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Specific Job-Exposure Records to Assess in Routine Present Carcinogenic Risks

Deschamps F*
Department of Occupational Health, Medicine Faculty, University of Champagne-Ardenne, France

Abstract

Objectives: The aim of the study is to use specific job-exposure records, to identify occupational exposures to carcinogens.

Methodology: We built 105 forms corresponding to specific jobs, including the main risks. The occupational practitioner during the annual medical examination indicated by a cross the presence or lack of specific risks.

Results: A specific job-exposure record was filled for each of 2017 workers between February 2004 and September 2007. Nine hundred and fifty three workers corresponding to 47% of the studied population were exposed during work to one carcinogen or more. Main carcinogenic exposures were Hepatitis B viruses (712 cases), environmental tobacco smoke (85 cases) and inorganic acids (81 cases).

Discussion: The workers are exposed to occupational carcinogens, although most of them belong not to industrial but to tertiary sector, which gathered activities majority at the beginning of the new millennium.

Keywords: Job-exposure records; New carcinogenic risks

Introduction

Job exposure matrices (JEM) have been commonly used in occupational epidemiology since the early 1980' [1]. A large number of JEM have been described, some designated for population based studies, others designated for use in specific industries such as electronic utilities, paint manufacturing or hard metals and still others for study specific chemicals. But only few could be used for all commercial and industrial sectors and moreover only by trained and skill professionals. The general principle of JEM is based on the construction of a database that associates jobs (the rows of the matrix) with data about exposures to various risks [2]. JEM applicable to the general working population are usually constructed by using mainly the expertise of specialists. These JEM give a range of work features which are specific of particular occupations. JEM are particularly valuable when a subject's recall for job activity or location, exceeds his ability to recall information relevant to different occupational exposures.

Standardized data are difficult to collect easily in a miscellaneous working population. In fact, health surveillance would greatly benefit from tools providing valid estimates of the prevalence of the main occupational exposures including cancer-producing substances according to specific jobs. Exposure assessment is an important stage of occupational medical visit [3]. Availability of exposure data particularly concerning carcinogens is an essential result. Exposure data are needed to organize workplace monitoring, and to estimate burden of occupational factors on population's health. JEM should be used for routine surveillance of occupational exposure. Most JEM published in the International panorama are used for epidemiological studies. Their utilization is usually complicated, reserved for skilled Health workers. We have constructed 105 job-exposure records (JER) that may be used by occupational health professionals for surveillance purposes.

The aim of this study is to investigate carcinogenic exposures according to job with JER use, which does not require specific training.

Methodology

JER construction

Most of carcinogenic estimates were based on the observation, for example SUMER survey, which is a job exposure matrix applicable to the general population by using only the expertise of specialists [4] or the colchic database [5] including occupational exposures measurements maintain by the National Institute of Research on Safety (INRS).

The knowledge's of the practitioners, concerning the working environment of the companies they control on a regular basis, were added. For each risk reported to be present, the physician assessed the duration of exposure. Only significant exposures were recorded. Physicians were instructed to also take into account significant passive exposures.

JER development

The objective was to construct a matrix in which the rows would represent the jobs and the columns the risks. The list of the 105 archetypal jobs is included in Table 1**.** Each of the 105 JER was linked to one or few occupations included in the International Standard Classification of 4760 Occupations (ISCO). *The JER development was a simplified synthesis of the main international databases collected partly in JEM previously mentioned.*

Intensity and frequency of risk exposures were excluded to simplify the JER use. Only the lack or the presence of the risk was determined. It was one of the main differences with classical JEM. The risks designation was standardized with eight items: biological risks, mental health risks, repetitive trauma disorders–heavy loads, shift work, physical risks,

***Corresponding author:** Deschamps F, Department of Occupational Health, Medicine Faculty, University of Champagne-Ardenne, 51 rue Cognacq Jay 51100 Reims, France, Tel: 33 326788933; Fax: (33) 326784356; E-mail: fdeschamps@chu-reims.fr

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Jobs	Numbers subjects	Percentage
Policemen	794	39,36
Administration Employees	380	18,83
Teachers	145	7,18
Researchers	122	6,04
Secretaries	107	5,30
Housemaids	71	3,52
Laboratory Technicians	63	3,12
Computer Scientists	50	2,47
Waiters	42	2,08
Managerial Staff	36	1,78
Cookers	35	1,73
Multivalent Workers	24	1,18
Stock Breeders	16	0,79
Industrial Chemist	14	0,69
Miscellaneous Jobs	118	5,85
TOTAL	**2017**	**100**

Table 1: Breakdown of the studied population according to job groups (n>10).

display use, high injury exposure, chemical and allergic risks with a special identification for cancer-producing toxics. *The matrix included all potential occupational risks. But in the study, our research was focused on carcinogenic risks.* We had developed exposure estimates by using international data concerning 105 "bench-mark jobs", which were the most representative of industrial and commercial sectors.

JER validation

JER were validated intrinsically and extrinsically by few ways. Firstly the same population of workers had risks assessment by different practitioners. The results obtained by JER use, were roughly the same whatever medical doctor involved. Secondly distribution risks evaluation obtained after visiting firms was comparable with data supplied by JER use.

JER use

Occupational physicians trained in occupational hygiene during their four years specialized residency, and it is mandatory that they devote at least a third of their working time in such tasks besides the annual medical visits that are also mandatory. The occupational practitioner (or hygienist) during the annual medical examination indicated by a cross the presence or the lack of determined major risks (example: carcinogenic exposure) completed by indication about main molecule concerned (for example formaldehydes) for a well-defined job. The concept exposure in JER does not refer to the number of exposure events - for example three times a year-but to the occurrence of agents' specific exposure of a worker. For example if one worker is exposed to two carcinogens, the number of exposed workers is one but the number of exposure is two. The distinction between exposure and exposed workers is necessary. One of the objectives of JER was to identify different occupational exposures for a determined worker and to inform him of possible present and long term effects.

Use of JER on a definite working population

We have bringing JER into operation using a working population of more than two thousands of individuals. They belonged to the public sectors and they met each year an occupational medical doctor. JER results were obtained during the annual medical examination. None who participated to the medical visit was excluded.

Results

During the annual medical examinations between February 2004 and September 2007, practitioners belonging to a determined non specific occupational health department of public sector of the town of 200 000 residents settled in the North-East of France, filled JER for 2017 workers belonging to miscellaneous activities. The main group of workers (794 subjects) included policemen. The other groups incorporated administration employees (380 persons), university workers as teachers (145 persons), researchers (122 persons), secretaries (107 persons), housemaids (71 persons) (Table 2).

Nine hundred and fifty three workers were exposed to one or more carcinogens. They represented almost half population. The number of cancer-producing substance exposures is 1125. Three jobs brought together over one carcinogen exposure: researcher (9 carcinogens), industrial chemist (3 carcinogens) and laboratory technician (7 carcinogens). The mean number of occupational carcinogen contact by workers is 1,18. Carcinogenic exposures could be identified in the groups of biological, chemical or physical hazards. Hepatitis risk contaminations, environmental tobacco smoke and inorganic acids inhalations were the three major carcinogens (Table 3) detected in the study. Exposure to Hepatitis viruses may occur after blood contamination contact during policing or restroom cleaning (Table 3). *For the studied population ten carcinogen exposures were recorded in relationship with IARC Classification.* If low level exposures (close to the non-occupational background) are excluded, the number of exposed workers would be a minimum 20% lower. Passive smoking at work is estimated to be the second most common exposure. Environmental tobacco smoke would have been still higher if short term exposure had been included.

Discussion

The physicians recorded the presence or absence of main risks including chemicals and particularly carcinogens. Despite the fact that more than 6 millions chemicals have already been identified and registered with the chemical abstract service and more than 50,000 are estimated to be regularly used in commerce, probably fewer than 1 000 chemicals or exposure situations have been scrutinized as to their potential for cancer causations. These last one have been included in the JER. Consequently JER included mainly data on agents evaluated by the International Agency for Research on Cancer (IARC) (all agents in groups 1 and 2 A in addition ionizing radiation were included although not evaluated by IARC).

Occupational Carcinogenic Exposures Over 10 workers (population studied n=2017)		
Risks	**Number**	**Percentage**
Hepatitis Viruses	712	35,3
Environmental Tobacco Smoke	85	4,2
Inorganic Acids	81	4,0
Ultra violets	40	1,9
Aromatic Amines	27	1,3
Formaldehydes	27	1,3
Chromium	23	1,1
Nickel	17	0,8
Radioactivity	16	0,7
Benzene	13	0,6
TOTAL NUMBER	*1041*	

Table 2: Breakdowns of the studied population according to carcinogenic exposures at work.

	JOBS (percentage in relationship with job)								
OCCUPATIONAL CARCINOGENS	**Administrative Employees**	**Researchers**	**Industrial Chemists**	**Housemaids**	**Laboratory Technicians**	**Policemen**	**Secretaries**	**Waiters**	**TOTAL**
	n=380	n=122	n=14	n=71	n=63	n=794	n=107	n=42	
Hepatitis Viruses		8 (6)		49 (69)	6 (9)	634 (80)			697
Environmental Tobacco Smoke	54 (14)						9 (8)	15 (35)	78
Inorganic Acids		42 (34)	11 (78)		22 (35)				75
Ultra violets		23 (18)	5 (35)		11 (17)				39
Aromatic Amines		15 (12)	6 (42)		5 (8)				26
Formaldehydes		8 (6)			17 (27)				25
Chromium		11 (9)			7 (11)				18
Radioactivity		13 (10)							13
Nickel		10 (8)							10
Benzene		5 (4)			5 (8)				10

Table 3: Carcinogenic exposures at work according to specific jobs (number of exposed workers per carcinogen and per job >= 5)

Most of the workers included in the studied population belong to tertiary sector. But this population with a third of policemen is not representative of tertiary sector. Number of carcinogenic exposures expected should be weaker than data obtained. In fact almost half of workers have contact with occupational cancer-producing substances. The strengths of JER system are in systematic nature, wide coverage and ease of use.

Classical JEM are realistic but much too complicated to be used for routine surveillance of different occupational exposure at an individual scale by a practitioner. *Consequently it is difficult to compare results of academic JEM with the data obtained in this study using JER.* The main way of using JEM was to query the database, when occupational health care providers felt that they were not fully informed about the environment of the workplace of some workers. But no country has available sufficiently representative measurements of common occupational exposures to numerous harmful exposures for the thousands of jobs that can be encountered in the general population to construct JEM based solely on statistical analysis of such databases [6,7]. Moreover the use of JEM to assess individual exposures has long been known to involve some misclassification engendered by the imprecision of the job exposure assessments included in the matrix [8]. This pitfall is not reduced by JER using.

All theses aspects justify the use of our simplified JER. We don't recommend the use of specialist coders to utilize our JER method. JER has been developed to be used without particular skills by occupational physicians and other prevention professionals responsible for surveillance of the health of the workforce.

Major strengths of the method were the use of the prompt list to get right job record and accurate exposure by "a priori" risk identification. The 105 different specific job records limit the extent of misclassification, because of the use of detailed International Standard Classification of Occupations. The use of an International code is adapted to all circumstances in all countries.

Another approach to assess coding quality is to compare self-reported exposures with that determined by JER. The results show that a lot of workers are ignorant of their own exposure, an observation made in other studies [9]. NANNI and colleagues [10] found that only 15% of agricultural workers could remember use of specific chemicals. Use of JER allowed the exposures to be determining in an objective manner, since it did not rely on personal recall to different occupational exposures. Although it is not an absolute exposure measurement, it does offer a substantial advance over dichotomous categories based on self-report carcinogenic exposures. When comparing the exposure status to several occupational chemicals as assessed by JER, to the lack of systematic data registration, we found that job records database were largest and more justified. The subjects' occupational exposures which were assessed with JER are without major missing. Many researchers and practitioners still focus on only one characteristic (more often concerning asbestos) of a job [11].

In this study, each worker was exposed (mean) to more than one carcinogen. SUMER and other JEM results identified that around ten percent of a whole working population had occupational carcinogenic risks(4) in fact the results presentation was different. In this study substantial part of carcinogenic exposure originated from activities not directly and systematically related to work as such (possible contamination by Hepatitis viruses, environmental tobacco smokes at work). The contribution of these factors are almost two third of whole exposures. *It is not possible using this methodology to separate occupational from environmental carcinogenic exposures. This statement is corresponding to the genesis of an occupational disease which is the adding of work and environmental exposures excluding to identify the main origin of the disease.* These results are quite similar to the data obtained by the computer assisted information system for the estimation of the number of workers exposed to establish and suspected human carcinogens in the number states of the European Union (CAREX) [12]. JER improvement is recommended for several reasons. Exposure has been recently restricted for some agents including few glycols and passive smoking at work. New industrial hygiene measurements data may lead to exclusions of some exposures, by contrast few may have to be added. The continuation of work would increase the validity of estimates and awareness of unidentified exposures and risks.

Conclusion

There is a general consensus that levels of exposure to carcinogens in the workplace have been decreasing during the last 20 or 30 years. In fact exposures are changing. Old high ones are being lowered, sometimes reduced by alternation of processing methods and sometimes removed by substitution with hopefully less hazardous materials. But it is important to collect and to evaluate disseminating data on carcinogenicity of occupational exposures, in order to develop strategies for prevention of disease. The most efficient strategy relies on primary prevention, that is identification (and if possibly elimination) of sources of exposure. In general it is not necessary to understand the jargon of a particular trade to take an adequate exposure history. Persistent questioning by the clinician can clarify the tasks involved in most jobs to choose the right JER.

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