



Risk of lung cancer by histology among immigrants to Sweden

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ABSTRACT

Background: We wanted to define lung cancer incidence rates by histological subtype among immigrants in Sweden to explore the effect of new environments on the incidence of lung cancer by histological subtype in different ethnic populations.

Methods: The nationwide Swedish Family-Cancer Database was used to calculate age-standardized incidence rates (ASR) (per 100,000) and standardized incidence ratios (SIRs). The patient series covered 19,255 male and 14,601 female Swedes, and 3236 male and 1751 female immigrants.

Results: By time since immigration, Former Yugoslavian (ASR=46.4) and Asian Arab (38.8) men, and Danish (23.3), Norwegian (19.5) and Finnish (14.5) women had the highest rates for lung cancer, while the lowest rate was seen among Asian Arab women (5.8). The highest adenocarcinoma rates were seen among South European men (11.5), and Danish (7.4) and Norwegian (6.9) women, while squamous cell (SCC) and small cell carcinomas rates were the highest among former Yugoslavian (16.0) and Baltic (8.8) men, respectively. Former Yugoslavian men (2.6) had the highest rate for large cell carcinoma. Compared to Swedes, former Yugoslavian men had the highest significant risk for SCC (SIR=3.62), small cell (3.14) and large cell (4.21) carcinomas, whereas the highest adenocarcinoma risk was seen among Asian Arabs (2.35). Danish women had the highest risks for SCC (1.91) and small cell carcinoma (2.56).

Conclusion: The ethnic-specific lung cancer rates by histology followed the rates in the countries of origin. Our findings may suggest that preservation of smoking habits in the host country is linked to the ethnic diversity of lung cancer incidence by histology.

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1. Introduction

The geographical distribution of lung cancer is characterized by wide variations and temporal patterns [1]. The highest rates (>81/100,000) have been reported in some African American men. A rate of 70–80 per 100,000 has been reported in China, Turkey and former Yugoslavia, while Africans, Latin Americans and Indians have the lowest rate (<10/100,000). Among women, Black and White Americans have the highest rate (>40/100,000). The lowest rates of less than 3/100,000 are reported among North Africans and Indians [2]. Lung cancer rate in men (18.2/100,000) is marginally higher than in women (16.8/100,000) in Sweden [3].

Squamous-cell carcinoma (SCC), small cell carcinoma, adenocarcinoma and large cell carcinoma are the most common histological subtypes of lung cancer. Tobacco smoking is associated with all histologies of lung cancer; obviously the association

is stronger for SCC and small cell carcinoma than adenocarcinoma [1,4]. A change in the proportions of SCC to adenocarcinoma has been reported over the last few decades [5]. This is probably due to changes in smoking behaviors and tobacco products (e.g. use of filtered cigarettes and lower tar contents) [6,7]. These changes are a likely explanation for diverging trends in lung cancer rates seen among both sexes in Western countries, with a decreasing rate in men and a slight increase in women [8,9]. In Sweden, smoking was banned in some public places in 2005 [10]. Heavy industrial environment, exposure to radon and indoor and outdoor pollution, and positive familial history are other risk factors of lung cancer [11–14].

Migrant studies provide data on interethnic and international differences in cancer rates. Furthermore, studies on immigrants may provide supplementary and confirmatory data on the incidence of cancer in countries without national cancer registries [15]. To our knowledge no study has investigated whether the lung cancer incidence in immigrants varies by different histology. In the present study, we reported rates of lung cancer by histology in the first-generation immigrants to Sweden in order to explore the incidence diversity among different ethnic populations in a new environment.

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2. Material and methods

We used the 2010 update of the nationwide Swedish Family-Cancer Database (FCD), which is a sub-dataset of the MigMed database run by Center for Primary Health Care Research at Lund University. The FCD contains information from the multigenerational registries, the national censuses, the Swedish Cancer Registry and the death notifications. The Database contains those born in Sweden since 1932 with their biological parents and additionally data on immigrants are included [16,17]. First-generation immigrants were defined as those born outside Sweden without identified parents in the Database. Countries included in each birth region were classified according to geographical setting and number of populations.

Data on cancers in FCD have a code according to the 7th revision of the International Classification of Disease (ICD) (<http://www.wolfbane.com/icd/index.html>): lung (ICD = 162.0, 162.1, 162.2 and 163). The ICD has been used in the Swedish Cancer Registry since the start of cancer registration in 1958 [18]. From 1993 onwards, ICD-O-2/ICD with histopathological data according to the Systematized Nomenclature of Medicine (SNOMED) was used. This coding system gives a detailed histology–topology of tumors: Adenocarcinoma (SNOMED = 8140, 8230, 8250, 8252–8255, 8260, 8310, 8333, 8470, 8480, 8490 and 8550), SCC (8052, 8070, 8073, 8083 and 8084), small cell carcinoma (8041–8043) and large cell carcinoma (8012–8014, 8082, 8123 and 8310) [19]. All lung cancers (100%) reported to the Cancer Registry were histologically verified [3].

The start of follow-up was defined as the birth year, the date of immigration, or January 1st, 1993, whichever came latest. The year 1993 was selected as the start year of follow-up based on the date of application of ICD-O-2/ICD in the Database. The end of follow-up was defined as the date of cancer diagnosis, death or emigration, the end of the last year of presence in the census, or the closing date of our study, December 31st, 2008, whichever came earliest. The year 2008 was selected as the stop year of follow-up based on the last date of available data in the FCD.

Standardized incidence ratios (SIRs) were calculated as the ratio of observed to expected number of cases. The expected numbers were calculated from 5-year age groups, sex and time periods (10-year bands from 1958 to 2008) in the native Swedes as the reference population. The age-standardized incidence rates (ASR) (per 100,000) was calculated by dividing the number of cases into person year at risk. The world population was used for standardization [20–23]. We selected the countries of origin where had at least 50 male lung cancer cases (Tables 1 and 2). Among 64 countries/groups

of immigrants, 11 countries were selected. Furthermore, at least two significant SIRs by histology was our criteria to show the risk of lung cancer by histology among immigrants (Figs. 1 and 2).

The effect of residential time in Sweden was tested for three groups: time since immigration <15 years, 15–29 and ≥30 years. Confidence intervals (95% CI) were calculated assuming a Poisson distribution. SAS software version 9.2 was used for the data analysis (SAS Institute Inc., Cary, NC, USA). During 16 years of follow-up, 5.9 million person years of male and 6.3 million person years of female immigrant were followed up. The median residential time was 32 years in men and 36 years in women.

3. Results

During the period of study from 1993 to 2008, we found that the median age at immigration was 32 years in men and 29 years in women. The median age at lung cancer diagnosis was 66 years in immigrant and 70 years in Swedish men, and 67 years in immigrant and Swedish women. The FCD included 19,255 cases of lung cancer in Swedish men and 3236 cases in immigrant men (Table 1). Former Yugoslavians (ASR = 46.4), Asian Arabs (38.8) and Turks (34.2) had the highest rates for lung cancer. The highest rates of adenocarcinoma were seen among South Europeans (11.5), former Yugoslavians (10.6) and Asian Arabs (10.4). The highest rates of SCC were seen among former Yugoslavians (16.0), Asian Arabs (11.9) and Danes (10.8). Balts (8.8) and former Yugoslavians (7.2) had the highest rates for small cell carcinoma. Former Yugoslavians (2.6) had the highest rate for large cell carcinoma.

The FCD included 14,601 cases of lung cancer in Swedish women and 1751 cases in immigrant women (Table 2). Danes (23.3), Norwegians (19.5) and Finns (14.5) had the highest rates for lung cancer, while the lowest rate was seen among Asian Arabs (5.8). The highest rates of adenocarcinoma were seen among Danes (7.4) and Norwegians (6.9). Danes (3.9), Norwegians (3.2) and Poles (3.2) had the highest rates for SCC. The highest rates of small cell carcinoma were seen among Danes (4.7) and Norwegians (4.4).

Table 3 compares the rates of lung cancer by histology among immigrants and the report of Cancer Incidence in Five Continents (CI5). A large difference in lung cancer incidence by histology was seen for adenocarcinoma between Danish immigrant (ASR = 5.9) and resident (12.2) men, for SCC between Serbian immigrant (2.1) and resident (4.8) women, and for large cell carcinoma between Danish immigrant (1.5) and resident (4.0) men.

Histology-specific risks of lung cancer among immigrant men are shown in Fig. 1. As compared to Swedish men, the highest adenocarcinoma risk was seen among Asian Arabs (SIR = 2.35), former

Table 1
Age-standardized (World) incidence rates (ASR) (per 100,000) for lung cancer by histology among male immigrants in Sweden from 1993 to 2008.

Birth region*	Person years	All		Adenocarcinoma		Squamous cell carcinoma		Small cell carcinoma		Large cell carcinoma	
		N	ASR	N	ASR	N	ASR	N	ASR	N	ASR
Sweden	53,666,185	19,255	19.3	5436	5.7	5044	4.9	2647	2.7	729	0.7
Former Yugoslavia	650,490	525	46.4	125	10.6	169	16.0	87	7.2	34	2.6
Asian Arab Countries	231,778	71	38.8	26	10.4	19	11.9	2	1.2	3	1.4
Turkey	185,620	90	34.2	25	9.4	21	8.8	13	5.2	3	1.3
Finland	878,265	976	33.3	267	9.1	276	9.4	181	6.1	32	1.1
Denmark	286,740	300	31.5	58	5.9	103	10.8	52	5.6	15	1.5
Eastern Europe	209,846	189	31.3	54	9.0	34	5.4	38	6.1	9	1.4
Southern Europe	159,094	102	30.5	40	11.5	16	4.7	9	2.7	2	0.6
Germany	249,346	221	25.1	64	7.1	62	7.1	32	3.8	10	1.1
Poland	167,874	78	24.5	27	9.2	22	6.5	12	3.0	2	0.6
Norway	303,742	179	22.9	47	6.7	54	6.4	30	4.3	6	0.6
Baltic countries	49,189	66	19.9	19	4.4	19	2.9	10	8.8	2	0.2
All immigrants**	5,941,136	3236	29.5	910	8.2	899	8.3	517	4.7	140	1.3

* We selected the countries of origin where had at least 50 male lung cancer cases.

** "All immigrants" refers to all immigrants in the Database.

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