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Analysis of individuals with leukemia: cancer surveillance system limitations

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Abstract *Cancer is the second leading cause of death in the world with great impact on public health and leukemia is a hematological cancer directly related to different exposures at work. This study aimed to describe the occupational profile of individuals diagnosed with leukemia. This is a cross-sectional study of cases registered between 2007 and 2011 in the Integrador RHC database. Individuals from 26 Brazilian states, aged 20 years or older, were included. Of the 7,807 cases of leukemia, Minas Gerais recorded the highest occurrence (1,351). Only 52% of the cases had information on occupation. Occupations with the greatest number of cases of leukemia were agricultural, forestry and fishing workers; services, stores and markets vendors; and workers in the production of industrial goods and services. These occupations are exposed to substances considered by literature as carcinogenic agents to humans. There was a high underreporting of occupational data, compromising the quality of information and, therefore, the effectiveness of the Brazilian health surveillance system. The RHC also does not provide information about the agent used during the working day, the exposure time during working life and data from previous occupations.*

Key words *Leukemia, Occupational exposure, Hospital-based cancer records*

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Introduction

Cancer has been considered a disease of developed countries for four decades. However, this situation is changing and we can observe increased number of cases in developing countries that have few or medium resources[1]. In Brazil, this is one of the most complex problems faced by the Unified Health System (SUS) due to its epidemiological, social and economic magnitude, although a third of all new cases occurring annually in the world could be avoided[2].

The World Health Organization (WHO) has estimated 75 million people living with cancer by 2030, with 21 million new cases of the disease and 13 million deaths worldwide except for non-melanoma skin cancer. Currently, some 14 million new cases are estimated with 8 million deaths from cancer[3]. In Brazil, estimates for 2016, which apply for 2017, indicate that there are approximately 600,000 new cases of cancer, including non-melanoma skin cancer cases, reinforcing the magnitude of the cancer problem in the country. For all types of leukemia, the estimate for this type of cancer in Brazil is 5,540 new cases in men and 4,530 in women[4]. In the world ranking, among the most incident cancers, leukemia types hold 11th place, and with regard to death by cancer mortality, 10th place[3].

Leukemia types are divided into four groups: acute and chronic, which are subdivided into myeloid and lymphoid. Acute leukemia types are aggressive diseases that originate in hematopoiesis stem cells, characterized by increased production speed, decreased apoptosis, cell differentiation blockage, resulting in accumulated primitive hematopoietic cells, called blasts, and leading to bone marrow failure. Its diagnosis is defined by more than 20% of blasts in the blood or bone marrow[5].

According to Fritschi & Driscoll[6], approximately 10.8% of cancer cases in men and 2.2% of cancer cases in women, excluding non-melanoma skin cancer, are caused by exposure in the occupational environment.

The International Agency for Research on Cancer (IARC) seeks to identify environmental factors that may increase the risk of cancer in humans and, by 2014, identified 32 occupational agents and 11 circumstances of exposure classified as carcinogenic to humans. In addition, it identified 27 agents and 6 exposure conditions as potentially carcinogenic to humans[7]. Of the more than 100 carcinogens identified by the IARC, approximately 25% induce leukemia or lymphomas[8].

The elimination or significant reduction of exposure to carcinogenic agents in the occupational environment in countries with a high human development index is considered the cause of the prevention of thousands of cancer cases in the world[9]. On the other hand, due to poor working conditions and the use of obsolete technology, occupational exposure to carcinogens is believed to be higher in workers from developing countries[10].

According to the Brazilian National Cancer Institute (INCA)[11], work environments have several carcinogenic agents, the effects of which can be enhanced with exposure to other cancer risk factors, such as environmental pollution, a trans-fats-rich diet, alcohol abuse, biological agents and smoking.

Among exposures in the occupational environment, the main risk factors for the development of leukemia are solvents such as benzene, tetrachlorethylene, styrene and chlorophenols, aromatic amines, ionizing radiation, electromagnetic fields, creosote, chromium, arsenic, ethylene oxide, asbestos, some antineoplastic agents and agrochemicals[11,12]. According to IARC's most recent report (2014)[7], butadiene and formaldehyde gases 1-3 used in the plastic, rubber and textile industries are also classified as group 1 occupational carcinogens, that is, carcinogenic to human beings.

Because cancer is a long-standing latent disease, the retrospective assessment of exposure to carcinogenic risk factors requires tools that retrieve information about the individual experiences in the distant or recent past vis-à-vis the diagnosis[10].

Completing occupational data in medical records is a means of obtaining information regarding past exposures, including in the occupational environment. The recorded data serve as a basis for planning the physical structure itself and can also be used as a source of information for administrative planning, clinical research and survival analysis[13], as well as is an important health surveillance tool.

While knowingly relevant, such information is still scarcely recorded in epidemiological studies, hampering the establishment of possible associations between pathology and occupational exposure[14]. It is of the utmost importance that hospitals specializing in oncology have a reliable database that can assist them in making decisions about the types of possible treatments, as well as in the establishment of campaigns for the early detection of work-related cancer.

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The Hospital-based Cancer Records (RHC) is a database that collects information about the diagnosis, treatment and development of cases of neoplasms serviced in general or specialized oncology hospitals. This database allows the elaboration of surveillance actions and health care planning, promoting the establishment of preventive measures, therapeutic decisions and other control measures[11]. The importance of this database is its contribution to cancer epidemiological surveillance actions in Brazil because it contains standardized, updated and quality information[11].

However, RHC still has low quality occupational records, and only the current work of patients is considered at the time of collecting this information, with no concern as to the former occupational exposures throughout their working life[11]. In a hospital-related case series study conducted in the mountain region of Rio de Janeiro in 2011, authors pointed out failures in completing occupational information in 45% of the medical records analyzed[14].

Due to the lack of recognition by health professionals regarding the completion of the occupational-related field in medical records, the publication "*Guidelines for Work-Related Cancer Guidelines*" provides models for recording occupational history, reinforcing the need to record not only the current occupation, but also all previous to agents or substances to which the individual was exposed[11].

In view of the above, this study aimed to describe the occupational profile of individuals diagnosed with leukemia in the Brazilian states, based on the RHC in order to critically evaluate the completion of work-related information in RHC.

Methodology

This is a cross-sectional observational study that used the database of the Hospital-related Cancer Records in the 5-year period from 2007 to 2011. We included individuals aged 20 years and over from all 26 Brazilian states, registered in the consolidated Integrador-RHC database. The state of Amapá was not included in this study because it did not evidence cases registered during the study period.

Data were collected in April 2014 and variables occupation and histological type were considered for all leukemia types (acute leukemia, leukemic, basophilic, hairy cells, chronic, Burkitt cells, lymphosarcomatous cells, mast cells, plasma cells, eosinophilic, acute lymphoblastic, chronic lymphoblastic, aleukemic lymphoid, sub-acute lymphoid, lymphoid, acute megakaryoblastic, acute myeloid, aleukemic myeloid, chronic myeloid, sub-acute myeloid, myeloid, acute myelomonocytic, chronic myelomonocytic, acute monocytic, chronic monocytic, aleukemic monocytic, sub-acute monocytic, moncytic, prolymphocytic, acute promyelocytic, sub-acute, leukemia, adult T-cell lymphoma leukemia). The occupations were classified according to the Brazilian Occupational Classification (CBO) (Chart 1).

This is a cross-sectional, secondary data-based study using data from the Hospital-related Cancer Records of the Integrating Module of Cancer Hospital Records made available by the National Cancer Institute José Alencar Gomes da Silva (INCA). Records include 239 hospital facilities located in all Brazilian regions. All cases recorded with histological type leukemia in the period 2007-20111 were included. Cases diagnosed in São Paulo were excluded from the study because they had other coordination than that of the Integrador.

Data review

In order to discuss the quality of data completion in the RHC, we calculated the frequency of occupational data of the cases that evidenced leukemia types as histological type in the RHC per federative unit. Subsequently, the prevalence of leukemia types in the large occupational groups, according to CBO was calculated in relation to the total number of cases due to this neoplasm in the period 2007-2011.

Results

Seven thousand eight-hundred and seven cases of leukemia were found in Brazil between 2007 and 2011. The state with the highest number of cases was Minas Gerais (1,351), followed by Rio Grande do Sul (1,082) and Rio de Janeiro (1,047). The most frequently recorded occupational group was service workers, store and market vendors (259), followed by agricultural, forestry, hunting and fishing workers (249) and workers in the production of industrial goods and services (181).

Of the total cases of leukemia types found, only 52% include information about the occupa-

Chart 1. Large occupation groups, according to the Brazilian Classification of Occupations (CBO) (Adapted from CBO 2010).

CBO - Brazilian Classification of Occupations
0 Members of the armed forces, police and military firefighters
1 Senior members of public authorities, leaders of public and corporate interest organizations, managers
2 Science and the arts professionals
3 Mid-level technicians
4 Administrative service workers
5 Service, shop and market sellers workers
6 Agricultural, forestry and fishing workers
7 Workers in the production of industrial goods and services[(a)]
8 Workers in the production of industrial goods and services[(b)]
9 Workers in repair and maintenance services

[(a)] Workers in extractive production, civil construction and industrial production of direct processes, which mobilize psychomotor and mental abilities focused primarily on the shape of products. [(b)] Workers who operate continuous industrial processes, which require mental abilities to control physical-chemical process variables.

tion of individuals (Table 1). The state of Sergipe did not include any occupational data records regarding the cases of leukemia diagnosed in the period. Table 2 shows the prevalence of leukemia by large occupation groups and subgroups, as per CBO. Among the large occupational groups, the most important ones regarding leukemia prevalence were service workers, store and market vendors (12.80%), agricultural, forestry hunting and fishing workers (13, 15%) and workers in the production of industrial goods and services (10.86%) (Table 2). When analyzing the prevalence of AML leukemia by occupational subgroups, we can observe that in the large group 5, domestic and domestic service workers account for more than 50% of cases of AML found (6.64%). In the large group 6 (Agricultural, forestry, hunting and fishing workers) the highest prevalence of AML (10.26%) was found in the subgroup of livestock and agricultural workers.

In the large group 7, two subgroups were highlighted: professionals such as masters in civil construction; workers of mineral extraction and beneficiation, molding machine workers; ceramists and other glass/ceramic workers; brickwork/parquetry worker; glaziers; other civil construction workers; civil construction machine operators; works and metal structures painter; other painters; (3.93%) and drivers of vehicles, train driver/stoker; maneuvering agent/assistant; animal drivers and other drivers (3.03%) with a total prevalence of leukemia in the large group of 7%.

Discussion

This study evidenced a prevalence of leukemia types among occupations of the large group 6 of 13.15%. This result probably occurred due to exposure to the use of pesticides during work activities.

Pesticides are defined as "substances or agents of physical, chemical or biological processes with the purpose of modifying the composition of the flora or fauna in order to preserve them from the harmful action of living beings harmful to the agricultural activity"[15]. They act as primers (when binding to DNA) or tumor promoters (cell division stimulator of a started/mutated cell). The appearance of neoplastic cells will depend on the absorption route and individual susceptibility[16].

Although its use in food production along with fertilizers has increased agricultural productivity, exposure to these substances is associated with environmental and human health issues such as acute poisoning and chronic disorders in the neurological, reproductive and endocrine systems, in addition to the development of cancer in humans[17,18].

In March 2015, the IARC published the monograph, volume 112, in which, after evaluating the carcinogenicity of five active ingredients of pesticides by a team of researchers from 11 countries, including Brazil, they classified herbicide glyphosate and insecticides malathion and diazinon as probable carcinogens for humans (Group 2A) and insecticides tetrachlorvinphos

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Table 1. Absolute and relative frequency of completion of occupational data, by federation unit (UF), in the period 2007-2011, Brazil.

UF of origin	Leukemia Cases	No occupation records	Occupation records available	% completion
Acre	29	17	12	41.4
Alagoas	131	57	74	56.5
Amapá	9	5	4	44.4
Amazonas	70	24	46	65.7
Bahia	414	199	215	51.9
Ceará	304	158	146	48.0
Distrito Federal	12	5	7	58.3
Espírito Santo	253	121	132	52.2
Goiás	8	2	6	75.0
Maranhão	143	83	60	42.0
Mato Grosso	98	53	45	45.9
Mato Grosso do Sul	89	56	33	37.1
Minas Gerais	1351	629	722	53.4
Para	217	135	82	37.8
Paraiba	207	101	106	51.2
Parana	870	359	511	58.7
Pernambuco	241	150	91	37.8
Piauí	223	124	99	44.4
Rio de Janeiro	1047	383	664	63.4
Rio Grande do Norte	267	204	63	23.6
Rio Grande do Sul	1082	597	485	44.8
Rondônia	8	5	3	37.5
Roraima	3	0	3	100.0
Santa Catarina	624	239	385	61.7
Sergipe	10	10	0	-
Tocantins	97	34	63	64.9
Total	**7.807**	**3.750**	**4.057**	**52.0**

* The state of São Paulo was not represented in this sample because its data were not integrated into this database during the study period. ** Incomplete data reflects the lack of information in the database.

and parathion as possible carcinogenic agents for humans (Group 2B). It is noteworthy that Malathion, diazinon and glyphosate are authorized and widely used in Brazil as insecticides in public health campaigns for vector control and as herbicides in agriculture, respectively[19]. The indiscriminate use of pesticides exposes rural workers, their families and the general population to the harmful effects of the use of such substances[20].

According to the WHO[21], developing countries consume 20% of all pesticides produced in the world. Brazil is the world's largest consumer of pesticides since 2008, accounting for 86% of consumption in Latin America[22].

The indiscriminate use of pesticides is a risk to workers' health, mainly due to the lack of knowledge about the potential effects on their health, improper use, low use or misuse of personal protective equipment and inadequate package disposal methods[23]. Some researchers have already found a positive association between leukemia types and the occupational use of organophosphorus and arsenical pesticides[24,25].

Concerning the occupations of the large group 5, which include domestic workers, we found a prevalence of leukemia of 12.80%. This finding may be explained possibly by exposure to substances such as domestic sanitizers. According to the National Health Surveillance

Table 2. Prevalence of cases of leukemia by large occupation groups (GG0. GG1. GG2. GG3. GG4).

	Large occupation groups	N	%
GG 0	**Members of the armed forces. police and military firefighters**	**54**	0.69
GG 1	**Senior members of public authorities. Leaders of public and corporate interest organizations. managers**	**266**	**3.41**
	Merchant	196	2.51
	Senior member of the Executive and Judiciary Branches. Senior public servant	41	0.53
	Directors and managers	29	0.37
GG 2	**Science and the arts professionals**	**394**	**5.05**
	Chemist. Physicist.	2	0.03
	Agronomist, civil, electric and mechanical engineers. Architect. Decorator.	33	0.42
	Biologist. Bacteriologist / Pharmacologist. Doctor. Dentist. Veterinarian. Pharmacist. Nutritionist. Nurse.	54	0.69
	Social worker. Psychologist. Therapist.	14	0.18
	Systems Analyst. Economist. Accountant. Lawyer.	57	0.73
	Higher education teacher.	37	0.47
	Primary and secondary schoolteacher.	133	1.70
	Artists.	33	0.42
	Librarian/Archivist.	3	0.04
	Religious.	6	0.08
	Secretary.	19	0.24
	Jobs / Salaries analyst; tax technician.	3	0.04
GG 3	**Mid-level technicians**	**188**	**2.41**
	Accounting and Administration technicians. Insurance analyst.	29	0.37
	Biology, chemical analysis, nursing/laboratory, production control technician; midwife; nursing staff; agricultural administrator	61	0.78
	Mining, building, electronics/telecommunications, mechanic; technical drawing technician; designer; computer programmer; computer operator. sound/cinema operator; pilots and the like	41	0.53
	Pre-school and professional training teachers	8	0.10
	Servants of justice and other public agents	17	0.22
	Buyer; sales agent; external salesman; broker; service sale agent	32	0.41
GG 4	**Administrative service workers**	**149**	**1.91**
	Administrative agent; office assistants and accounting/cashier; chief administrative officer and others	110	1.41
	Dactylographer/stenographer; typist	3	0.04
	Postman / messenger; Telephone operator / telegraph operator; Booth attendant; front desk clerk	32	0.41
	Supply/storage worker	4	0.05

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Agency[26], household sanitizers are substances or preparations intended for household sanitation, disinfection or disinfestation, in collective or public environments, in places of common use and in water treatment. They are subdivided into four groups: cleaning products (detergents, dishwashers, coconut soap, etc.); antimicrobial agents' products (such as disinfectants, sterilants, deodorants used in various environments); disinfectants (e.g. rodenticides or insecticides) and homemade organic products (such as those used to remove organic matter from boxes of fat), in addition to including products used in hospitals or clinics to clean surfaces (floors, walls etc.) and to sanitize instruments and medical and dental articles.

Domestic workers deal daily with a multiplicity of chemicals, such as detergents, waxes, disinfectants, powdered soaps, among others, which contain toxic chemicals in their composition, making this occupation prone to health risks[27]. Scientific research to date is still inconclusive as

Table 2. continuation

	Large occupation groups	N	%
GG 5	**Service. shop and market sellers workers**	**999**	**12.80**
	Domestic / Domestic service workers	518	6.64
	Building services workers	106	1.36
	Sales manager. Salesperson. Ambulant / day laborer. Other trade professionals	159	2.04
	Hairdresser/beauty worker; launderer/dyer	48	0.61
	Police officer; firefighter; security guard; Other security workers	94	1.20
	Customs broker/public transport inspector	6	0.08
	Butler / housekeeper; cook; waiter; commissioner; workers in building administration services; travel agent / tour guide	51	0.65
	Other works/services	17	0.22
GG 6	**Agricultural. forestry and fishing workers**	**1027**	**13.15**
	Farming workers	427	5.47
	Agricultural workers	533	6.83
	Livestock workers	11	0.14
	Forestry workers	1	0.01
	Fishing workers	55	0.70
GG 7	**Workers in the production of industrial goods and services**	**848**	**10.86**
	Master of civil construction; miner / construction site worker; other mineral extraction and beneficiation workers; molding machine workers; ceramist and other glass/ceramic workers; brickwork/parquetry worker; glazier; other civil construction workers; civil construction machine operator; works and metal structures painter; other painters; mason/plasterer.	307	3.93
	Wood treatment workers; other chemical workers; joiner; wood plowing machine operator; carpenter and other woodworking workers	57	0.73
	Weaver; knitwear weaver; textile finishing worker; other textile workers; leather/skin tanner; tailor/dressmakers; modeler/cutter; serial-couturier; embroiderer/serger; Other sewing workers; shoemaker; shoe manufacturing and finishing workers.	98	1.26
	Toolmaker/modeler; turner/milling machine worker; machine-tool operator; Metal sharpening and polishing workers; other machining work; mechanical adjuster; Machine builder	23	0.29
	Electric and electronic assemblers; installations electrician and other electrical workers	39	0.50
	Plumber / pipe installer; Welder / flame cutter; plating/boiler worker; assembler of metal structures; jeweler/goldsmith	41	0.53
	Typographic composer; typographic printer; photographic laboratory worker; other graphic works	9	0.12
	Stevedore / loader; Other commodity handlers; Other manual workers	34	0.44
	Vehicle driver. Train driver/stoker; maneuvering agent/assistant; animal drivers and other drivers	240	3.07

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to the carcinogenic potential of the household cleaning sanitizers, since their chemical composition varies greatly in each product. However, it is important to highlight that some detergents contain benzene, which is considered by the International Agency for Research on Cancer to be a myelotoxic agent, that is, highly toxic and carcinogenic to bone marrow[7].

Table 2. continuation

	Large occupation groups	N	%
GG 8	**Workers in the production of industrial goods and services**	**64**	**0.82**
	Fusion oven operator; other metallurgy/steel workers; glass oven operator	23	0.29
	Sugar manufacture and refining worker; food industry worker; baker/ confectioner; Cachaça, beer, wine and other beverage manufacture workers; other food manufacture and preservation workers.	26	0.33
	Fixed machine operator	15	0.19
GG 9	**Workers in repair and maintenance services**	**68**	**0.87**
	Vehicles, aircraft and machinery maintenance mechanics; other mechanical work.	66	0.85
	Railway agent	2	0.03
	Total completed	**4057**	**52.00**
	Not applicable	556	7.12
	Work not classified according to occupation	1627	20.84
	Without information	1567	20.07
	Total not completed	**3750**	**48.00**
Total		**7807**	**100.00**

Source: own elaboration based on the classification adopted by the CBO.
A high proportion of "not applicable", "not classified according to occupation" and "without information" was observed.

Regarding the professional categories with the highest prevalence of leukemia (7%) in group 7, they include activities related to civil construction, mining, ceramics, glazing, painting (3.93%) and driving, train driver/stoker; maneuvering agent/assistant; animal drivers and other drivers (3.03%). While civil construction-related activities mainly use silica and asbestos, classified by IARC as Group 1 carcinogens, for raw material, final product or by-product of the cement, ceramics, mineral extraction industry[11], there is no scientific evidence to date that reveal their association with hematological cancers, such as leukemia. Since 1997, literature has shown that occupational exposure to silica is strongly associated with the development of lung cancer. The risk of this type of cancer occurring varies according to the type of activity developed in the work sector – the industrial sector and how crystalline silica appears[7].

A possible explanation of the higher prevalence of leukemia in the professional categories of group 7 highlighted above is the greater exposure to solvents, especially benzene, which is widely used in this type of industrial activity. Benzene belongs to the group of polycyclic aromatic hydrocarbons and is a known carcinogenic. It is found in gasoline and automotive exhaust, among other uses, such as paint industry, lacquers, varnishes, adhesives, glue, degreasing agents, cleaning products and detergents and are used in the production of dyes, plastic, agricultural products, pharmaceutical products and fabric industries[12,28-30].

According to Uzma et al.[31], humans absorb about 50% of inhaled benzene depending on their concentration in the atmosphere and the level of exposure. The most evident changes due to chronic exposure to this substance occur in the hematopoietic system, and may be the cause of AML[32]. This solvent induces toxic effects on blood and bone marrow, causing leucopenia, pancytopenia and aplastic anemia. Even at low exposure levels, benzene is an established carcinogen in the pathogenesis of leukemia types, and myeloid leukemia is the most common type[33,34].

Several other authors have found an association between leukemia types and occupational exposure to solvents[35-38].

In the systematic review study and meta-analysis conducted by Khalade et al.[39], a significant increase in the risk of AML and chronic lymphocytic leukemia (CLL) was identified by exposure to benzene in the workplace. The studies analyzed indicated sufficient evidence that benzene exposure increases the risk of leukemia with dose-response patterns. However, in the meta-analysis, no association was found between occupational exposure to benzene and risk of chronic myeloid leukemia (CML).

Strom et al.[40], in a control case study conducted in Texas with 638 adults diagnosed with AML

and 636 controls found a positive association between occupational exposure to solvents, even at low levels, and acute myeloid leukemia (AML), for both genders. Regarding males, the occupational activities with the highest risk of leukemia were auto mechanics, fuel industry workers (petroleum), chemical industry workers and gas station operators; for women, main occupations were hairdressers, rubber industry workers, chemists and cosmetics.

Completion of the occupational data in the RHC is of extreme importance as a tool to identify possible exposures arising from the work process that may be associated with the cancer investigated and provide more in depth investigations about the occupation/activity-cancer relationship. With regard to leukemia and considering the period of the study, we can define such completion as incipient. In addition, because it is a secondary database, we are unable to affirm whether this information was filled correctly or not.

According to the "Hospital-based Cancer Records – Planning and Management" manual[41], variable "main occupation" corresponds to the activity that the patient performed the longest, provided there is no time interval greater than ten years between termination of the former activity and the current date or retirement date in case of inactive status. However, the registration of the current occupation – and not the longest one – can lead to error regarding the attribution of a possible causal association between occupation and cancer. It is worth mentioning that a large period of latency between exposure and onset of disease is required for the vast majority of cancers (mean of 20 years for solid tumors and between 1.5 and 15 years for those of the hematopoietic system)[42]. Hence the difficulty of establishing the causal link between occupational exposures and the occurrence of cancer.

The main sources of errors regarding the use of secondary information databases are the lack of complete information during the period under study, the loss of exposure information or other variables of interest, lack of uniform data and ambiguous or inconsistent information. Therefore, its use implies limitations, especially when the researcher has little control over the quality of data for the period studied, the definition of the terms used and the nature of the information[10].

Nevertheless, in our study, it was possible to observe the higher prevalence of leukemia in groups exposed to substances known to be leukemogenic. Several authors have observed the occurrence of leukemia in specific professional categories, recognizing them as more exposed to carcinogenic agents such as solvents, household sanitizers, formaldehyde and pesticides[12,39]. According to Chagas et al.[38], the main occupational carcinogenic agents (ionizing radiation, benzene, ethylene oxide), work sectors and processes, such as rubber industry and the shoe manufacturing and repair are risk factors for the development of leukemia types.

Conclusion

This study demonstrated the main occupational activities recorded in RHC, where individuals were diagnosed with AML, which included service workers, store and market vendors, agricultural, forestry, hunting and fishing workers and workers in the production of goods and services.

However, when analyzing the RHC, we note incomplete occupational information in cancer hospital records in the country. We also note the lack of records of activities performed and the substances to which workers were exposed during the course of their working life and the time of that exposure. Therefore, we emphasize the need to sensitize health professionals, regardless of the specialty, in order to improve not only the notification of cancer cases in information systems, but also to improve records regarding information on the occupational history of individuals and the performance of additional studies that can establish the association between occupational, environmental and occupational exposure.

Collaborators

FN Carvalho, MSC Mello and UB Otero worked in design and outline or data review and interpretation; paper writing or critical review; approval of the version to be published. Flávia Nascimento de Carvalho; ES Moraes participated in design and outline or data review and interpretation; in paper writing or critical review. FAM Nogueira participated in paper writing or critical review.

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