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Occupational exposure and lung cancer risk - Study in two different Romanian areas

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ABSTRACT
Lung cancer is the most frequent neoplasm worldwide and the incidence in Constanta County is in continuous increasing. Occupation as a cause of lung cancer is common. The authors examined the relation between occupation and lung cancer in two patient cohorts from different areas of Romania: Constanta and Valcea. In 2005–2010, in Constanta and Valcea counties, 488 and 344 incident lung cancer cases were enrolled. Lifetime occupational histories (industry and job title) were coded by using standard international classifications and were translated into occupations known (list A) or suspected (list B) to be associated with lung cancer. An exposure excess of 14.6% for patients from Constanta ever employed in occupations known to be associated with lung cancer (list A) was found, with the largest contributions from the oil refinery and shipbuilding industries No overall excess was found for list B with the exception of drivers and truck drivers (men) and launderers and dry cleaners (women), in both groups of patients. These results indicate that past exposure to occupational carcinogens remains an important determinant of lung cancer occurrence.

Key words: lung cancer, occupations

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Introduction

Lung cancer is the most frequent neoplasm worldwide, with more than 1.6 million new cases and 1.3 million deaths in 2008 [1]. Although tobacco smoking is by large the most important cause, occupation is an important cause of lung cancer. It has been estimated that 13 to 29% of lung cancers in men are secondary to on-the-job exposure to chemicals and materials that increase the risk of lung cancer [2]. Many of these exposures are preventable through awareness, and taking appropriate precautions. In the year 2000, it was estimated that 10% of lung cancer deaths among men (88,000 deaths) and 5% among women (14,300 deaths) worldwide were attributable to exposure to 8 occupational lung carcinogens (arsenic, asbestos, beryllium, cadmium, chromium, diesel fumes, nickel, and silica) [2,3,4]. In Europe, assuming attributable fractions of 7% - 15% (men) and 2% - 9% (women), the estimated numbers of deaths caused by exposure to chemicals in the workplace were more than 29300 and 3200, respectively [2]. Prevalence of occupational exposure to carcinogens is still high: in 1990–1993, of almost 140 million workers in 15 states of the European Union, 32 million were estimated to be exposed to carcinogenic agents and about 7 million to the 8 above-mentioned carcinogens [5].

Different approaches are used to evaluate occupational exposure to carcinogens [6,7,8]: one makes use of lists of occupations known (list A) or suspected (list B) to be associated with lung cancer based on evaluations of carcinogenic risks by the International Agency for Research on Cancer (IARC) [9,10]. These lists are periodically updated and have been extensively used worldwide as a standardized tool to quantify the burden of occupational lung cancer [8,11,12], but there remains a need to continue to evaluate occupations and try to uncover additional jobs and occupations that may contribute to the lung cancer burden.

Objective

The study aimed to analyze the role of occupational exposures as a determinant of lung cancer risk.

Materials and Methods

The study included patients diagnosed with lung cancer in the Pneumology Departments of Constanta Clinical Pneumophtisiology Hospital and "Constantin Anastasatu" Pneumology Hospital of Ramnicu Valcea, between 2006 - 2010.

Extensive demographic and clinical data were collected for lung cancer cases, including morphology coded according to the International Classification of Diseases for Oncology, Third Edition [13] and categorized into major histologic subtypes based on World Health Organization/International Association for the Study of Lung Cancer classification [14].

All subjects completed self- administered questionnaire regarding lifetime history (years of start/stop, industry, job title) of jobs held for at least 6 months. Industries and job titles were coded following the International Standard Industrial Classification of All Economic Activities [15] and the International Standard Classification of Occupations [16]. The codes were then translated into occupations known (list A) or suspected (list B) to entail a carcinogenic risk for the lung [9,10]. The list B occupation filling station attendant, for which there are no specific exposures, was identified through text search. Subjects with job titles from both lists were assigned to list A and to list B only if they had never worked in list A occupations.

We performed a statistical analysis by using the softs: GraphPad StatMate (1.01) and GraphPad Prism 4 (4.03).

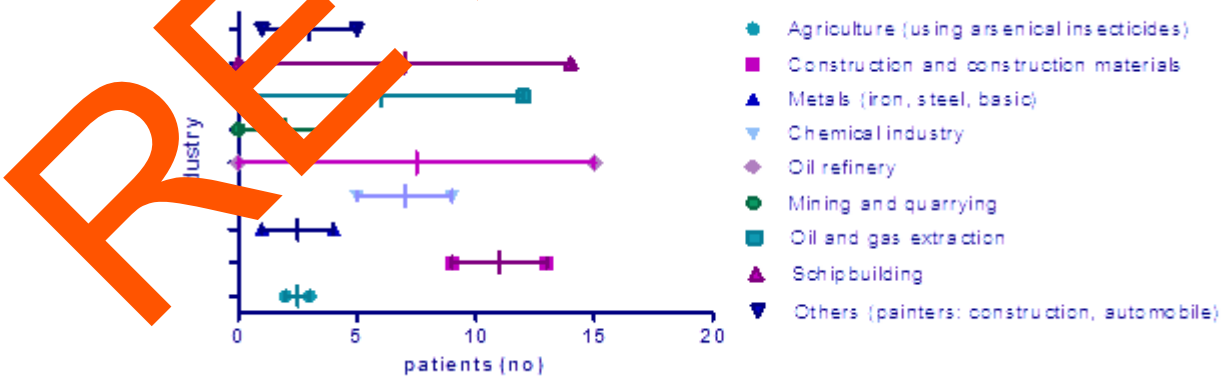

Figure 1 – Exposure to list A occupations

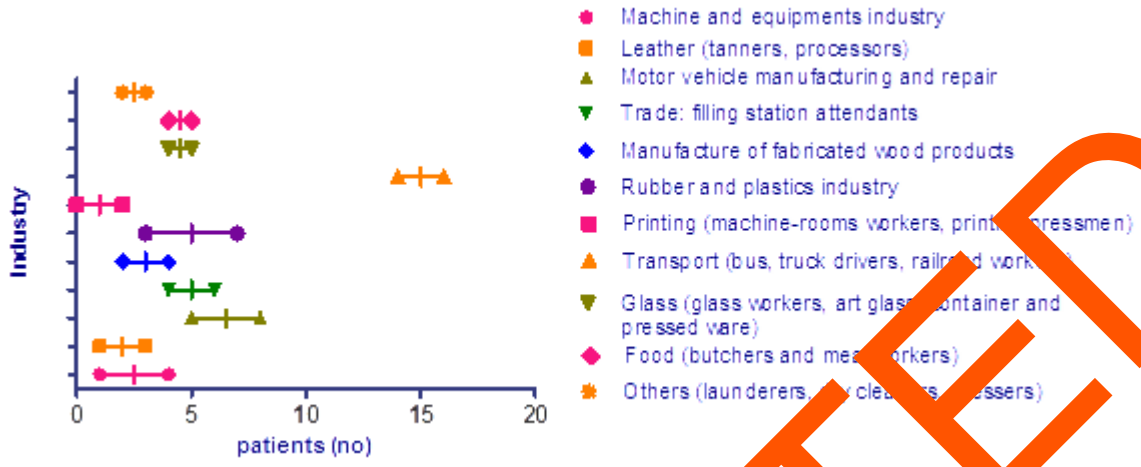

Figure 2 – Exposure to list B occup ons

Results

Of the 822 lung cancer cases registered in Pneumology Departments, during the 5-year p d there were 478 patients from Constanta and 344 om Ramnicu Valcea. The main characteristics of l g cancer patients are given in Table I.

Table I - Selected characteristics o ng cance patients

	All (%)	Constanta		Valc		
	822	478	%	344	%	
Age, years (mean±SD)	63.03±10	62.22±10.05		6±9.76		<0.05
Gender (sex ratio)		1 (388/90)		5.5/1	/53)	
Smoking						
Never	72 (8.8)	44	9.2	28	8.1	ns
Former (quit >6 months ago)	175 (21.2)	98	5	77	22.4	ns
Current	575 (69.9)	336	70.	239	69.5	ns
Cigarette pack ars (mean±SD)	61. .84	63.5±10.02		59.07±11.34		<0.05
Histology	3 (88)					
Squamous	291 (40.2)	8	39.8	121	40.2	ns
A oma	207 (28.6)	124	29.3	85	28.2	ns
LC	4 (14.	63	14.9	44	14.6	ns
Large cell c inoma		30	7.1	19	6.3	ns
Others	76 (.5)	37	8.7	32	10.6	ns

The patients from CT developed the disease at an e lier age than patients from VL (62.22 versus 65.26 ars; P <0.05). Less than 10% of patients were never smokers (9.2% CT group, 8.1% VL group). Almost a fifth of the patients (175/822 cases) were former smokers. In both groups, about 70% of patients were current smokers but the patients from CT group had smoked eater numbers of cigarettes (63. pack-years versus 5 7 pack-years, P<0.05).

The majority of lung cancers were squamous ce carcinomas (.5%) in both groups.

Among all tients, 70 cases (14.64%) from CT grou d 27 c s (7.84%) from VL group, had ever worked in list A occupations (P<0.05) (Table II). The m frequent exposures in CT patients were in oil refinery (15 cases) and shipbuilding (14 cases). For VL group of patients, the exposures in constructions (9 cases) and chemical industry (9 cases) were more frequents.

Table II - The number and percentage of patients according to list A occupations

Industry	CT group of patients		VL group of patients	
	No	%	No	%
Agriculture (using arsenical insecticides)	2	0.41	3	0.87
Construction and construction materials	13	2.71	9	2.61
Metals (iron and steel, basic)	4	0.83	1	0.29
Chemical industry	5	1.04	9	2.61
Oil refinery	15	3.13	0	0
Mining and quarrying	0	0	4	1.16
Oil and gas extraction	12	2.51	0	0
Shipbuilding	14	2.92	0	0
Others (construction, automobile painters)	5	1.04	1	0.29
Total	70	14.64	27	7.84
P value			<0.05	

In total, 114 cases (13.86%): 56 cases (11.71%) from CT group of patients and 48 cases (13.95%) from VL group of patients had been working in

occupations in list B, with no statistical differences between the two groups (Table III). We found a marked elevated exposure for bus and truck drivers in both groups (16 cases in CT group and 14 cases in VL group of patients). For women, we found increased level of exposure for launderers and dry cleaners (5 cases in both groups of patients).

Table III - The number and percentage of patients according to list B occupations

Industry	CT group of patients		VL group of patients	
	No	%	No	%
Machine and equipment industry	4	0.83	1	0.29
Leather (tanners, processors)	3	0.62	1	0.29
Motor vehicle manufacturing and repair	8	1.67	5	1.45
Trade: filling station attendants	6	1.25	4	1.16
Manufacture of fabricated wood products	2	0.41	4	1.16
Rubber and plastics industry	3	0.62	7	2.03
Printing (machine-rooms workers, printing pressmen)	2	0.41	0	0
Transport (bus, truck drivers, railroad workers)	16	3.34	14	[illegible]
Glass (art glass, container and pressed ware)	4	0.83	5	1.4[illegible]
Food (butchers and meat workers)	5	1.04	[illegible]	1.45
Others (launderers, dry cleaners, joiners)	3	[illegible]2	2	0.58
Total	56	[illegible]	[illegible]	[illegible]
P value		0.0[illegible] 95% -1067 to 1207		

Discussion

Lung cancer incidence in Romania [1] and, particularly in Constanta county is rising dramatically over several decades. Although tobacco smoking is by far the most important cause, occupational factors play a remarkable role.

This study was performed in 2005–2010 in Constanta, eastern Romania - one of the most populated, 724000 inhabitants, 65% living in urban areas, economically relevant, and industrialized region in Romania, high lung cancer incidence and mortality rates (higher than national rates) and in Valcea - southwestern Romania, 412000 inhabitants, 55% living in rural areas, lower incidence and mortality rates than national values, in order to analyze the role of occupational exposures as a determinant of lung cancer risk.

We found an exposure excess of 14.6% for patients from Constanta ever employed in occupations known (list A) to be associated with lung cancer, with the largest contributions from the oil refining and shipbuilding industries. For patients from Valcea, the frequency of exposure was lower (7.8%, P<0.05), with higher contributions from constructions and chemical industries. These findings are similar with results reported in other studies [17,18].

Statistical analysis showed differences regarding the exposure according with occupation list A (P<0.05).

Of the occupations suspected (list B) to be associated with lung cancer, we found a suggestive increase for bus, truck drivers and railroad workers (men) in both groups of patients, with no statistical differences regarding the frequency of exposure (P=0.0885 CI 95% -1067 to 1207). The findings for individual occupations in list B are suggestive because the number of exposed subjects was great. The increased risk for bus and truck drivers deserves mention because it was based on a substantial number of exposed workers (16 cases in Constanta and 14 cases in Valcea group of patients). For women, we found a moderate risk increase for launderers and dry cleaners, a finding reported in other studies [17].

This study confirmed the important role of past occupational exposures as a determinant of lung cancer risk at the beginning of the new century. The low exposure level for list A occupations among women was expected, given that exposure to most occupational lung carcinogens occurred in workplaces in which women constituted a minority.

In conclusion, the findings of this study confirm the need for continuous monitoring and improved control of work-related exposures, both for prevention and workers compensation purposes. Future occupational health studies should improve their ability to address interindividual variability in response to the lower exposures in work settings.

Conclusions

The frequency of exposure for patients from Constanta ever employed in occupations known to be associated with lung cancer (list A) was higher than the level of exposure for Valcea group of patients.

Over representation of oil refinery and shipbuilding industry exposure was observed in the group of patients from Constanta.

Of the occupations suspected to be associated with lung cancer (list B), the higher exposure was found for bus, truck drives and railroad workers, in both groups of patients.

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