CHEMICAL OCCUPATIONAL RISKS IDENTIFIED BY NURSES IN A HOSPITAL ENVIRONMENT[1]

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Hospital nursing workers are exposed to occupational chemical risks. This quantitative study aimed to identify what chemical substances nurses have contact with in their activities, what substances cause health problems and what alterations correspond to possible problems caused by the chemical products they mention. A self-administered data collection instrument was answered by 53 nurses, who mentioned exposure mainly to antibiotics and benzene (100%), iodine (98.1%) and latex-talc (88.7%); the main problem-causing substances mentioned were antineoplastic substances (86.7%), glutaraldehyde (79.2%) and ethylene oxide (75.5%); the described health alterations were: eye watering; allergic reactions; nausea and vomiting, while other health problems that can be caused by the above listed products were not mentioned. These workers need further information on occupational chemical risks, which they could have received in undergraduate or permanent education courses.

DESCRIPTORS: occupational risk; risk factors; occupational health; chemical compounds

RIESGOS OCUPACIONALES QUÍMICOS IDENTIFICADOS POR ENFERMEROS QUE TRABAJAN EN AMBIENTE HOSPITALARIO

Trabajadores de enfermería se someten a los riesgos ocupacionales químicos. La finalidad de este estudio cuantitativo fue identificar entre enfermeros con cuales sustancias químicas tienen contacto ocupacional, cuales sustancias pueden causador de problemas en su salud y qué alteraciones están de acuerdo con aquellas que pueden ser ocasionadas por los productos químicos citados. Un instrumento de recopilación de datos auto-administrado fue respondido por 53 enfermeros, que mencionaron que están expuestos principalmente a los antibióticos y benzina (100%), yodo (98,1%) y latex-talco (88,7%); las principales sustancias causadoras de problemas de salud citadas fueron antineoplásicos (86,7%), glutaraldehido (79,2%) y óxido de etileno (75,5%); las alteraciones a la salud que describieron fueron: lacrimación de los ojos; reacciones alérgicas; náuseas y vómitos, sin mencionar otros problemas de salud que pueden ser ocasionados por los productos citados. Estos trabajadores necesitan adquirir mayor conocimiento respecto a los riesgos ocupacionales químicos, que podrían haber recibido en el pregrado o en los cursos de educación continuada.

DESCRIPTORES: riesgos laborales; factores de riesgos; salud ocupacional; compuestos químicos

RISCOS OCUPACIONAIS QUÍMICOS IDENTIFICADOS POR ENFERMEIROS QUE TRABALHAM EM AMBIENTE HOSPITALAR

Os trabalhadores de enfermagem hospitalares submetem-se aos riscos ocupacionais químicos. Este estudo quantitativo objetivou identificar entre enfermeiros com quais substâncias químicas eles têm contato ocupacional, quais as que podem causar problemas à sua saúde e que alterações condizem com as que podem ser ocasionadas por produtos químicos. Um instrumento de coleta de dados auto-administrado foi respondido por 53 enfermeiros que mencionaram estar expostos principalmente aos antibióticos e benzina (100%), iodo (98,1%) e látex-talco (88,7%); as principais substâncias causadoras de problemas de saúde citadas foram antineoplásicos (86,7%), glutaraldeído (79,2%) e óxido de etileno (75,5%); as alterações à saúde que descreveram foram: lacrimejamento; reações alérgicas; náuseas e vômitos, não mencionando outros problemas de saúde que podem ser ocasionados pelos produtos citados. Estes trabalhadores necessitam adquirir maior conhecimento quanto aos riscos ocupacionais químicos, que poderiam ter recebido na graduação / ou nos cursos de educação continuada.

DESCRITORES: riscos ocupacionais; fatores de risco; saúde ocupacional; compostos químicos

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INTRODUCTION AND OBJECTIVES

Nursing workers in hospitals are exposed to different occupational risk agents/factors, including chemical substances, which can be inhaled, digested or come in contact with the skin, causing health damage[1]. Some circumstances favor this kind of occupational exposure, such as prolonged use of latex gloves; handling of detergents and solvents; manipulation of ultimate generation antineoplastic and antibiotic drugs; inhalation of anesthetic gases; exposure to formaldehyde and glutaraldehyde vapors and sterilizing gas, among others[1-2].

This exposure does not always entail harmful effects on health, which depend on factors like: type and concentration of chemical agent, frequency and duration of exposure, work practices and habits and individual susceptibility[2]. Prevention is one way of avoiding occupational health problems caused by exposure; however, for prevention to be effective, workers need to be aware of the risks posed by chemical substances.

This study aimed to identify what chemical substances/compounds hospital nurses are exposed to in daily work; what substances cause health problems and what alterations correspond to possible problems caused by chemical products.

METHODOLOGY

Study type and setting

Quantitative study, carried out among nurses at the emergency care unit of a university hospital (ECUUH) in Ribeirão Preto (SP), subdivided into different sectors, such as urgency care room; hospitalization units, surgical center, recovery, material center and intensive therapy center.

Population and Sample

The institution's human resource department provided a list of 102 nursing workers. Nineteen workers were excluded because of leave of absence. Data collection instruments were handed out to the remaining 83 nurses for completion. However, even after the researchers had insisted, 30 instruments were not returned. Hence, 53 (51.9%) workers participated.

Inclusion and Exclusion Criteria

The 53 participants were professionally active nurses who agreed to participate in the study. Forty-nine workers were excluded, some of whom due to (sick or maternity) leave, others were on holiday, some refused to participate and others did not return the data collection instrument to the researchers.

Procedures

The study was carried out during one month in 2001. Participants worked during morning, afternoon and night shifts and in different nursing work places. The data collection instrument was self-administered, consisted of open/closed questions and was divided in two parts: Worker Identification and Occupational Chemical Risk Data. The tool was previously assessed by three Occupational Health researchers from the University of São Paulo and considered adequate in terms of clarity and contents. Before its application at the ECUUH, it was applied to 10 nurses from another care unit at the same university hospital, who considered the instrument as clear and easy to understand. After this process, the tool was distributed to the participants and later collected.

Ethical Aspects

The study was approved by the board of directors and Research Ethics Committee of the ECUUH. All participants read and signed the Free and Informed Consent Term before filling out the data collection instrument, as determined by the Brazilian National Health Council[3].

RESULTS AND DISCUSSION

Sample Characteristics

Forty-seven (88.7%) participants were women and six (11.3%) were men, which is in line with other research showing that the nursing workforce is mainly female[1,4]. Table 1 shows their age range, time in the profession and time worked at the institution.

Table 1 – Participants per age range, time in the profession and time worked at the institution. Ribeirão Preto, SP, 2001 (n=53)

Age Range	n	%	Time worked (years)	in then	profession %	at then	institution %
			0 - 5	29	54,7	33	62,3
20 - 30	26	49,0	5 - 10	5	9,4	4	7,5
30 - 40	15	28,3	10 - 15	8	15,1	10	18,9
40 - 50	10	18,9	15 - 20	6	11,3	3	5,6
50 - 60	2	3,8	20 - 25	2	3,8	2	3,8
			25 - 30	2	3,8	1	1,9
			30 - 35	1	1,9	-	-
Total	**53**	**100,0**	**Total**	**53**	**100,0**	**53**	**100,0**

A majority of workers were between 20 and 30 years old (49%), in fertile age, which causing concern about their exposure to certain chemical agents that are capable of causing reproductive changes[1-2]. In terms of time worked in nursing (54.7%) and at the ECUUH (62.3%), most respondents had been working for up to five years.

Sixteen (30.2%) participants worked fixed shifts and 37 (69.8%) alternating shifts. In the second group, 10 (27%) worked mornings and afternoons, while 27 (73%) also worked night shifts. Day shifts correspond to six hours of work per day, with a minimum interval of 12 hours between them; the duration of night shifts is 12 hours, followed by 36 hours of rest.

Occupational Chemical Risk Data

Participants confirmed they came in contact with different chemical compounds in their work environment. Table 2 shows the 15 most mentioned substances/compounds.

Table 2 – Chemical substance/compound mentioned as causes of occupational exposure. Ribeirão Preto, SP, 2001 (n=53)

Chemical Substance/Compound	Exposure			
	Yes		No	
	n	%	n	%
Antibiotics	53	100,0	0	0
Benzene	53	100,0	0	0
Iodine	52	98,1	1	1,9
Latex/talc	47	88,7	5	9,4
Glutaraldehyde	38	71,7	15	28,3
Formaldehyde	21	39,6	32	60,4
Nitrous Oxide	11	20,7	42	79,3
Antineoplastic	6	11,3	47	88,7
Sodium Hypochlorite	6	11,3	47	88,7
Alcohol	5	9,4	48	90,6
Ethylene Oxide	2	3,8	51	96,2
Chlorhexidine	2	3,8	51	96,2
Oxygen Water	2	3,8	51	96,2
Ether	1	1,9	52	98,1
Nitrogen	1	1,9	52	98,1

The five most frequently mentioned chemical agents were: antibiotics and benzene (100% each), iodine (98.1%), latex/talc (88.7%) and glutaraldehyde (71.7%). These are frequently found in hospitals and are used for medication treatment (antibiotics), skin degreasing (benzene), material cleaning/disinfection (glutaraldehyde and sodium hypochlorite), skin asepsis (iodine) and hand protection (latex gloves). In spite of its frequent use in hospital practice, there was little mention of alcohol (9.4%). The few mentions of antineoplastic agents (11.3%) were probably due to the absence of a specific cancer care sector at the ECUUH, so that the participants only carry out chemotherapy procedures occasionally.

Table 3 shows which of the 15 substances mentioned by the workers they indicated as possible causes of health problems.

Table 3 – Chemical substance/compound mentioned as possible cause of health problems. Ribeirão Preto, SP, 2001 (n=53)

Chemical Substance/Compound	Health Problems			
	Yes		No	
	n	%	n	%
Antineoplastic	46	86,7	7	13,3
Glutaraldehyde	42	79,2	11	20,8
Ethylene Oxide	40	75,5	13	24,5
Antibiotics	39	73,6	14	26,4
Formaldehyde	39	73,6	14	26,4
Latex/talc	37	69,8	16	30,2
Nitrous Oxide	30	56,6	23	43,4
Benzene	29	54,7	24	45,3
Iodine	28	52,8	25	47,2
Ether	1	1,9	52	98,1
Alcohol	1	1,9	52	98,1

In spite of their reduced exposure to antineoplastic drugs, 46 participants (86.7%) identified these agents as the most harmful substances for nursing workers' health, followed by glutaraldehyde (79.2%), ethylene oxide (75.5%), antibiotics and formaldehyde (73.6% each), latex/talc (69.8%), nitrous oxide (56.6%), benzene (54.7%) and iodine (52.8%). Few workers indicated ether and alcohol (1.9% each) as possible causes of occupational health problems, possibly because they are commonly used in different nursing tasks and, thus, tend to be depreciated.

Antineoplastic agents are constantly used because of their therapeutic properties; however, these substances exert mutagenic, carcinogenic and teratogenic effects, which pose risks to the workers handling them when appropriate safety measures are not observed[1-2,5]. Cytostatic agents, anesthetic gases

and sterilizing agents are some of the main causes of reproductive problems, like abortions and congenital malformations, in exposed workers, which confirm the danger of handling these substances[5-7].

The study participants indicated that occupational exposure to the above mentioned substances can cause the health problems shown in Table 4.

Table 4 – Health problems identified by 53 nurses as a result of occupational exposure to chemical substance/ compound. Ribeirão Preto, SP, 2001

Chemical Substance / Compound	Health Problem*																									
	Eye watering		Allergic Reactions		Nausea and/or vomiting		Diarrhea		Blood Alteration		Alopecia		Neoplasms		Sterility		Spontaneous Abortion		Bacterial Resistance		Desensitization		Headache		Respiratory Alteration	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Latex/Talc	7	13,2	44	83,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antineoplastic	-	-	6	11,3	11	20,7	5	9,4	27	50,9	16	30,2	8	15,1	12	22,6	7	13,2	-	-	-	-	-	-	-	-
Antibiotics	1	1,9	12	22,6	8	15,1	14	26,4	8	15,1	3	5,7	1	1,9	-	-	-	-	1	1,9	1	1,9	-	-	-	-
Nitrous Oxide	6	11,3	3	5,7	6	11,3	2	3,8	5	9,4	3	5,7	1	1,9	3	5,7	6	11,3	-	-	-	-	-	-	-	-
Formaldehyde	27	50,9	9	16,9	4	7,5	1	1,9	-	-	5	9,4	2	3,8	1	1,9	-	-	-	-	-	-	1	1,9	1	1,9
Glutaraldehyde	18	33,9	15	28,3	10	18,8	-	-	2	3,8	1	1,9	2	3,8	2	3,8	1	1,9	-	-	-	-	1	1,9	1	1,9
Ethylene Oxide	4	7,5	2	3,8	2	3,8	-	-	3	5,7	1	1,9	14	26,4	7	13,2	2	3,8	-	-	-	-	-	-	-	-
Benzene	14	26,4	22	41,5	13	24,5	-	-	-	-	-	-	-	-	-	-	1	1,9	-	-	-	-	1	1,9	-	-
Iodine	-	-	27	50,9	1	1,9	1	1,9	2	3,8	-	-	2	3,8	2	3,8	2	3,8	-	-	-	-	-	-	-	-
Sodium Hypochlorite	-	-	1	1,9	1	1,9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Each subject gave more than one response.

Due to the increased use of gloves in hospitals as a result of biosafety concerns, latex has come up as one of the causes of dermatitis and occupational urticaria. Hypersensitivity can be due to latex, talc used in internal glove layers or chemical substances added during rubber processing[8]. Our results in terms of latex/talc exposure are in line with literature. Immunological tests can be carried out to identify susceptible workers and, thus, minimize the appearance of these problems.

Participants identified blood alterations as the main problem produced by handling antineoplastic agents. However, these drugs are responsible for several health problems, mainly in terms of human reproduction[5,7,9-10]. Occupational exposure risks involve inhalation of aerosols, direct contact with skin and mucous membranes and ingestion of food and medication contaminated with their residues. These can provoke health damage, including chromosome alterations, mutagenicity, infertility, abortion, menstrual disorders and immediate symptoms like dizziness, headache, nausea, mucous alterations and allergic reactions[9]. The frequency of menstrual irregularities and amenorrhea is higher among nurses manipulating these agents[10]. Spontaneous abortions can occur, mainly during the first three months of pregnancy, besides chromosome alterations and congenital malformations[1,5,11-12]. Other manifestations include skin, mucous and eye irritations; hair fall and decreased immunological resistance, increased drug resistance, pharyngitis, hoarseness, herpes and cancer[13]. Risks can come from the excretions of chemotherapy patients, since part of these substances continue unaltered or take the form of inactive metabolites, found in patients' feces, urine and vomit. Hence, protective equipment has to be used to handle them[1].

Nurses can inhale, digest or come in skin contact with antibiotics, causing sensitivity. Cephalosporin can cause allergies and allergic rhinitis in anyone exposed[14]. Participants associated antibiotics with episodes of diarrhea and allergic reactions, which could also be related to rhinitis.

Another risk is posed by exposure to anesthetic gases (nitrous oxide, halothane), which can cause negative reproductive effects, especially in surgical center workers (nurses, anesthetists, technicians). These substances reduce fertility and increase the incidence of abortions and congenital malformations[1]. Spontaneous abortion can occur as a consequence of occupational exposure, mainly in nurses, during the first term of pregnancy[15]. Again, results are in line with literature, as participants indicated abortions as health problems caused by these gases. They also mentioned benzene and iodine as other causes of abortion.

Sterilizing solutions, vapors or gases also constitute occupational risk agents. Formaldehyde vapors irritate mucous nose, mouth and eye membranes; they can produce symptoms of sickness,

even at low concentrations, and cause dermatitis, edema or larynx spasm, obstructive bronchitis and, occasionally, pulmonary edema[1]. Glutaraldehyde can also be a cause of these symptoms; exposure to this substance at 2% among workers at an endoscopy unit revealed eye watering, rhinitis, dermatitis, respiratory difficulties, nausea and headache[16]. Participants' information about symptoms like eye watering, although to a limited extent, is in accordance with literature.

Occupation exposure to ethylene oxide is a pertinent source of concern, as this substance causes serious health damage, such as increased cutaneous injuries and conjunctivitis; presence of leukemia, lymphoma, gastric and esophageal neoplasms, liver and kidney dysfunctions, respiratory diseases and decreased hemoglobin, due to the degeneration of amino acids; in case of acute intoxication, symptoms include dyspnea, alterations in level of conscience, nausea, vomiting, diarrhea, lymphocytosis, peripheral neuritis and encephalopathy[17]. Neoplasms indicated by the participants are in line with literature information about the association between the use of ethylene oxide and clinical symptoms in people exposed.

Although indicated as problem causers, participants did not attribute any health alterations to alcohol, oxygen water, ether and nitrogen.

CONCLUSIONS

Most participants were women, between 20 and 30 years old, who had been working as nurses and at the institution for up to 5 years. All nurses indicated they came in contact with chemical substances at their work place. The five most mentioned products were: antibiotics and benzene, iodine, latex/talc and glutaraldehyde.

As to what chemical substances can cause health problems, antineoplastic agents were indicated as causes, as well as formaldehyde, glutaraldehyde, ethylene oxide, antibiotics and latex/talc, among others. The nurses believed the following signs and/or symptoms can be caused by chemical products: cutaneous allergic reactions caused by latex/talc; blood alterations by antineoplastic agents; diarrhea by antibiotics; eye watering, nausea and/or vomiting and spontaneous abortions by nitrous oxide and eye watering by formaldehyde and glutaraldehyde, among others.

However, participants did not indicate clinical alterations mentioned in literature, which shows that their knowledge about the chemical occupational risk factors they are exposed to is still insufficient. To minimize this situation, this theme should be included in undergraduate nursing course curricula and permanent in-service education, explaining appropriate safety measures to decrease occupational risks, particularly chemical risks, and their harmful effects on workers' health.

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