Work-Related Hematologic Cancers Identified in Patients at Hospital do Cancer I of the National Cancer Institute, RJ, Brazil

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Cânceres Hematológicos Relacionados ao Trabalho Identificados em Pacientes do Hospital do Câncer I, no Instituto Nacional de Câncer, RJ, Brasil

Cánceres Hematológicos Relacionados con el Trabajo Identificados en Pacientes del Hospital del Cáncer I del Instituto Nacional del Cáncer, RJ, Brasil

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ABSTRACT

Introduction: Cancer is a disease with global public health impact and the work environment can have high concentrations of physical, chemical and biological agents, exposing workers to carcinogens. **Objective:** To evaluate the profile of cases of hematological cancers suspected of being work-related cancer. **Method:** Assessment of sociodemographic and occupational data of patients with hematological cancers to elaborate the occupational history followed by analysis of the relationship between exposure to carcinogens and cancer, considering the epidemiological criteria of temporality, biological plausibility and consistency. **Results:** 22 cases evaluated demonstrated a relationship between cancer and occupational exposure, the main agents being benzene, solvents, oils, petroleum derivatives and formaldehyde, non-ionizing radiation and glues. **Conclusion:** Occupational exposure may contribute to the occurrence of work-related cancer. The occupational record is an important tool for establishing the cause-and-effect relationship between exposure to risk factors and hematological cancers, helping health professionals in the process of notifying these cases in Brazil.

Key words: Occupational Cancer; Occupational Risks; Surveillance of the Workers Health; Hematologic Neoplasms.

RESUMO

Introdução: O câncer é uma doença de impacto para a saúde pública mundial e o ambiente de trabalho pode apresentar altas concentrações de agentes físicos, químicos e biológicos expondo os trabalhadores a agentes cancerígenos. **Objetivo:** Avaliar o perfil de casos de cânceres hematológicos suspeitos de câncer relacionado ao trabalho. **Método:** Avaliação de dados sociodemográficos e ocupacionais de pacientes com cânceres hematológicos para compor histórico ocupacional, seguida da análise da relação entre a exposição aos agentes cancerígenos e o câncer, considerando os critérios epidemiológicos de temporalidade, plausibilidade biológica e consistência. **Resultados:** Um total de 22 casos avaliados demonstrou relação entre o câncer e a exposição ocupacional, sendo os principais agentes o benzeno, solventes, óleos, derivados de petróleo e formaldeído, radiações não ionizantes e colas. **Conclusão:** A exposição ocupacional pode contribuir para a ocorrência de câncer relacionado ao trabalho. O recordatório ocupacional é uma ferramenta importante para estabelecer a relação de causa e efeito entre a exposição aos fatores de risco e os cânceres hematológicos auxiliando os profissionais de saúde no processo de notificação desses casos no Brasil.

Palavras-chave: Câncer Ocupacional; Riscos Ocupacionais; Vigilância em Saúde do Trabalhador; Neoplasias Hematológicas.

RESUMEN

Introducción: El cáncer es una enfermedad con impacto en la salud pública global y el ambiente laboral puede tener altas concentraciones de agentes físicos, químicos y biológicos, exponiendo a los trabajadores a cancerígenos. **Objetivo:** Evaluar el perfil de los casos de cánceres hematológicos sospechosos de ser cáncer de origen laboral. **Método:** Evaluación de datos sociodemográficos y ocupacionales de pacientes con cánceres hematológicos para ensamblar la historia ocupacional seguida del análisis de la relación entre la exposición a carcinógenos y el cáncer, considerando criterios epidemiológicos de temporalidad, plausibilidad biológica y consistencia. **Resultados:** 22 casos evaluados demostraron relación entre cáncer y exposición ocupacional, siendo los principales agentes benceno, solventes, aceites, derivados del petróleo y formaldehído; radiaciones no ionizantes y pegamentos. **Conclusión:** La exposición ocupacional puede contribuir a la aparición de cáncer relacionado con el trabajo. El registro ocupacional es una herramienta importante para establecer la relación de causa y efecto entre la exposición a factores de riesgo y los cánceres hematológicos, ayudando a los profesionales de la salud en el proceso de notificación de estos casos en el Brasil.

Palabras clave: Cáncer Profesional; Riesgos Laborales; Vigilancia de la Salud del Trabajador; Neoplasias Hematológicas.

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INTRODUCTION

Cancer is a non-communicable disease (NCD) impacting public health, one of the main four causes of early death worldwide[1]. It is the second major cause of populational death in Brazil and the National Cancer Institute (INCA)[2] estimates 704 thousand new cases of cancer (including non-melanoma skin cancer) for each year of the triennium 2023-2025.

The most common types of male cancer are prostate, colon and rectum, lung, stomach and oral cavity. For women, the most frequent are breast, colorectal, cervical, lung and thyroid. Of the hematological cancers, non-Hodgkin lymphoma is ranked ninth for men and tenth for women among the ten most frequent cancers in Brazil.

The rising cancer incidence is related to demographic-epidemiologic transition as ageing and increase of NCD. In addition, exposure to environmental risk factors accounts for 60% to 90% of cancers, among them those related to unhealthy diet, physical inactivity, tobacco and smoke use, chemical, biologic and physical agents found in work environment[3]. According to Hoff[4], work-related cancer (WRC) is responsible for 4% to 40% of cancer cases, depending on the type of tumor and epidemiologic study utilized to calculate the attributable fraction. In 2015, 27% of the cases of workers affected by work-related diseases died by cancer[5].

Strong evidences reveal that the appearance of hematological cancers as leukemias, lymphomas and myelomas in young adults can be associated with exposure to potentially carcinogenic chemicals as benzene and pesticides found in work environments[6,7]. Nevertheless, WRC persists as a nationally sub-notified disease due to technical-operational difficulties to notify at the Information System of Notifiable Health Harms (Sinan)[8].

The present study described the profile of suspected WRC hematologic cancers in patients attended to at INCA's *Hospital do Câncer I* (HCI) for notification at Sinan.

METHOD

Descriptive study-based investigation of hematologic cancers diagnosed at the hospital. Eligible cases were selected *in loco* by purposive sampling after active search at INCA database. Outpatient male and female 20 years old or older patients living in the State of Rio de Janeiro, with suspected or confirmed diagnosis of leukemia, non-Hodgkin lymphoma and multiple myeloma assisted at HCI/INCA Oncology and Hematology Clinic and by Social Workers or admitted at the wards from August 2019 to March 2020 have been selected.

Structured questionnaire-based individual interviews previously pre-tested with oncologic patients with other than hematologic cancer diagnosis were conducted by skilled and trained health professionals of the Environment, Work and Cancer Department (ATATC) of the Coordination of Prevention and Surveillance (Conprev) and Social Service of HCI/INCA. Patients in poor physical and/or emotional status to respond to the interview were not eligible as well as those with positive lab tests for the following oncogenic viruses: human immunodeficiency virus (HIV), hepatitis virus B and C, human papilloma virus, human herpes viruses and Epstein Barr virus.

196 eligible patients were identified to be interviewed and respond to the questionnaire. They were invited just before their outpatient visits to join the study and, if accepted, signed the informed consent form (ICF).

However, due to COVID-19 imposed limitations, especially for cancer patients, not all the patients were interviewed. Therefore, 52 patients were approached, four refused to join (two males and two females) and eventually 48 questionnaires were applied. After reviewing the interviewees' charts, two HIV-positive patients were rejected due to the study exclusionary criteria.

46 sociodemographic questionnaires have been applied to collect data on color/race, education, social security, month family income, tobacco and alcohol use. The patients responded to questions about labor activities in the last 20 years (working one or more years), time in each activity, workload, exposure to carcinogenic agents, for instance: have you been exposed to benzene while in this occupation? (yes/no). Histopathological confirmation of the type of cancer was obtained after reviewing the electronic chart available at INCA intranet (clinical mode).

The evaluation of the cause-and-effect relation between the cancer diagnosed and occupational exposure consisted in analyzing the responses about the occupation, time in years in activity and exposure to carcinogenic agents. Subsequently, in order to establish the positive association with WRC, six ATATC multidisciplinary professionals evaluated the occupational recall of the interviewees and attempted to find scientific literature support, especially monographs of the International Agency for Research on Cancer (IARC) which classifies certain occupational exposures as carcinogenic or acknowledged as carcinogenic[7,9,10]. The team's consensual decision was based on temporality, biological plausibility and consistency between the occupational activity and type of cancer diagnosed[11].

The following variables were included to present the sociodemographic and occupational characteristics

of the patients: sex (female, male), age-range (20-39; 40-59; 60-79; 80-99 years), skin color (White or Black), residence (Rio de Janeiro, other municipalities), family income in minimum wages (≤ 1; 2-4; >4); education (elementary, high-school, university), social security status (sickness benefit, retired, without social security, pension), occupation/job (yes, no), age when started working (5-10 years; 10-15 years; 15-20 years; 20-25 years; 25-30 years; 30-35 years; 35-40 years). In addition, the characteristics of way of life, especially tobacco use (smoker, ex-smoker, never smoked, age when started smoking, cigarettes smoked per day and age when quit smoking) and frequency of alcohol use have also been collected.

The primary sites of the neoplasms were grouped according to the International Classification of Diseases and Related Health Problems 10th edition[12] (ICD-10): leukemias (acute myeloid leukemia – AML – C92.0, chronic myeloid leukemia – CML – C92.1, chronic lymphocytic leukemia – CLL – C91.1 and other leukemias – C94.7); lymphomas (non-Hodgkin lymphoma – NHL – C85.0 and unspecified lymphoma – C85.9) and multiple myeloma – MM – C90.0.

Occupational exposures were separated in ten groups: Group 1 (benzene, solvents, oils, petroleum derivatives and formaldehyde); Group 2 (glues); Group 3 (household cleaners); Group 4 (agriculture and household pesticides); Group 5 (hair dyes); Group 6 (medicines and other chemicals); Group 7 (metals); Group 8 (non-ionizing radiation); Group 9 (ionizing radiations); Group 10 (biological material).

The results were obtained and presented through descriptive statistics with absolute and relative frequency of categorical variables utilizing the software Epi Info 7[13].

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RESULTS

Males were predominant (56.2%) over females (43.4%) in the age-range of 20-80 years with predominance of 60-79 years of age. The majority of the interviewees claimed they were Black (54.4%), 56.5% completed elementary school, 32.6%, high-school and 10.8%, university. 76% earned between two and four minimum wages and 69.5% had no social security (Table 1).

Table 1. Sociodemographic, life habits and occupational characteristics of patients diagnosed with hematologic cancers at HCI/INCA from 2019 to 2020 (n = 46)

Variable	n	%
Sex		
Female	20	43.4
Male	26	56.2
Age range		
20-39 years	6	13
40-59 years	15	32.6
60-79 years	22	47.8
80-99 years	3	6.5
Skin color		
White	21	45.6
Black	25	54.4
Municipality (residence)		
Rio de Janeiro	19	41.3
Others	27	58.7
Family income (minimum-wage) *		
≤ 1	5	10.86
2 – 4	35	76.08
> 4	6	13.04
Education		
Elementary	26	56.5
High-school	15	32.6
University	5	10.8
Age when started working		
5-10 years	7	15.2
11-15 years	15	32.6
16-20 years	19	41.3
21 or +	5	10.6
Tobacco		
Ex-smoker	23	50
Current smoker	1	2.1
Never	22	47.8
Age when started smoking		
Before 20 years of age	16	34.7
21 or +	8	17.2
NR/DNK	22	47.8
Alcohol use		
Does not drink	23	50
Rarely or Never	4	8.7
Once a day	1	2.2
Once a week	5	10.9
2 or + times a week	7	15.2
Once a month	2	4.3
2 or + times a month	3	6.5
NR/DNK	1	2.2

Caption: HCI = *Hospital do Câncer I*; INCA = National Cancer Institute; NR/DNK = Not responded/Does not know.
(*) Minimum-wage = R$ 998.00.

All the interviewees worked in the last 20 years. The age when they started working ranged from 5 to 40 years, the most frequent were young adults (5 to 20 years).

50% claimed they quit smoking and 47.8% never smoked, only one interviewee smokes currently (2.1%). 23.9% (15-20 years of age) of them tried smoking.

Regarding alcohol use, 50% claimed they did not drink alcohol and 8.7%, rarely or never. Alcohol use during one week was higher among those who claimed they drank two or three times a week.

Non-Hodgkin lymphoma was predominant among the types of cancer with 23 cases (41.3%) followed by leukemias, 12 cases (26.0%) and multiple myeloma with 11 cases (23.9%). The distribution among subtypes of lymphomas and leukemias was: non-Hodgkin lymphoma (19 cases, 41.3%), unspecified lymphomas (four cases, 8.7%), acute myeloid leukemia (three cases, 6.5%), chronic myeloid leukemia (five cases, 10.8%), chronic lymphocytic leukemia (three cases, 6.52%), other leukemias (one case, 2.2%).

Most of the individuals claimed they have been exposed during their work life to more than one group of exposure agents, but the frequency was higher for Group 1: benzene, solvents, oils, petroleum derivatives and formaldehyde (21 cases; 95.4%) and Group 8: non-ionizing radiations (15; 68.1%). Exposure to Group 9 (Table 2) has not been reported.

Professions and occupations varied widely: administrative activities (operational, accounting analysts, personnel supervisor, educational supervisor, operational supervisor, human resources assistant), commerce and services (waiter assistant, school cafeteria staff, bank staff, trader, sales, trainee in paints shop, market fair), general services (general services assistant, general services), civil construction (grinder, foreman, mason, mason aide), household (housewife), military and other professions (stamps engraver, kite manufacturer, fireworks manufacturer, car wash, mechanic, car mechanic, motor shop, driver, bus driver, ambulance driver, equipment operator, printer, taxi driver) and self-employed worker.

After analyzing suspicious WRC, the experts classified 22 cases of suspected association of work with the hematological cancer diagnosed, with predominance of the following types of cancer: non-Hodgkin lymphoma (Table 3), acute myeloid leukemia, chronic myeloid leukemia and chronic lymphocytic leukemia (Table 4) and multiple myeloma (Table 5).

Completed notifications of WRC cases were sent to the Health Secretary of Rio de Janeiro for further filing at Sinan.

DISCUSSION

The relation between occupational exposure and types of cancer was attributed to 22 cases in the present study, consistent with a similar study by Baldo et al.[11] who notified 305 cases of the 579 investigations conducted. A research carried out by "*Hospital de Câncer de Barretos* (*SP*)" found 550 cases of the 1,063 investigations performed[15] with a simplified screening questionnaire.

Black men, older than 60 years of age, who completed elementary school were predominant, with expressive

Table 2. Exposure Groups of carcinogenic agents of 22 (n) suspicious cases of work-related cancer

Exposure Groups	Exposure	
	n	%
Group 1 - Benzene, solvents, oils, petroleum derivatives and formaldehyde	21	95.4
Group 2 - Glues	9	40.9
Group 3 – Household cleaners	7	31.8
Group 4 – House and agriculture pesticides	5	22.7
Group 5 – Hair dyes	4	18.1
Group 6 - Medicines and other chemicals	1	4.5
Group 7 - Metals	3	13.6
Group 8 – Non-ionizing radiations	15	68.1
Group 9 – Ionizing radiations	0	0
Group 10 – Biological specimens	1	4.5

Table 3. Profile of WRC cases of non-Hodgkin lymphoma* according to age, occupation, time of activity and exposure agents (n = 11)

Cases	Age	Occupation	Time (years)	Exposure agents
1	26	Occ1: equipment operator Occ2: equipment operator	Occ1: 2 Occ2: 3	Occ1 and Occ2: kerosene, lube oil, turpentine, thinner, removers, glues, disinfectants, used motor oil, anti-oxidants, mobile use
4	26	Occ1: operational supervisor Occ2: sales man Occ3: print operator Occ4: print operator	Occ1: 1 Occ2: 1 Occ3: 2 Occ4: 1	Occ1, Occ2 and Occ4: benzene, dyes, glues and mobile use Occ3: mobile use
8	37	Occ1: driver Occ2: staff supervisor Occ3: self-employed Occ4: driver Occ5: driver Occ6: education supervisor Occ7: education supervisor Occ8: waiter's assistant Occ9: car washer	Occ1: 2 Occ2: 3 Occ3: 2 Occ4: 2 Occ5: 3 Occ6: 2 Occ7: 1 Occ8: 1 Occ9: 2	Occ1: lubricant oil, cleaning products (detergent, washing powder and disinfectant), mobile use Occ2: house pesticides and rodenticide, mobile use Occ3, Occ4 and Occ5: mobile use Occ6, Occ7 and Occ8: no exposure agent Occ9: gasoline, lubricant oil, benzene, turpentine, cleaning products (detergent, washing powder and disinfectant), thinner, removers, solvents
16	71	Occ1: taxi-driver	Occ1: 20	Occ1: gasoline, kerosene, lubricant oil, cleaning products (detergent), mobile use
23	59	Occ1: mechanic	Occ1: 28	Occ1: gasoline, kerosene, lubricant oil, thinner, glues, cleaning products (detergent, gasoline, diesel), solar radiation, mobile use
28	76	Occ1: general services (farm)	Occ1: 20	Occ1: tickiside and other veterinary medications, used motor oil, solar radiation, biologic specimens and necropsy material of animals
35	44	Occ1: car mechanic Occ2: motor repair	Occ1: 11 Occ2: 8	Occ1 and Occ2: gasoline, kerosene, lubricant oil, solvents, benzene, turpentine, thinners, paint and grease removers, glues (seal), used motor oil, mobile use
36	63	Occ1: bus driver	Occ1: 20	Occ1: benzene, solar radiation and mobile use.
40	59	Occ1: ambulance driver Occ2: taxi-driver	Occ1: 12 Occ2: 13	Occ1: mobile use Occ2: gasoline
44	58	Occ1: foreman	Occ1: 20	Occ1: removers, solvents, wood glue, iron, solar radiation
48	53	Occ1: general services Occ2: general services assistant	Occ1: 4 Occ2: 7	Occ1: benzene, turpentine, thinner, removers, sun radiation Occ2: no agent

Captions: WRC = work-related cancer; Occ = Occupation.
(*) all males.

Table 4. Profile of WRC cases of leukemia according to age, occupation, time in activity and carcinogenic agents (n = 7)

Cases	Age	Occupation	Time (years)	Exposure agents	Types of cancer
6	57	Occ1: taxi driver Occ2: human resources assistant Occ3: transportation manager	Occ1: 2 Occ2: 10 Occ3: 25	Occ1: solar radiation and mobile use Occ2: no exposure agent Occ3: gasoline, kerosene, lubricant oil, benzene, turpentine, thinners, diesel solvents, wood glue, cleaning products (chlorine)|, disinfectants, used motor oil, dyes	AML
10	50	Occ1: truck driver Occ2: kite manufacturer	Occ1: 10 Occ2: NA	Occ1: lubricant oil, mobile use Occ2: kite glue	CML
11*	59	Occ1: sales woman (soap store). Occ2: general services in fabric manufacturer	Occ1: 3 Occ2: 7	Occ1: no exposure agent Occ2: kerosene, lubricant oil, thinner, solvents, glue and cleaning products, pesticide and rodenticide, dyes	CLL
12	39	Occ1: mason Occ2: mason Occ3: mason Occ4: mason Occ5: bricklayer Occ6: grinder Occ7: grinder	Occ1: 4 Occ2: 1 Occ3: 1 Occ4: 3 Occ5: 3 Occ6: 1 Occ7: 1	Occ1, Occ2, Occ3, Occ4 and Occ5: solar radiation, solvents, tar Occ6 and Occ7: solar radiation	AML
30	60	Occ1: operational analyst Occ2: accounting analyst Occ3: accounting analyst	Occ1: 8 Occ2: 7 Occ3: 8	Occ1: lubricant oil, benzene, turpentine, thinner, removers, solvents, used motor oil, mobile use. Occ2: mobile use Occ3: no agent	AML
32	53	Occ1: bank clerk Occ2: canteen attendant (school cafeteria) Occ3: military Occ4: trainee paint shop	Occ1: 18 Occ2: 4 Occ3: 2 Occ4: 6	Occ1: mobile use Occ2: no agent Occ3: solar radiation Occ4: thinner, paint (base), solvents and removers	CML
33	46	Occ1: driver Occ2: fireworks manufacture	Occ1: 12 Occ2: 18	Occ1: mobile use Occ2: glues, sulphur, dyes – calcium, strontium salts (bone marrow injury), lithium carbonate, sodium, titanium powder, aluminum and magnesium, iron, copper and barium	CML

Captions: Occ = occupation; NA = not applicable; AML = acute myeloid leukemia; CML = chronic myeloid leukemia; CLL = chronic lymphocytic leukemia. (*) 11, sole woman.

Table 5. Profile of WRC cases of multiple myeloma according to age, occupation, time of work and exposure agents (n = 4)

Cases	Age	Occupation	Time (years)	Exposure agents
14	61	Occ1: general services assistant (air taxi) Occ2: driver	Occ1: 13 Occ2: 3	Occ1: kerosene, mobile use, solar radiation Occ2: lube oil, used engine oil, solar radiation
18*	64	Occ1: housewife Occ2: engraver	Occ1: NA Occ2: 34	Occ1: chlorine, detergent, acid, household pesticides Occ2: kerosene, glues, lead
26	51	Occ1: tradesman Occ2: general services (soap manufacturing)	Occ1: 20 Occ2: 4	Occ1: cleaning products (bleach and chlorine), disinfectants Occ2: cleaning products (bleach and chlorine), disinfectants, turpentine, removers, solvents, household pesticides
27	62	Occ1: market fair Occ2: equipment operator	Occ1: 10 Occ2: 14	Occ1: solar radiation Occ2: benzene

Caption: WRC = work-related cancer; Occ = Occupation; NA = not applicable.
(*) Woman (18).

participation of those who started working with less or with 15 years of age and between 16 and 20 years old and complete elementary school. This is a relevant information since cancer has a long-term latency, although the time between exposure and disease of hematologic cancer is shorter[10]. Vazquez et al.[15] concluded in their study that 61.8% of the patients had less than eight years of education.

The majority of the participants was ex-smokers, suggesting that tobacco use may have contributed in some moment of their work life to potentialize the effects of the carcinogenic occupational exposure.

In addition, it is possible that they would be in treatment and quit smoking because of the disease. The number and percent of individuals that never smoked (47.8%) was consistent with 42.6% found in the study of Barretos (SP). Data on alcohol use indicated that half of the interviewees did not use alcohol on a regular bases, while those who did, reduced their intake to three times a week at the most.

Occupational exposure was consistent with the classification of IARC that refers acknowledged evidences between exposure and disease to 38 occupational agents, 12 exposure situations (industries and occupations), 41 agents and six circumstances as probable causes of cancer[16]. Specifically for hematologic cancers investigated herein, chemical agents as benzene, formaldehyde, 1,3 butadiene, antineoplastic drugs and a few pesticides and exposure to radiations and infections by oncologic viruses are relevant[17,18].

Although the present study and other Brazilian investigations[11,15] indicate an expressive number of WRC, only 3,693 cases (Sinan) have been notified between 2007 and 2022 in the country. However, notification is not a simple process, skilled professionals are required to conduct active search and obtain occupational recall because clinical files are missing or incomplete in that regard[11,19].

Based on the results of a study which utilized Social Security information to present the distribution of benefits granted due to cancer between 2008 and 2014, Sales-Fonseca et al.[20] noticed that the number of accident-related disease benefits (WRC) was 100-fold lower than social security benefits. Nevertheless, 4,263 workers were granted the benefit, higher than the cases notified at Sinan for the same period.

Failing to acknowledge the association of work with cancer is not only a Brazilian reality, it is world issue. The existing scientific literature found that in Taiwan, Norway, Australia and Singapore, for instance, there are less cases than anticipated, considering an attributable fraction of 5% for occupational factors and development of cancer[21].

Nearly all the suspected cases analyzed were exposed to chemical agents of Group 1 (benzene, solvents, industrial oils and formaldehyde (21; 95.4%). Group 8 (non-ionizing radiations) stands out as well (15; 68.1%). Exposure to glues, household cleaners, pesticides, hair dyes, metals, medicines and biological material were found but in lower proportions.

The aim of the study of Azevedo and Silva et al.[22] was to estimate attributable fractions to modifiable risk factors in Brazil and reached a percent of 16.79% for occupational factors related leukemias as benzene, formaldehyde, gamma radiation and chemicals utilized in industrial rubber manufacturing process.

These results are consistent with meta-analyzes to evaluate occupational exposures and risks of non-Hodgkin lymphomas from a case-control study[23] conducted in Minnesota, USA between 2005 and 2009, which indicated significant associations among myelodysplastic syndromes/leukemias and exposure to benzene (odds ratio – OR = 1.77, confidence interval – CI 95%, 1.19, 2.63; and OR = 2.10, CI 95%, 1.35, 3.28, respectively). Another similar study[24] conducted in Shanghai revealed the association among AML and occupational risk factors as benzene, glues and adhesives and paints and pigments.

The detailed analysis of the occupations and exposure of suspected cases revealed the variety of chemical, physical and/or biologic agents the workers were exposed to, sometimes in the same period and occupation. Cancer was diagnosed for young adults (26 years) in cases 1 and 4, an age range which contributes to the work force; these cases were exposed to carcinogenic agents as benzene and solvents and mobile use classified by IARC as Group 2B. Latency of hematologic cancers is shorter than solid tumors[25].

The interviewees of seven cases currently analyzed (4, 6, 8, 27, 35, 36 and 48) reported occupational exposure to benzene in at least one occupation for years. But in 12 cases (1, 11, 12, 14, 16, 18, 23, 26, 30, 32, 40 and 44), the interviewees reported exposure to several types of solvents or gasoline. This result was expected and is well described in the literature since hematologic cancers are related to exposure to benzene[26], formaldehyde[27], rubber related chemical agents and vulcanization[28], radiations[29] among other agents.

Difficulty to interview all the cases consulted at INCA during the period analyzed (partially due to COVID-19 pandemic), identification of past exposures requiring memory retrieve (not always possible), poor implementation of occupational recall as hospital routine are some of the study limitations, in addition to efforts to schedule the interviews and poor articulation within SUS to identify and notify WRC across the health network. Routine capture of occupational recall by hospital professionals is being expected to minimize these issues, further to a more robust study currently in development including new approaches.

CONCLUSION

The present investigation showed the importance of occupational recall to establish the cause-and-effect relation of the exposures to risk factors in working environments and the appearance of hematologic cancers. It is a key tool to help health professionals in the identification of WRC cases.

CONTRIBUTIONS

All the authors contributed to the study design, acquisition, analysis and interpretation of the data, wording and critical review. They approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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