

# Cancer per Economic Activity at Brazil's Southeast Region: Benefits Granted by the Brazilian Social Security System

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*Câncer segundo a Atividade Econômica na Região Sudeste do Brasil: Benefícios Concedidos pelo Regime Geral de Previdência Social*

*Cáncer según Actividad Económica en la Región Sudeste del Brasil: Beneficio Concedido por el Sistema General de Seguridad Social de Brasil*

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## ABSTRACT

**Introduction:** Despite the economic importance of the Region, there are still few studies in the literature about occupational cancer in Brazil's Southeast Region. **Objective:** Compare the distribution of cancer-related benefits granted by the Brazilian Social Security System (RGPS) by economic activity of the insured individual, between 2008 and 2014, at Brazil's Southeast Region. **Method:** The proportions of cancer-related accidental (work-related) and social security (general) benefits granted, according to the economic activity of the insured individual (bank cashier, salesperson, transport and freight worker, railway worker, industrial worker, sailor, public servant, rural worker, and blank) were calculated. **Results:** Cancer represented 3.07% (271,086) of the benefits granted for all causes. Commercial and rural activities showed the largest proportions of cancer-related benefits granted in all States. For both activities, breast and prostate cancers were the main locations that justified the approval of social security benefits, and other malignant skin neoplasms were the main locations for accidental benefits. **Conclusion:** The disproportionality between the number of cancer-related social security and accidental benefits granted suggests an error in many benefits, disfavoring accidental benefits. The improvement of the anamneses of the worker by the medical expert, with the use of additional documents, can aid the establishment of the causal link between the professional activity and the cancer developed, granting accidental benefits when this link exists. Moreover, surveillance strategies to boost the implementation of actions to prevent occupational cancer are still necessary at that Region.

**Key words:** occupational cancer; occupational health; social security; Brazil.

## RESUMO

**Introdução:** Apesar da importância econômica da Região, ainda existem poucos estudos na literatura sobre o câncer ocupacional na Região Sudeste do Brasil. **Objetivo:** Comparar a distribuição do câncer entre os benefícios concedidos pelo Regime Geral de Previdência Social (RGPS), por ramo de atividade econômica do segurado, no período de 2008 a 2014, na Região Sudeste do Brasil. **Método:** Foram calculadas as proporções de benefícios acidentários (relacionados ao trabalho) e previdenciários (geral) concedidos por câncer, segundo o ramo de atividade econômica do segurado (bancário, comércio, transporte e carga, ferroviário, industrial, marítimo, serviço público, rural e não preenchido). **Resultados:** O câncer representou 3,07% (271.086) dos benefícios concedidos por todas as causas. Os ramos de atividades comerciais e rurais tiveram as maiores proporções de benefícios concedidos por câncer, em todos os Estados. Para ambos, as principais localizações de câncer que motivaram a concessão de benefícios previdenciários foram mama e próstata, e as outras neoplasias malignas da pele foram a principal localização para os benefícios acidentários. **Conclusão:** A desproporcionalidade entre o número de benefícios previdenciários e acidentários concedidos por câncer sugere erro em muitos benefícios, desfavorecendo os acidentários. O aprimoramento das anamneses do trabalhador pelo médico perito, com a utilização de documentos complementares, pode auxiliar no estabelecimento do nexo causal entre a atividade profissional e o câncer, concedendo benefícios acidentários quando houver esse nexo. Adicionalmente, ainda são necessárias estratégias de vigilância para subsidiar a implementação de ações de prevenção do câncer ocupacional na Região Sudeste do Brasil.

**Palavras-chave:** câncer ocupacional; saúde ocupacional; previdência social; Brasil.

## RESUMEN

**Introducción:** A pesar de la importancia económica de la Región, todavía hay pocos estudios en la literatura sobre el cáncer ocupacional en la Región Sudeste del Brasil. **Objetivo:** Comparar la distribución del cáncer entre los beneficios otorgados por el Sistema General de Seguridad Social (RGPS), según la actividad económica del asegurado, de 2008 a 2014, en la Región Sudeste del Brasil. **Método:** Se calcularon las proporciones de los beneficios accidentales (laborales) y previsionales (generales) otorgados por cáncer, de acuerdo con la actividad económica del asegurado (bancaria, comercial, transporte y carga, ferroviaria, industrial, marítima, servicio público, rural y no llenado). **Resultados:** El cáncer representó el 3,07% (271.086) de los beneficios por todas las causas. Las actividades comerciales y rurales tuvieron las mayores proporciones de beneficios otorgados por cáncer, en todos los estados. Para ambos, las principales localizaciones de cáncer que motivaron el otorgamiento de los beneficios de la seguridad social fueron las de mama y próstata, y otras neoplasias malignas de la piel fueron la principal localización de los beneficios accidentales. **Conclusión:** La desproporción entre el número de beneficios de seguridad social y de accidentes otorgados por cáncer sugiere un error en muchos beneficios, desfavoreciendo los por accidentes. El perfeccionamiento de las anamnesis del trabajador por parte del perito médico, con el uso de documentos complementarios, puede ayudar a establecer el nexo de causalidad entre la actividad profesional y el cáncer, otorgando beneficios accidentales cuando exista dicho nexo. Además, todavía se necesitan estrategias de vigilancia para apoyar la implementación de acciones de prevención del cáncer ocupacional en la Región Sudeste del Brasil.

**Palabras clave:** cáncer profesional; salud laboral; seguridad social; Brasil.

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## INTRODUCTION

Since the 1980s, the global burden of cancer attributable to occupational exposure has been estimated between 2% and 5%<sup>1,2</sup>, and more recent epidemiological studies continue to demonstrate the importance of occupational exposures to physical and chemical carcinogens for fractions attributable to cancer<sup>3-5</sup>. Corroborating these findings, the World Health Organization (WHO)'s International Agency for Research on Cancer (IARC)<sup>6-10</sup> consolidated evidences about the carcinogenicity in humans related to occupations, exposure to complex mixtures, and chemical agents, including benzene, benzopyrene, mineral oils, coke production, formaldehyde, among others. New agents as nanoparticles and pesticides and situations of exposure like night shift work were also classified.

High Human Development Index (HDI) countries have achieved major progress in the prevention of occupational cancer, with the elimination or substantial reduction of the exposure to some carcinogens, such as asbestos, aromatic amines, benzidine, and benzene. However, many production processes utilizing these substances were unacceptably exported to low HDI countries, generating an unequal distribution of these exposures within the society as a whole<sup>11</sup>.

In Brazil, the Southeast Region is the most economically developed of the country and, in 2009, was responsible for more than 60% of the country's industrial transformation. The state of São Paulo concentrates a substantial portion of the Brazilian industries, followed by the state of Rio de Janeiro, with a major multi-industrial center, tourism-targeted profile and shipyards. The economy of Espírito Santo is diversified and involves oil and gas, cellulose, marble and granite, furniture and metallurgical and steel businesses. The state of Minas Gerais is also known for its metallurgical and steel working sectors due to the mineral resources found in the Region<sup>12</sup>.

Despite the economic importance of the Region, there are few studies available in the literature about occupational cancer<sup>13</sup>. The present study aims to compare the distribution of cancer-related benefits granted by the Brazilian Social Security System (RGPS) by economic activity of the insured individual, between 2008 and 2014, at Brazil's Southeast Region.

## METHOD

Ecological study about cancer-related benefits granted to individuals by the RGPS, between 2008 and 2014, in the four States – São Paulo, Rio de Janeiro, Minas Gerais and Espírito Santo – of the Southeast Region. The public data

were requested from the National Social Security Institute (INSS) by means of the Online Citizens' Information System and lately made available to the study in hard copies, since the number of benefits granted for each cancer (ICD-10 code C00-C97), detailed for Region and fields of activities are not available on the agency's website.

Four types of benefits granted by the Brazilian General Social Security System were selected for the study: social security sickness leave (B31), social security disability retirement (B32), accidental sickness leave (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)<sup>14</sup>.

The sickness leave (B31 and B91) is granted to the insured individual when unable to practice the routine activities for a period exceeding 15 consecutive days (the first 15 days must be paid by the employer) and when this condition is not considered irreversible. The disability retirements (B32 and B92) are granted to insured individuals who are considered impaired and unrehabilitated for subsistence activities and will be paid while they remain in this condition. Accidental 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 employer must give the worker after returning to work<sup>15</sup>. It should be noted that according to article 20 of Law 8,213/91<sup>15</sup>, diseases arising from a certain activity, or arising or aggravated by work or conditions of its performance, are considered work-related accidents. Hence, occupational cancer caused by the work environment should also be classified as a work accident<sup>16</sup>.

The benefits analyzed in this study were classified according to the field of economic activity of the insured individual determined by the RGPS as: bank cashier, salesperson, transport and freight worker, railway worker, industrial worker, sailor, public servant, rural worker, and blank.

The proportional distributions of the benefits granted in the selected period were calculated, the numerators were: (a) the number of benefits of each category (B31, B32, B91, and B92) granted according to ICD-10 groups (all causes, cancer, other causes, and unclassified causes), for each state of the Southeast Region (ES, MG, RJ, and SP); (b) the number of benefits granted according to the ICD-10 groups (all causes, cancer, and other causes) for each state of the Southeast Region, according to the field of activity; and (c) the number of cancer-related benefits from each category (accidental benefits and social security) granted for each ICD-10 code (C00-C97), according to the field of activity (commercial, rural, and transport and freight).

The denominators were: (a) the number of benefits granted for all causes, between 2008 and 2014, according to Region and fields of activities (Tables 1 and 2); and (b) the number of cancer-related benefits granted between 2008 and 2014, according to Region and fields of activities (Tables 3 to 5).

The review and approval by the Institutional Review Board of “*Escola Nacional de Saúde Pública (Ensp)*” of “*Fundação Oswaldo Cruz (Fiocruz)*” was waived because only secondary and public data were utilized.

## RESULTS

From 2008 to 2014, 8,844,378 social security and accidental benefits for all causes of disease were granted to insured individuals by the RGPS of Brazil’s Southeast Region. Of this total, 3.07% (271,086 benefits) were cancer-related and 92.24% (8,158,249 benefits) were granted for all other causes.

Table 1 presents the proportional distribution of the four types of cancer-related benefits and other causes benefits. For the entire Southeast Region, cancer-related benefits were granted, 3.21% of social security sickness

leave; 0.09% of accidental sickness leave; 6.60% of social security disability retirement; and 0.75% of accidental disability retirement. These proportions have remained relatively stable in the four States of the Region, and as expected, in all the States the distribution of accidental benefits was lower than social security benefits.

Table 2 presents the proportional distribution of the benefits according to the economic activity: bank cashier, salesperson, transport and freight worker, railway worker, industrial worker, sailor, public servant, rural worker, and blank. The fields of commercial, rural, and transport and freight activities present the highest number of benefits granted for all causes, most likely due to a great number of insured individuals by the RGPS for these economic activities. The commercial and rural fields stand out, with the largest proportions of cancer-related benefits granted in all States. The state of São Paulo presents the largest number of cancer-related benefits granted for commercial activities (143,040), followed by Minas Gerais (59,415), Rio de Janeiro (48,207), and Espírito Santo (10,053). The state that granted more benefits for rural activities was Minas Gerais (6,134), followed by Espírito Santo (1,728), São Paulo (1,703), and Rio de Janeiro (462).

**Table 1.** Proportional distribution of cancer and other causes-related benefits granted by the Brazilian General Social Security System, according to the States of Brazil’s Southeast Region, 2008 to 2014

Benefit	Region	All causes (100 %)	Cancer N (%)	Other causes N (%)	Not classified N (%)
Social security sickness (B32)	ES	306,731	9,538 (3.11)	291,009 (94.87)	6,184 (2.02)
	MG	1,823,145	53,368 (2.93)	1,726,477 (94.70)	43,300 (2.38)
	RJ	1,203,854	38,895 (3.23)	1,134,385 (94.23)	30,574 (2.54)
	SP	3,758,850	125,794 (3.35)	3,521,774 (93.69)	111,282 (2.96)
	Southeast	7,092,580	227,595 (3.21)	6,673,645 (94.09)	191,340 (2.70)
Accidental sickness (B91)	ES	35,731	81 (0.23)	35,398 (99.07)	252 (0.71)
	MG	236,464	260 (0.11)	235,187 (99.46)	1,017 (0.43)
	RJ	138,922	123 (0.09)	137,854 (99.23)	945 (0.68)
	SP	666,761	514 (0.08)	662,340 (99.34)	3,907 (0.59)
	Southeast	1,077,878	978 (0.09)	1,070,779 (99.34)	6,121 (0.57)
Social security disability retirement (B32)	ES	23,901	2,188 (9.15)	16,344 (68.38)	5,369 (22.46)
	MG	184,221	11,926 (6.47)	120,138 (65.21)	52,157 (28.31)
	RJ	114,416	9,661 (8.44)	80,862 (70.67)	23,893 (20.88)
	SP	318,170	18,489 (5.81)	170,635 (53.63)	129,046 (40.56)
	Southeast	640,708	42,264 (6.60)	387,979 (60.55)	210,465 (32.85)
Accidental disability retirement (B92)	ES	1,384	14 (1.01)	1,136 (82.08)	234 (16.91)
	MG	8,866	64 (0.72)	7,347 (82.87)	1,455 (16.41)
	RJ	5,192	55 (1.06)	4,493 (86.54)	644 (12.40)
	SP	17,770	116 (0.65)	12,870 (72.43)	4,784 (26.92)
	Southeast	33,212	249 (0.75)	25,846 (77.82)	7,117 (21.43)

**Note:** Total number of benefits granted in the Southeast Region: 8,844,378.

**Table 2.** Proportional distribution of cancer-related and other causes benefits granted by the Brazilian General Social Security System, according to the activities and States of Brazil's Southeast Region, 2008 to 2014

State	Activities	All causes	Cancer N (%)	Other causes N (%)
ES	Bank cashier	1	-	1 (100.00)
	Salesperson	303,848	10,053 (3.31)	293,795 (96.69)
	Transport and freight	2,848	39 (1.37)	2,809 (98.63)
	Railway	1	-	1 (100.00)
	Industrial	1	-	1 (100.00)
	Sailor	-	-	-
	Public servant	5	-	5 (100.00)
	Rural	48,996	1,728 (3.53)	47,268 (96.47)
	Blank	8	1 (12.50)	7 (87.50)
	Total	355,708	11,821 (3.32)	343,887 (96.68)
MG	Bank cashier	3	-	3 (100.00)
	Salesperson	2,002,558	59,415 (2.97)	1,943,143 (97.03)
	Transport and freight	4,897	43 (0.88)	4,854 (99.12)
	Railway	2	-	2 (100.00)
	Industrial	31	2 (6.45)	29 (93.55)
	Sailor	-	-	-
	Public servant	61	2 (3.28)	59 (96.72)
	Rural	147,134	6,134 (4.17)	141,000 (95.83)
	Blank	81	7 (8.64)	74 (91.36)
	Total	2,154,767	65,603 (3.04)	2,089,164 (96.96)
RJ	Bank cashier	7	-	7 (100.00)
	Salesperson	1,393,372	48,207 (3.46)	1,345,165 (96.54)
	Transport and freight	2,340	57 (2.44)	2,283 (97.56)
	Railway	-	-	-
	Industrial	28	3 (10.71)	25 (89.29)
	Sailor	2	-	2 (100.00)
	Public servant	9	-	9 (100.00)
	Rural	10,532	462 (4.39)	10,070 (95.61)
	Blank	38	5 (13.16)	33 (86.84)
	Total	1,406,328	48,734 (3.47)	1,357,594 (96.53)
SP	Bank cashier	12	-	12 (100.00)
	Salesperson	4,477,672	143,040 (3.19)	4,334,632 (96.81)
	Transport and freight	12,428	150 (1.21)	12,278 (98.79)
	Railway	1	-	1 (100.00)
	Industrial	51	1 (1.96)	50 (98.04)
	Sailor	1	-	1 (100.00)
	Public servant	318	12 (3.77)	306 (96.23)
	Rural	21,278	1,703 (8.00)	19,575 (92.00)
	Blank	124	7 (5.65)	117 (94.35)
	Total	4,511,885	144,913 (3.21)	4,366,972 (96.79)
<b>Total for the Southeast Region</b>		<b>8,428,688</b>	<b>271,071 (3.22)</b>	<b>8,157,617 (96.78)</b>

**Note:** The total number does not correspond to the 8,429,335 benefits granted in the Southeast Region because of discrepancies in the data provided by the INSS.

The largest number of benefits granted for commercial, rural, and transport and freight activities offers a good opportunity for data analysis. In this sense, Tables 3 to 5 present the 10 main cancer locations that justified the approval of benefits for these activities.

Nevertheless, it is important to highlight that other fields of activities also presented considerable proportions of cancer-related benefits granted such as industry workers of Minas Gerais (6.45%) and Rio de Janeiro (10.71%), public servants in Minas Gerais (3.28%) and São Paulo (3.77%). For the entire Southeast Region, six social security benefits were granted to industrial workers, due to lip, colon, breast, prostate, myeloid leukemia and pancreatic cancers. In addition, for public servants, 14 social security sickness leave were granted due to breast cancer, other malignant neoplasms of the skin, rectum, kidney (not including the renal pelvis), malignant skin melanoma, diffuse non-Hodgkin's lymphoma, as well as

malignant neoplasms of the larynx, stomach, pancreas, and other endocrine glands and related structures.

For commercial activities, social security benefits were granted to the following main locations of cancer: breast, prostate, and colon cancers, with 25.02%, 25.02%, and 6.01% of the sickness leave, and 19.61%, 7.48%, and 6.56% of the disability retirement, respectively.

The main cancer locations of accidental benefits were other malignant skin neoplasms and bronchial and lung cancers, with 25.47% and 14.36% of the sickness leave granted and 10.71% and 15.18% for disability retirement, respectively. Myeloid leukemia (12.73% of sickness leave and 6.25% for disability retirement) and stomach cancer (9.86% of sickness leave and 10.27% for disability retirement) stood out (Table 3).

For rural activity, breast cancer (17.59% and 14.71%), prostate cancer (11.46% and 8.13), esophageal cancer (5.63% and 7.86%), stomach cancer (5.58% and 6.13%),

**Table 3.** Proportional distribution of the 10 main locations of cancer that justified the granting of benefits for commercial activities, Brazil's Southeast Region, 2008 to 2014

Social Security Benefits		Accidental Benefits	
ICD-10	N (%)	ICD-10	N (%)
<b>Sickness leave</b>			
C50 - Breast	54,872 (25.02)	C44 - Other malignant neoplasms of the skin	204 (25.47)
C61 - Prostate	19,369 (25.02)	C34 - Bronchi and Lungs	115 (14.36)
C18 - Colon	13,176 (6.01)	C92 - Myeloid leukemia	102 (12.73)
C53 - Cervix	9,619 (4.39)	C16 - Stomach	79 (9.86)
C16 - Stomach	8,396 (3.83)	C67 - Bladder	50 (6.24)
C73 - Thyroid Gland	8,031 (3.66)	C32 - Larynx	35 (4.37)
C20 - Rectum	7,449 (3.40)	C25 - Pancreas	32 (4.00)
C34 - Bronchi and Lungs	6,733 (3.07)	C91 - Lymphoid leukemia	27 (3.37)
C71 - Brain	4,666 (2.13)	C50 - Breast	25 (3.12)
C64 - Kidney, not including renal pelvis	4,293 (1.96)	C40 - Bones and joint cartilage of the limbs	14 (1.75)
Other neoplasias	82,728 (37.72)	Other neoplasias	118 (14.73)
<b>Disability retirement</b>			
C50 - Breast	7,915 (19.61)	C34 - Bronchi and Lungs	34 (15.18)
C61 - Prostate	3,018 (7.48)	C44 - Other malignant neoplasms of the skin	24 (10.71)
C18 - Colon	2,648 (6.56)	C16 - Stomach	23 (10.27)
C34 - Bronchi and Lungs	2,441 (6.05)	C32 - Larynx	17 (7.59)
C20 - Rectum	2,112 (5.23)	C92 - Myeloid leukemia	14 (6.25)
C16 - Stomach	1,885 (4.67)	C61 - Prostate	13 (5.80)
C71 - Brain	1,595 (3.95)	C67 - Bladder	11 (4.91)
C32 - Larynx	1,440 (3.57)	C90 - Multiple and plasma cell myeloma	11 (4.91)
C15 - Esophagus	1,106 (2.74)	C50 - Breast	7 (3.13)
C53 - Cervix	1,024 (2.54)	C18 - Colon	6 (2.68)
Other neoplasias	15,174 (37.60)	Other neoplasias	64 (28.57)

**Caption:** ICD-10 = International Classification of Diseases.

and colon cancer (5.15% and 5.52% of the sickness leave and disability retirement, respectively) were the main cancer sites for which social security benefits were granted. For accidental benefits, the main tumor locations for sickness leave and disability retirement, respectively, were: other malignant skin neoplasms (72.83% and 29.17%), myeloid leukemia (6.94% and 20.83%), bronchial and lung cancer (5.20% and 25.00%), and stomach cancer (4.62% and 4.17%) (Table 4).

Prostate cancer was the main location for which social security sickness leave (15.91%) were granted, the second for social security disability retirement, with breast cancer (13.89%) ranked first. Other relevant diseases justifying social security benefits included rectal cancer (7.95%) and stomach cancer (6.25%) for sickness leave, and colon cancer, for sickness leave (6.25%) as well as disability retirement (6.48%) (Table 5).

Of the accidental benefits for transport and freight activities, only 5 accidental benefits were granted: 4 sickness leave (3 due to other malignant skin neoplasms and 1 to prostate cancer) and 1 disability retirement caused by brain cancer. These data were not included in Table 5.

## DISCUSSION

The global estimation of new cases of cancer in Brazil in 2023 is 704,000 cases (49.3% in the Southeast Region)<sup>17,18</sup>. When considering the year of 2011, that was the present study middle point, it was expected 489,270 new cases, with more than 50% in the Southeast Region (247,980)<sup>19</sup>. In seven years of study, only 271,086 cancer-related benefits were granted, probably because most cancers are age dependent and developed after the insured retirement for service time, when they did not

**Table 4.** Proportional distribution of the 10 main locations of cancer-related benefits granted for rural activities, Southeast Region of Brazil, 2008 to 2014

Social security benefits		Accidental benefits	
ICD-10	N (%)	ICD-10	N (%)
<b>Sickness Leave</b>			
C50 - Breast	1,413 (17.59)	C44 - Other malignant neoplasms of the skin	126 (72.83)
C61 - Prostate	921 (11.46)	C92 - Myeloid leukemia	12 (6.94)
C15 - Esophagus	452 (5.63)	C34 - Bronchi and Lungs	9 (5.20)
C16 - Stomach	448 (5.58)	C16 - Stomach	8 (4.62)
C18 - Colon	414 (5.15)	C67 - Bladder	4 (2.31)
C53 - Cervix	308 (3.83)	C91 - Lymphoid leukemia	4 (2.31)
C44 - Other malignant skin neoplasias	303 (3.77)	C25 - Pancreas	2 (1.16)
C20 - Rectum	296 (3.68)	C32 - Larynx	2 (1.16)
C34 - Bronchi and Lungs	213 (2.65)	C05 - Palate	1 (0.58)
C71 - Brain	189 (2.35)	C31 - Sinuses	1 (0.58)
Other neoplasias	3,078 (38.31)	Other neoplasias	4 (2.31)
<b>Disability retirement</b>			
C50 - Breast	264 (14.71)	C44 - Other malignant neoplasms of the skin	7 (29.17)
C61 - Prostate	146 (8.13)	C34 - Bronchi and Lungs	6 (25.00)
C15 - Esophagus	141 (7.86)	C92 - Myeloid leukemia	5 (20.83)
C16 - Stomach	110 (6.13)	C16 - Stomach	1 (4.17)
C18 - Colon	99 (5.52)	C25 - Pancreas	1 (4.17)
C20 - Rectum	90 (5.01)	C32 - Larynx	1 (4.17)
C34 - Bronchi and Lungs	83 (4.62)	C45 - Mesothelioma	1 (4.17)
C32 - Larynx	73 (4.07)	C64 - Kidney, not including renal pelvis	1 (4.17)
C71 - Brain	68 (3.79)	C73 - Thyroid Gland	1 (4.17)
C53 - Cervix	43 (2.40)		
Other neoplasias	678 (37.77)	Other neoplasias	0 (0.00)

**Caption:** ICD-10 = International Classification of Diseases.

**Table 5.** Proportional distribution of the 10 main locations of cancer-related benefits for transport and freight activities, Southeast Region of Brazil, 2008 to 2014

<b>Social security benefits</b>	
<b>ICD-10</b>	<b>N (%)</b>
<b>Sickness leave</b>	
C61 - Prostate	28 (15.91)
C20 - Rectum	14 (7.95)
C16 - Stomach	11 (6.25)
C18 - Colon	11 (6.25)
C50 - Breast	10 (5.68)
C34 - Bronchi and Lungs	9 (5.11)
C15 - Esophagus	7 (3.98)
C44 - Other malignant neoplasms of the skin	7 (3.98)
C32 - Larynx	6 (3.41)
C67 - Bladder	6 (3.41)
Other neoplasias	67 (38.07)
<b>Disability retirement</b>	
C50 - Breast	15 (13.89)
C61 - Prostate	10 (9.26)
C18 - Colon	7 (6.48)
C16 - Stomach	6 (5.56)
C20 - Rectum	5 (4.63)
C32 - Larynx	5 (4.63)
C34 - Bronchi and Lungs	5 (4.63)
C71 - Brain	4 (3.70)
C10 - Oropharynx	2 (1.85)
C11 - Nasopharynx	2 (1.85)
Other neoplasias	47 (43.52)

**Caption:** ICD-10 = International Classification of Diseases.

**Note:** Only 5 Accident benefits were granted: 4 sickness benefits (3 due to other malignant skin neoplasms, and 1 due to prostate cancer) and 1 disability-related early retirement caused by brain cancer.

had access to the benefits analyzed in this work. Even so, this is a small number. But what the results revealed is the negligible granting of accident-related benefits. Considering the attributable fraction of occupational cancer<sup>1</sup>, it was expected that 4% of the cancer-related benefits would be work-related. However, only 0.45% of the cancer-related benefits were accident-related benefits.

It is also negligible the notifications of the occupational cancer in the Notifiable Diseases Information System (SINAN)<sup>20</sup>, having registered only 582 cases between 2008 and 2014. The unsatisfactory communication between the health sector and the social security creates a “cascading effect” defined by Otero and Mello<sup>21</sup> in which the most affected person is the worker. The non-notification of cancer cases on SINAN by the health sector and the non-granting of benefits due to the poor connection with the

INSS, intensifies the problem. Without any document issued by the health sector, suggesting that the cancer may be work-related, the INSS expert’s decision becomes more difficult and complex, although today there is the Epidemiological Technical Nexus (NTEP), a methodology to help the identification of the diseases and accidents related to the professional activity defined by INSS. Actions that promote this intersectionality are essential.

The poor recognition of cancer and its relation to work is a world problem reported in Florida, USA, Taiwan, China and Norway<sup>22</sup>. Nonetheless, it is already possible to conclude that some efforts are being made to mitigate this problem, such as the strategies of the management of knowledge and technology to control cancer adopted by Bolivia, which includes an epidemiological surveillance system for occupational exposure to carcinogenic agents<sup>23</sup>.

The great impact of cancer on years of life lost due to disabilities described in the literature<sup>24,25</sup> can be seen in the present study by the expressive number of social security benefits for disability retirement in all States (> 5%), with highest numbers in Espírito Santo (9.15%). Commercial, rural, and transport and freight activities presented the highest absolute numbers of cancer-related benefits granted.

There are innumerable occupational exposures to carcinogenic agents in the commercial sector as construction materials, including asbestos roof tiles and water tanks, sand and other dusts, solvents, paints and varnishes, products for the preservation of wood, fuels, among other agents and mixtures. Rebelo<sup>26</sup> in a study to evaluate information about occupation of patients listed in Brazil’s Hospital-Based Registries observed that the “Commerce Professionals” group presented high percentages of bladder and lung cancers, compared to other occupational groups, not including the groups of “Agriculture and Cattle Raising” and “Domestic Workers and Servants”.

Prostate cancer in men and breast cancer in women were the types of cancers detected in commercial activities most commonly approved for granting social security benefits. However, these two locations are less important when accidental benefits are analyzed. Rubber, health, transport and services and agricultural workers are most commonly associated with prostate cancer according to the literature. In a recent meta-analysis, Krstev and Knutsson<sup>27</sup> found greater risk of prostate cancer in workers exposed to pesticides and chrome, those working in night shifts, and airplane pilots. Sauvé et al.<sup>28</sup> observed a high risk of prostate cancer in gas station attendants and textile industry occupations. For breast cancer, high odds of occurrence were found by Villeneuve et al.<sup>29</sup> among textile industry workers, rubber and plastic industry workers, and

women employed for more than 10 years as nurses and tailors/seamstresses. In the same line, the present study has also detected the disproportional granting of social security and accidental benefits for breast and prostate cancer as expected.

The most common exposure of rural workers is associated with pesticides. In the study cited above, Rebelo<sup>26</sup> concluded that there was high percentage of topographies of tumors in the sinuses, pleura, lungs and bladder for agriculture and cattle raising workers compared to other occupational groups.

Skin cancer, myeloid leukemia and stomach cancers were the most common types for which accidental benefits were granted for rural activities, as the present investigation concluded. These are described in the literature as associated with exposures in rural environments, mainly due to the use of pesticides<sup>30-32</sup>. No cases of prostate cancer or breast cancer were found among accidental benefits. However, it is well-known that these tumors can be related to the use of pesticides<sup>33,34</sup>. What calls attention is lung cancer, which ranked 3<sup>rd</sup> in 10 locations that most commonly were granted accidental benefits in rural activities, but for which it was found low incidences<sup>35</sup>.

Professionals who work with transport and freight are susceptible to accidents and chronic diseases<sup>36</sup>. According to IARC<sup>37</sup>, the exposure to exhaust fumes from diesel motors, present in the occupational activity, is associated with the risk of lung and bladder cancers. The present study observed a discrete number of benefits granted to this professional category.

Very few accidental benefits were granted for transport and freight activities among the 10 main cancer sites. It is well-known, however, that this activity presents multiple exposures, given that the motor's exhaust is a complex mixture of particles and gases, in addition to agents as benzene, formaldehyde, and other well-known carcinogenic agents. Lee et al.<sup>38</sup> concluded that workers in this field of activity have a greater risk of lung cancer, as well as liver cancer, bile duct cancer, bladder cancer, and cancer of other digestive organs.

Expressive numbers of accidental and social security benefits were not found for industry workers. The numbers are minimal (2 cases in Minas Gerais, 3 cases in Rio de Janeiro, and 1 case in São Paulo). This was unexpected, since the literature mentions that specific industries and industrial processes are generally classified as being carcinogenic.

The rubber, aluminum, iron and steel industries are typically associated with specific types of cancer, such as lung, bladder, laryngeal, leukemia, skin cancers, among others<sup>39</sup>. Combined results from 105 observational studies revealed that the exposures to chemical agents utilized during the

production of rubber increased the risk of bladder cancer, lung cancer, leukemia, and laryngeal cancer<sup>40</sup>.

Corroborating these findings, a study conducted with rubber industry workers in São Paulo, Brazil found an increased risk of stomach and upper airway tumors, and possibly of cancer in general among workers from small-scale rubber companies, when compared to workers from large-scale companies<sup>41</sup>.

It is also important to highlight that skin cancer, associated mainly with occupational exposure to solar radiation, is being pointed out as one of the main work-related neoplasms related to work worldwide<sup>2</sup>.

Ultraviolet radiation (UVR) is a very common exposure for certain occupations, such as industrial workers, sailors, rural workers, transport and freight workers, salespeople, and bank cashiers, which can increase the risk of developing skin cancer<sup>42</sup>. It was also found that most of the benefits was granted to this type of cancer among workers for this period. In industries, for example, it is estimated that welding employs nearly 11 million people in the world. Welders are known for being exposed to all kinds of UVR emitted from arc welding and often suffer burns and cutaneous erythema and this activity is classified as carcinogenic for humans, based on sufficient evidence of ocular melanoma<sup>42</sup>.

Finally, it should be noted that the surveillance of cancer cases can be more effective based on the awareness and training of professionals who feed the various existing information systems, paying attention to the adequate notification and recording of these cases in each system. However, for the surveillance of these cases to be complete, it is necessary to invest in strategies to prevent exposures in the workplace, through the elimination, replacement or reduction of carcinogens, monitoring the health status of workers and work environments, continuously, in order to avoid/reduce exposures and illnesses<sup>13,21</sup>.

## CONCLUSION

Brazil's Southeast Region had more reports of accidental sickness leave in the commercial, rural, and transport and freight activities, as well as for skin cancer, lung cancer, leukemia, stomach and bladder cancer. This information is relevant for the elaboration of surveillance strategies for these specific occupational groups.

However, based in the estimates of cancer during the period and the exposures to well-known carcinogenic agents in these activities, the disproportionality between the number of cancer-related social security and accidental benefits granted suggests an error in the granting of many benefits, disfavoring accidental benefits (work-related). The utilization, during the anamneses of the worker by



the medical expert, of documents such as the Notification of Work Accidents, Professional Social Security Profile and copy of the Notification Form of the National Disease Notification System for work-related cancer, the notification form from the Information System for Notifiable Diseases such as work-related cancer, or even a medical report pointing out the suspicion that the cancer may be work-related, can aid the expert to establish the causal link between the professional activity and the cancer developed, for granting accidental benefits when this link exists.

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Nuria Sales-Fonseca contributed to data acquisition. Nuria Sales-Fonseca and Sabrina S. Santos drafted the manuscript. All the authors contributed to the study design, analysis and interpretation of the data, revised and approved the final version for publication.

### DECLARATION OF CONFLICT OF INTEREST

There is no conflict of interests to declare.

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