (3.44)
C15 - Esophagus	7,545 (3.79)	C20 - Rectum	5,549 (2.27)
C44 - Other malignant neoplasms of the skin	6,871 (3.45)	C16 - Stomach	5,528 (2.26)
C62 - Testicles	6,432 (3.23)	C34 - Bronchi and lungs	5,302 (2.17)
C32 - Larynx	6,305 (3.16)	C54 - Body of uterus	5,253 (2.15)
C71 - Brain	6,302 (3.16)	C44 - Other malignant neoplasms of the skin	4,238 (1.73)
Other Neoplasms	88,471 (44.41)	Other neoplasms	54,757 (22.40)
Accident sickness benefit (B91)			
C44 - Other malignant neoplasms of the skin	1,716 (56.69)	C44 - Other malignant neoplasms of the skin	770 (62.30)
C34 - Bronchi and lungs	245 (8.09)	C34 - Bronchi and lungs	79 (6.39)
C92 - Myeloid leukemia	221 (7.30)	C16 - Stomach	61 (4.94)
C16 - Stomach	204 (6.74)	C92 - Myeloid leukemia	60 (4.85)
C67 - Bladder	107 (3.53)	C50 - Breast	56 (4.53)
C32 - Larynx	103 (3.40)	C25 - Pancreas	19 (1.54)
C91 - Lymphoid leukemia	91 (3.01)	C67 - Bladder	19 (1.54)
C25 - Pancreas	63 (2.08)	C91 - Lymphoid Leukemia	19 (1.54)
C40 - Limb bones and cartilage	43 (1.42)	C53 - Colon	15 (1.21)
C95 - Leukemia of unspecified type	28 (0.93)	C31 - Sinuses of the face	14 (1.13)
Other neoplasms	206 (6.81)	Other neoplasms	124 (10.03)
Social security disability retirement (B32)			
C61 - Prostate	6,054 (13.32)	C50 - Mama	16,150 (41.19)
C34 - Bronchi and lungs	3,303 (7.27)	C53 - Cervix of the uterus	2,725 (6.95)
C16 - Stomach	3,194 (7.03)	C18 - Colon	2,115 (5.39)
C18 - Colon	2,722 (5.99)	C34 - Bronchi and lungs	1,898 (4.84)
C20 - Rectum	2,596 (5.71)	C56 - Ovary	1,587 (4.05)
C32 - Larynx	2,559 (5.63)	C20 - Rectum	1,530 (3.90)
C71 - Brain	2,269 (4.99)	C71 - Brain	1,265 (3.23)
C15 - Esophagus	2,170 (4.78)	C16 - Stomach	1,140 (2.91)
C22 - Liver and hepatic bile ducts	1,013 (2.23)	C90 - Multiple myeloma/plasmocytes	662 (1.69)
C90 - Multiple myeloma/plasmocytes	994 (2.19)	C54 - Body of the uterus	576 (1.47)
Other neoplasms	18,570 (40.86)	Other neoplasms	9,564 (24.39)
Accident disability retirement (B92)			
C44 - Other malignant neoplasms of the skin	143 (23.83)	C44 - Other malignant neoplasms of the skin	43 (20.98)
C34 - Bronchi and lungs	93 (15.50)	C50 - Mama	38 (18.54)
C16 - Stomach	49 (8.17)	C34 - Bronchi and lungs	31 (15.12)
C32 - Larynx	42 (7.00)	C16 - Stomach	14 (6.83)
C61 - Prostate	32 (5.33)	C92 - Myeloid leukemia	12 (5.85)
C92 - Myeloid leukemia	26 (4.33)	C25 - Pancreas	7 (3.41)
C90 - Multiple myeloma/plasmocytes	20 (3.33)	C90 - Multiple myeloma/plasmocytes	6 (2.93)
C67 - Bladder	19 (3.17)	C53 - Cervix of the uterus	4 (1.95)
C25 - Pancreas	18 (3.00)	C18 - Colon	3 (1.46)
C40 - Limb bones and cartilage	16 (2.67)	C22 - Liver and hepatic bile ducts	3 (1.46)
Other neoplasms	142 (23.67)	Other neoplasms	44 (21.46)

Source: Authors.

cident benefits) granted for all causes, in each state, in the period from 2008 to 2014 showed that in 19 of the 26 states (including all states in the Southern region) and in the Federal District there was no granting of accident benefits for cancer. The eight states that generated these concessions were: in the Northeast region, Bahia (0.03%); in the North region, Rondônia (0.79%); in the Midwest region, Mato Grosso (0.51%) and Mato Grosso do Sul (0.06%); in the Southeast region, all states, namely: Rio de Janeiro, São Paulo, Minas Gerais (0.01% each) and Espírito Santos (0.03%). These proportions are shown in parentheses in Figure 1.

Discussion

This study found a high number of benefits granted for malignant neoplasms (> 500,000, from 2008 to 2014). However, this number represents less than 3% of the total number of grants for the period.

In general, in Brazil, the statistics related to morbidity by chronic noncommunicable diseases (NCDs) mention hypertension, depression, arthritis, and diabetes as the most prevalent. However, cancer is becoming increasingly relevant, not only because of morbidity, but also because of mortality, the disabilities generated by the disease, and the repercussion on the granting of social security benefits. Moura et al. (2007) when analyzing the main NCDs that generated the concession of benefits, from 2000 to 2002, in Recife, found that high blood pressure, diabetes mellitus, arthrosis, breast cancer, and bowel cancer were the main causes for the concession of sickness benefits. And for disability retirements it was cerebrovascular diseases, diabetes mellitus, arthritis, digestive tract cancer, and schizophrenia¹².

In the health sector, 1,023 cases of work-related cancer were reported in the Information System on Notifiable Diseases since the system was created in 2004 until 2016. In other words, an average of 78 cases/year¹³. Considering the fraction attributable to occupational risk factors for cancer, approximately 5%, and the estimate of 625,000 cancer cases in 2021 in Brazil, 31,250 new cases of work-related cancer would be expected in this year alone. It should be noted that the problem of little recognition of the relationship between cancer and work is not unique to Brazil but is a worldwide problem. In Taiwan, for example, 3,500-4,000 cases are registered ev-

ery year, while the expected number would be 75,000. In Norway, only 300 cases of cancer suspected of being work-related have been reported, when one would expect about 1,200-1,300 cases per year. Only 200 of these (66.7% of reported cases) are recognized by the National Insurance System to claim compensation for occupational disease¹⁴. Langard and Lee (2011) further report that in Australia, Singapore, Japan and South Africa there are significant numbers of cancer cases identified as work-related, but far from what is expected, considering the attributable fraction of 5%¹⁵.

In our study, we believe that the quantitative discrepancy between the concession of social security benefits (B31, B32) and accident benefits (B91, B92), may be centered in some factors such as: (I) difficulty in identifying and recognizing the causal link between the diagnosed cancer and the occupation and/or exposures to chemical, physical or biological agents with carcinogenic potential in the workplace¹⁶; (II) in the restriction of categories for the concession of accident benefits, which only allows the inclusion of employees, independent workers and special insured members, different from the social security ones, which contemplate all affiliations³; (III) in the absence of the Communication of Work Accident (CAT) and other documents issued by the work physician, by the public or private hospital network, signaling the possibility of that cancer being attributed to work. This responsibility is up to the medical expert, who, based on his decision-making autonomy, can deny the accident characterization of the nexus, should he not be imbued with an anamnesis of the occupational history and have at hand other instruments that help him in this decision¹⁴.

Another difficulty, concerns the long latency periods between exposure and disease observed for most solid tumors (average of 20 years)¹⁷. Thus, if the occupational history is not recovered, the causal link may not be established, since the current occupation may not be the same that led to the illness, or the worker may already be retired at the time of diagnosis, no longer being eligible for the benefits analyzed in this study¹⁴.

Observing the proportions of benefits granted for all causes, in Brazil, men received 55.55% and women 44.45% of the benefits. This distribution may reflect the population aged 16 to 59 years protected by Social Security, which, in the year 2014, was composed of 55.95% men and 44.05% women¹⁸. However, a female predominance was observed in the total number of cancer

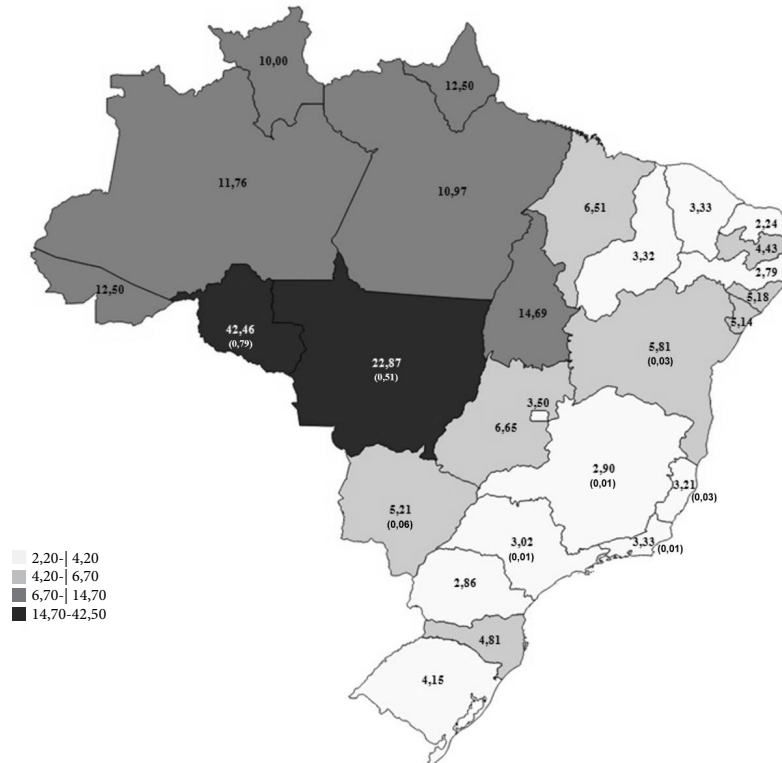


Figure 1. Proportion of pension benefits granted for cancer, among benefits granted for all causes, in each state in Brazil – 2008 to 2014.

The proportions of accident benefits granted for cancer, among the benefits granted for all causes, in each state in Brazil, 2008 to 2014, are presented in brackets for the 8 states that granted this benefit in the analyzed period.

Source: Authors.

benefits granted and in cancer welfare assistance. This female predominance in cancer benefit recipients was also seen in a study of Dutch welfare recipients (64.00%)¹⁹. However, it is interesting to note that cancer incidence rates are higher in men, than in women, both in Brazil and in the Netherlands¹.

In relation to accident aids, both for all causes and for cancer, the highest amount was granted to males. This result is consistent with the higher number of men in economic sectors with greater contact with chemical, physical and biological agents with carcinogenic potential, such as civil construction, industry and agriculture, for example²⁰.

In the distribution of benefits, according to clientele, in Brazil, we observed a predominance

of urban clientele over rural clientele. However, there was a discrete predominance of the rural clientele over the urban clientele in accident benefits granted for cancer. Since this article has no information regarding the neoplastic locations that motivated the granting of benefits according to the type of clientele, there is no way to hypothesize occupational exposure in this case, but it should be pointed out that in the National Household Sample Survey (PNAD-2014), the urbanization rate, measured by the proportion of people living in urban areas, was 84,8%²¹, therefore, it would be expected that more benefits would be granted to the urban clientele, unlike the results of this study. However, studies conducted in Brazil have been indicating an increase in cases and deaths from cancer among rural workers²² and in

comparison with workers in other economic sectors²³, consolidating our findings.

The types of malignant neoplasms that represented the highest costs for Finland were found to be breast, prostate, colorectal, lung, and leukemia²⁴. Apparently, breast, prostate, colorectal and lung cancers also generate high costs for Brazilian social security, since they appear among the main cancer locations that generate benefits. For the Mexican Institute of Social Security, the main malignant neoplasms that motivated the granting of disability retirement, in the period from 2006 to 2012, were: breast, colon, Brain, lung, and stomach²⁵.

The analysis of the main cancer locations that granted benefits also shows that the types of cancer that generated accident or social security benefits are different. In the welfare type, the first neoplasms observed are breast and cervical cancer in women and prostate, stomach and lung cancer in men, mainly reflecting the high incidence rates of these neoplasms estimated for Brazil in the year 2014²⁶. In the accident type, skin cancer and lung cancer are the most granted. It can be observed that leukemias appear only in the rankings of the top 10 topographies that generated accident benefits. These results are consistent with the literature, since leukemias, in general, are related to exposure to benzene²⁷, to formaldehyde²⁸, to chemical agents used during rubber production and vulcanization²⁹, to radiations³⁰, among other agents³¹. Other neoplasms that may be work-related, such as cancer of the stomach, bladder, larynx, prostate, and breast, are present in the list of accident benefits, in men and women, to a greater or lesser degree.

In relation to breast cancer, besides the well-known risk factors, we highlight work-related factors, such as radiation, exposure to pesticides, polychlorinated biphenyls, and night work, some of which still have limited evidence³¹. Other factors cited are clerical work, due to lifestyle and reproductive factors (long period of study, late first pregnancy, low parity) compared to women working in sales, transportation and production³², as well as environmental exposure to polycyclic aromatic hydrocarbons³³.

The risk factors for prostate cancer are age, race, ethnicity, obesity³⁴ and first-degree family history of the same type of cancer³⁵. Associated occupational risk factors (although with limited evidence) are arsenic and inorganic arsenic compounds; cadmium and its compounds; occupational exposure as a firefighter; malathion pesticide; night work; exposure to chemical agents

during rubber production and exposure to ionizing radiation³¹. The small number of this type of cancer among those that generated accident-related sickness benefits is striking (only 32 cases of disability - B92), compared to 35,762 of the social security type (B91).

It is worth mentioning the concession of 2,486 benefits of the type of accidental illness aid (B91) for non-melanoma skin cancer, in both sexes, which represents 60.00% of all benefits of this type. This is also the main neoplasm that generates accidental disability retirements. On the one hand, a large number of concessions for this neoplasm is expected, since non-melanoma skin cancer was the most incident neoplasm in the year 2014, for Brazil²⁶. In addition, cumulative sun exposure is known to be an important risk factor for non-melanoma skin cancer³⁶ and that many workers, who work outdoors, are exposed most of their lives to solar radiation³⁷. Thus, one can believe that it was unequivocal to the medical expertise the occupational exposure to the sun as a result of the activity performed outdoors. On the other hand, it is important to point out that, in general, the treatment for non-melanoma skin cancer consists of curative surgery, performed as an outpatient³⁸, not requiring time off work.

Regarding thyroid cancer, which was the third most common neoplasm that led to the granting of benefits for social security sickness in women, it is important to note the increase in incidence over the past three decades in high- and middle-income countries such as Brazil. This increase has been called the epidemic of overdiagnosis, due to the detection by imaging technology of lesions without clinical significance. Recent data suggest that this increase in incidence and over diagnosis is slowing down⁴. Thus, future studies, which verify the concession of benefits for cancer, in more recent periods, may verify a reduction in the concession of benefits for thyroid cancer, in relation to the present work.

We observed a higher proportion of cancer accident benefits in all the states of the southeastern region, including Mato Grosso do Sul in the central region and the state of Bahia in the northeastern region. This study took place after the implementation of the Epidemiological Social Security Nexus, and still, 19 states did not grant cancer benefits for occupational accidents, suggesting that, in these states, the occupational exposure and cancer nexus is not yet apparent.

Recognizing occupational carcinogens is important for primary prevention, financial compensation, and surveillance of the exposed work-

er, as well as identifying the causes of cancer in the world population³⁹. All these findings point out that more studies are needed to evaluate the association between occupational activities and cancer. For this purpose, Social Security data are a good tool. Moreover, it is necessary to ensure that other information systems, such as population-based cancer registries and hospital-based cancer registries, have complete information on occupation, allowing for future studies. It is also important to stress the importance of filling out the module work-related cancer of the Sistema de Informação de Agravos de Notificação – SINAN (Information System of Notifiable Diseases) established by the Administrative Rule 777, of April 28, 2004, to give visibility to cancer as a work-related disease⁴⁰.

Studying the occurrences of cancer that generated the granting of benefits in the GRSS requires a broad reflection. First, considering the interests involved in the receipt of a benefit, and later, concerning the surveillance of workers' health. The main limitation of this work is the use of secondary data made available by the INSS in different spreadsheets, one for each variable studied, instead of a single database, thus making it impossible to cross-reference the analyzed variables. Furthermore, the data collected could only be analyzed as absolute and relative frequencies of benefits granted, since the lack of information on the average monthly number of contributors made it impossible to estimate the incidence of cancer in the population insured under the GRSS. However, the data were analyzed with caution so that these limitations, inherent in the

ecological study design, would not produce bias in the data presented. Despite these limitations, one should point out the uniqueness of the data used, due to the presence of variables that are not usually obtained in cancer registries. In addition, the strength of this study is the evaluation of the data for an 8-year period, allowing a more homogeneous and precise analysis, because it reduces possible annual oscillations.

There is no doubt that Brazil has been improving its attention on work-related cancer surveillance¹⁶, but it seems that, starting with the professionals who compose the first care to the patient until those who record the information in these systems, proper importance is not given to the completeness of the information. Perhaps there should be, in the training of these professionals, awareness of this issue since cancer control requires concrete information.

The present article does not aim to show the link between cancer and work, but to allow reflection on the non-measurement of malignant neoplasms peculiar to the work environment in Brazil.

Conclusion

The distribution of cancer occurrences that generated concessions of Social Security benefits from 2008 to 2014 suggests a disproportionality of the concession of social security benefits in relation to accident benefits, mainly in the North, Northeast and South regions of Brazil.

Collaborations

All authors contributed to the study conception and design. Data collection were performed by Sales-Fonseca N. Analysis were performed by Sales-Fonseca N and Santos SS. The first draft of the manuscript was written by Sales-Fonseca N. All authors commented on previous versions and approved the final manuscript.

References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA A Cancer J Clin* 2021; 71(3):209-249.
2. Reis CS, Noronha K, Wajnman S. Envelhecimento populacional e gastos com internação do SUS: uma análise realizada para o Brasil entre 2000 e 2010. *Rev Bras Estud Popul* 2016; 33(3):591-612.
3. Brasil. Lei nº 8.213, de 24 de julho de 1991. Dispõe sobre os Planos de Benefícios da Previdência Social e dá outras providências. *Diário Oficial da União* 1991; 24 jul.
4. IARC. *World cancer report: cancer research for cancer prevention*. Lyon: IARC; 2020.
5. Olsson A, Kromhout H. Occupational cancer burden: the contribution of exposure to process-generated substances at the workplace. *Mol Oncol* 2021; 15(3):753-763.
6. Counil E, Henry E. Is it time to rethink the way we assess the burden of work-related cancer? *Curr Epidemiol Rep* 2019; 6(2):138-147.
7. Shrivastava S, Shrivastava P, Ramasamy J. Occupational Cancer: public health interventions to minimize its burden and impact on the society. *Iran J Cancer Prev* 2014; 7(2):111-113.
8. Grabois M, Souza M, Guimarães R, Otero U. Completude da informação “ocupação” nos registros hospitalares de câncer do Brasil: bases para a vigilância do câncer relacionado ao trabalho. *Rev Bras Cancerol* 2014; 60(3):207-214.
9. Brasil. Lei 12.527, de 18 de novembro de 2011. Regula o acesso a informações previsto no inciso XXXIII do art. 5º, no inciso II do § 3º do art. 37 e no § 2º do art. 216 da Constituição Federal; altera a Lei no 8.112, de 11 de dezembro de 1990; revoga a Lei no 11.111, de 5 de maio de 2005, e dispositivos da Lei no 8.159, de 8 de janeiro de 1991; e dá outras providências. *Diário Oficial da União* 2011; 18 nov.
10. Instituto Nacional do Seguro Social (INSS). Auxílio-doença: comum ou acidente de trabalho? [Internet]. 2020. [acessado 2020 jun 19]. Disponível em: <https://www.inss.gov.br/beneficios/auxilio-doenca/auxilio-doenca-comum-ou-acidente-de-trabalho>
11. World Health Organization (WHO). Cancer: key facts [Internet]. 2018. [cited 2021 jan 10]. Available from: <https://www.who.int/news-room/fact-sheets/detail/cancer>
12. Moura AAG, Carvalho EF, Silva NJC. Repercussão das doenças crônicas não-transmissíveis na concessão de benefícios pela previdência social. *Cien Saude Colet* 2007; 12(6):1661-1672.
13. Centro Colaborador da Vigilância aos Agravos à Saúde do Trabalhador (CCVISAT). Sistema de Informação de Agravos de Notificação – SINAN [Internet]. 2021 [acessado 2021 jun 30]. Disponível em: <http://www.ccvisat.ufba.br/sinan-2/>
14. Otero UB, Mello MSC. Fração atribuível a fatores de risco ocupacionais para câncer no Brasil: evidências e limitações. *Rev Bras Cancerol* 2016; 62(1):43-45.
15. Langård S, Lee L. Methods to recognize work-related cancer in workplaces, the general population, and by experts in the clinic, a Norwegian experience. *J Occup Med Toxicol* 2011; 6(1):24.

16. Brasil. Ministério da Saúde (MS). *Doenças relacionadas ao trabalho: manual de procedimentos para os serviços de saúde*. Brasília: MS; 2001.
17. Centers for Disease Control and Prevention (CDC). *Investigating suspected cancer clusters and responding to community concerns*. Atlanta: CDC; 2013.
18. Ministério da Fazenda (MF). Dataprev. *Anuário estatístico da Previdência Social/Ministério do Trabalho e Previdência Social, Empresa de Tecnologia e Informações da Previdência Social – ano 1*. Brasília: ASCOM; 2015.
19. Muijen P, Duijts S, Bonefaas-Groenewoud K, Beek A, Anema J. Factors associated with work disability in employed cancer survivors at 24-month sick leave. *BMC Cancer* 2014; 14:236.
20. Instituto de Pesquisa Econômica Aplicada (Ipea). Retrato das desigualdades de gênero e raça. Mercado de trabalho. Distribuição percentual da população ocupada com 16 anos ou mais de idade, por cor/raça, segundo sexo e setor de atividade – Brasil, 1995 a 2015 [Internet]. 2020. [acessado 2021 mar 10] Disponível em: https://www.ipea.gov.br/retrato/indicadores_mercado_trabalho.html
21. Instituto Brasileiro de Geografia e Estatística (IBGE). *Síntese de indicadores sociais – uma análise das condições de vida da população brasileira*. Rio de Janeiro: IBGE; 2014.
22. Miranda Filho AL, Koifman RJ, Koifman S, Monteiro GTR. Brain cancer mortality in an agricultural and a metropolitan region of Rio de Janeiro, Brazil: a population-based, age-period-cohort study, 1996-2010. *BMC Cancer* 2014; 14:320.
23. Boccolini PMM, Asmus CIRF, Chrisman JR, Câmara VM, Markowitz SB, Meyer A. Stomach cancer mortality among agricultural workers: results from a death certificate-based case-control study. *Cad Saude Colet* 2014; 22(1):86-92.
24. Torkki P, Leskelä R-L, Linna M, Mäklin S, Mecklin J-P, Bono P, Kataja V, Karjalainen S. Cancer costs and outcomes for common cancer sites in the Finnish population between 2009-2014. *Acta Oncol* 2018; 57(7):983-988.
25. Zitle-García EJ, Saucedo-Valenzuela AL, Ascencio-Montiel IJ, García-Paredes J. Malignant tumors as cause of disability at the Instituto Mexicano del Seguro Social. *Rev Med Inst Mex Seguro Soc* 2018; 56(2):173-179.
26. Ministério da Saúde (MS). Instituto Nacional de Câncer José Alencar Gomes da Silva (Inca). Estimativa 2014 – incidência de câncer no Brasil. *Rev Bras Cancerol* 2014; 60(1):63.
27. Khalade A, Jaakkola MS, Pukkala E, Jaakkola JJ. Exposure to benzene at work and the risk of leukemia: a systematic review and meta-analysis. *Environ Health* 2010; 9:31.
28. Zhang L, Steinmaus C, Eastmond DA, Xin XK, Smith MT. Formaldehyde exposure and leukemia: A new meta-analysis and potential mechanisms. *Mutat Res* 2009; 681(2-3):150-168.
29. Boniol M, Koechlin A, Boyle P. Meta-analysis of occupational exposures in the rubber manufacturing industry and risk of cancer. *Int J Epidemiol* 2017; 46(6):1940-1947.
30. Hauptmann M, Daniels RD, Cardis E, Cullings HM, Kendall G, Laurier D, Linet MS, Little MP, Lubin JH, Preston DL, Richardson DB, Stram DO, Thierry-Chef I, Schubauer-Berigan MK, Gilbert ES, Berrington de Gonzalez A. Epidemiological studies of low-dose ionizing radiation and cancer: summary bias assessment and meta-analysis. *J Natl Cancer Inst Monogr* 2020; 2020(56):188-200.
31. International Agency for Research on Cancer (IARC). List of classifications by cancer sites with sufficient or limited evidence in humans, IARC monographs volumes 1-132ª [Internet]. 2020. [cited 2021 mar 15]. Available from: https://monographs.iarc.who.int/wp-content/uploads/2019/07/Classifications_by_cancer_site.pdf
32. Kullberg C, Selander J, Albin M, Borgquist S, Manjer J, Gustavsson P. Female white-collar workers remain at higher risk of breast cancer after adjustments for individual risk factors related to reproduction and lifestyle. *Occup Environ Med* 2017; 74(9):652-658.
33. White AJ, Bradshaw PT, Herring AH, Teitelbaum SL, Beyea J, Stellman SD, Steck SE, Mordukhovich I, Eng SM, Engel LS, Conway K, Hatch M, Neugut A, Santella RM, Gammon MD. Exposure to multiple sources of polycyclic aromatic hydrocarbons and breast cancer incidence. *Environ Int* 2016; 89-90:185-92.
34. Pietro GD, Chornokur G, Kumar NB, Davis C, Park JY. Racial Differences in the Diagnosis and Treatment of Prostate Cancer. *Int Neurourol J* 2016; 20(Suppl. 2):S112-S119.
35. Beebe-Dimmer JL, Yee C, Paskett E, Schwartz AG, Lane D, Palmer NRA, Bock CH, Nassir R, Simon MS. Family history of prostate and colorectal cancer and risk of colorectal cancer in the women's health initiative. *BMC Cancer* 2017; 17(1):848.
36. World Health Organization (WHO). Radiation: ultraviolet (UV) radiation and skin cancer [Internet]. 2017. [cited 2020 set 20]. Available from: [https://www.who.int/news-room/q-a-detail/ultraviolet-\(uv\)-radiation-and-skin-cancer](https://www.who.int/news-room/q-a-detail/ultraviolet-(uv)-radiation-and-skin-cancer)
37. Modenese A, Korpinen L, Gobba F. Solar Radiation Exposure and Outdoor Work: An Underestimated Occupational Risk. *Int J Environ Res Public Health* 2018; 15(10):2063.
38. Basset-Seguín N, Herms F. Update in the management of basal cell carcinoma. *Acta Derm Venereol* 2020; 100(11):284-290.
39. Loomis D, Guha N, Hall AL, Straif K. Identifying occupational carcinogens: an update from the IARC Monographs. *Occup Environ Med* 2018; 75(8):593-603.
40. Brasil. Lei no 6.184, de 11 de dezembro de 1974. Dispõe sobre a integração de funcionários públicos nos quadros de sociedades de economia mista, empresas públicas e fundações resultantes de transformação de órgãos da Administração Federal Direta e autárquicas; revoga a Lei nº 5.927, de 11 de outubro de 1973, e dá outras providências. *Diário Oficial da União* 1974; 11 dez.

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