RESEARCH COMMUNICATION

Comparison of Cancer Incidence in Iran and Iranian Immigrants to British Columbia, Canada

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Abstract

Migrant studies provided strong evidence about the role of environment and life style in cancer risk. Iran has experienced many immigrants to other countries with different cultures and environment. This study compares cancer incidence rates in Iran, Iranian immigrants to British Columbia (BC), Canada, and the BC general population. Cancer incidence rates were computed from two population-based cancer registries in Iran and from the BC cancer registry. A listing of common Iranian surnames and given names was produced to identify Iranian immigrants within the BC cancer registry. Age-standardized rates (ASRs) were calculated using mid year census data. The overall cancer incidence rate for Iranian female immigrants was intermediate between rates for Iran and the BC general population, and the rate for Iranian male immigrants was lower as compared to the other population groups. For female Iranian immigrants, the incidence of breast cancer was increased four-fold, and for colorectal cancer two-fold, as compared to Iranian rates. A dramatic decrease was found in the incidence of both stomach and oesophageal cancers for Iranian immigrants of both sexes. For male Iranian immigrants, the incidence of prostate cancer was increased as compared to Iranian rates. Differences in incidence rates of specific cancers were observed between BC Iranian immigrants and Iran, with cancer patterns in Iranian immigrants being more similar to the BC general population. This warrants further investigation into differences in lifestyle and cancer detection.

Key Words: Cancer incidence data - Iranian Immigrants - Canada

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Introduction

Studies of immigrants provide important information on the contribution of environmental and genetic factors in the etiology of various cancers. Comparison of cancer rates among immigrants and their descendents have suggested cultural practices that affect cancer risk. The classic migrant studies of Japanese immigrants to the United States (Kolonel et al., 1980), and European immigrants to Australia (McMichael et al., 1980), provided early strong arguments for the importance of environmental and lifestyle factors in cancer etiology. Recent migrant studies have shown that cancer incidence rates vary among immigrants from different countries (Hemminki et al., 2002), and these rates become very similar to those of the adopted country in second-generation immigrants (Hemminki and Li, 2002). It appears that the first two decades of life are important in setting the pattern for cancer development later in life (Hemminki and Li, 2002). Differences in polymorphisms of genes may confer susceptibility or resistance towards carcinogenesis and the study of immigrant groups, and their offspring, is one mean of investigating the genotyping of cancer risk. Studies of immigrants are also very useful for the planning and evaluation of cancer control programs for these peoples in their host countries.

Canada has welcomed over 13 million immigrants since 1901 and each new wave of immigrants has added to the nation's ethnic and cultural composition. One in six adults living in Canada today was born elsewhere and came to Canada as an immigrant or a refugee (Beiser. ???). A majority of recent immigrants (73%) live in Canada's three census metropolitan areas: Toronto, Montreal and Vancouver (http://atlas.gc.ca) The Iranian population began to immigrate to western countries, including Canada, after 1979. Nearly 3 million Iranian immigrants and refugees now reside in different countries around the world from different provinces of Iran with different ethnic origins (Emami et al., 2004).

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The Iranian population provides excellent opportunity to conduct migrant studies in Canada for several reasons. Firstly, as of 2001 over 19,000 Iranian immigrants reside in British Columbia (BC), Canada (http://www12.statcan.ca/english/census01). Most Iranian immigrants to Canada come from urban middle or upper social class with different levels of education, representing a mixture of different ethnic groups from different provinces in Iran. Secondly, well established population-based cancer registries are located in different regions of Iran which can provide reliable data on cancer incidence. Thirdly, recent improvements in living standards in Iran have resulted in dramatic improvements in all health indicators, such as a lowering in infant mortality and in morbidity and mortality from infectious disease. Electricity, healthy drinking water, natural gas for heating and cooking, telephone communication and transport are now available for 98% of urban and 90% of rural areas (Statistical Center of Iran, 1997; http://earthtrends.wri.org). 85 % of adult males and 71% of adult females are literate and life expectancy has increased to 69 years in males and 71 years in females. With these changes, there is now a shift towards a greater prevalence of chronic disease in Iran. Cancer now accounts for 14 % of all deaths and is the third leading cause of death, after cardiovascular disease and accidents (Mehrabi et al., 2003).

A recent study of Iranian immigrants to Sweden reported differences in the distribution of cancer types between the Iranian immigrants and the native Swedish population, with approximately 50% less cancer in Iranian immigrants. Incidence rates were lower in Iranian immigrants for most sites except for stomach in females and prostate in males (Hemminki et al., 2002). This work needs to be replicated in other countries, especially where there are established population-based cancer registries. This paper describes and compares the cancer incidence among four population groups served by cancer registries: residents of the Ardabil and Kerman provinces in the Islamic Republic of Iran, Iranian immigrants to BC, Canada, and the general population of BC.

Materials and Methods

Study Groups: Geography and Demography

Four population groups were examined: residents from two regions of Iran (Ardabil and Kerman provinces) and residents from BC, Canada, including Iranian immigrants and the general population. We selected these two regions in Iran for two reasons: both have established population-based cancer registries with data available for comparison and both have very low immigration rates. BC was selected because of its established provincial cancer registry and sizable Iranian immigrant population. The age distribution of these four population groups is shown in Table 1, based upon most recent available census data.

Ardabil province, in the northwest by the Caspian Sea, is a mountainous land with an area of 17,953 square kilometres. The total population of Ardabil province is 1.1 million persons, with 46% living in urban areas. The population is homogenous, the majority (95%) being of Azari ethnicity (http://en.wikipedia.org/wiki/Kerman_Province). Kerman province, in the southeast of Iran, is the third largest province with an area of 181,714 square kilometres. The total population of Kerman province is about 2 million persons, with 53% living in urban areas (http://en.wikipedia.org/wiki/Kerman_Province). The population is homogenous. BC is the westernmost province in Canada, with and area of 944,735 square kilometres. The total population is over 4 million , ethnically diverse and concentrated around the two cities of Vancouver and Victoria. The Iranian immigrant population totals approximately 19,000 persons, residing mainly in Vancouver (http://www12.statcan.ca/english/census01).

Table1. Size and Percentage Breakdown of the Population

		Ardabil 1996	Kerman 1996	BC Iranians 2001	BC General Pop. 2001
Males	<15 years	252,434 (42.8)	419,402 (41.6)	970 (9.6)	372,079 (18.4)
	15-24 years	122,061 (20.7)	213,009 (21.1)	2,045 (20.2)	282,365 (13.9)
	25-34 years	78,388 (13.3)	129,947 (12.9)	1,640 (16.2)	286,460 (14.2)
	35-44 years	49,242 (8.3)	102,598 (10.2)	2,175 (21.5)	342,465 (16.9)
	45-54 years	31,277 (5.3)	51,754 (5.1)	1,845 (18.2)	306,018 (15.1)
	55-64 years	28,518 (4.8)	44,953 (4.5)	880 (8.7)	193,873 (9.6)
	65-74 years	23,100 (3.9)	34,477 (3.4)	355 (3.5)	142,200 (7.0)
	>75 years	4,878 (0.8)	12,061 (1.2)	215 (2.1)	98,684 (4.9)
	Total*	589,946 (100)	1,008,201 (100)	10,125 (100)	2,024,144 (100)
Females	<15 years	240,403 (41.6)	417,252 (42.3)	1,015 (11.1)	352,521 (17.2)
	15-24 years	128,017 (22.1)	205,250 (20.8)	1,730 (19.0)	267,028 (13.0)
	25-34 years	76,735 (13.3)	132,187 (13.4)	1,490 (16.4)	286,054 (13.9)
	35-44 years	52,889 (9.1)	99,571 (10.1)	2,165 (23.8)	347,406 (16.9)
	45-54 years	33,007 (5.7)	52,522 (5.3)	1,575 (17.3)	308,183 (15.0)
	55-64 years	24,675 (4.3)	39,831 (4.0)	640 (7.0)	194,360 (9.5)
	65-74 years	17,890 (3.1)	28,693 (2.9)	315 (3.5)	148,149 (7.2)
	>75 years	4,424 (0.8)	10,813 (1.1)	195 (2.1)	150,602 (7.3)
	Total*	578,040 (100)	986,119 (100)	9,105 (100)	2,054,303 (100)

* Total may not equal sum of age-specific values because of people with unknown age

Data collection

Population-based cancer registries were used to describe the cancer incidence patterns in the different population groups. In Iran, these cancer registries are located in several regions, including the Ardabil and Kerman provinces. The Ardabil cancer registry was the first population-based cancer registry in the country, first established in 1965 and then again in 1996 after a period of inactivity (Sadjadi et al., 2003; 2005). The Kerman cancer registry was recently established in 1996. Both registries are run by provincial medical sciences universities and supervised by the Digestive Disease Research Center at the Tehran University of Medical Sciences. Information on newly diagnosed cancer cases is collected from a number of sources, with all data being sent to the provincial registry office and then to the central registry unit where data is checked by a team of epidemiologists. Canada has been a world leader in the establishment of population-based cancer registries, with cancer registration mandated by law. The BC cancer registry began in 1969 and has continued to cover the population of the province (Band et al., 1992).

Cancer incidence profiles were then determined, considering all newly diagnosed invasive cancer cases in the Ardabil cancer registry from 1996 to 1999, in the Kerman cancer registry from 1996 to 2000, and in the BC cancer registry from 1988 to 2003. Documents in all three registries were checked for any duplication. Information was collected on the age at diagnosis, gender and cancer site (ICD-O).

Since ethnicity is not recorded in the BC cancer registry, Iranian immigrants were identified within the BC registry using an Iranian name list. This listing of common Iranian surnames and given names was created using two methods: a manual search of names in the 2003 North Vancouver telephone directory (where the majority of Iranian immigrants reside in BC) by one of investigators (PY), and a computer generation of names for clients to the Screening Mammography Program of BC (SMPBC) who indicated 'Iran' as their place of birth. The SMPBC is a provincial breast cancer screening program which has served the women of BC since 1988. Over 220,000 women are screened annually; representing about 48% of all women aged 50-74 in BC (Screening Mammography Program of BC: 2003/2004 Annual Report). A total of 3,236 Iranian surnames and 1,354 given names were identified from these two sources. A more detailed description of the name listing is given elsewhere (Yavari et al., 2005). This name list was then linked with the BC cancer registry in order to obtain the cancer profiles for Iranians residing in BC.

Population statistics were then used to calculate age-adjusted incidence rates and these were obtained from published census data. Census data were collected for the following years: 1996 for Ardabil and Kerman provinces; 1991, 1996, and 2001 for BC Iranian immigrants; and 2001 for the BC general population. Target group profiles, using place of birth as 'Iran', were conducted by Statistics Canada in order to obtain the required information for Iranian immigrants to BC.

Analysis

Descriptive statistics were used to describe the cancer incidence rates for each of the four population groups. Frequencies were firstly determined for each cancer site, and then age standardized rates (ASR) were calculated using the mid-year census data for the time periods, where possible. These rates were age adjusted using the World Standard Population (Parkin et al., 1997). These descriptive statistics were computed for each of the four population groups by gender. Comparisons were then made between the four population groups.

Results

Cancer Incidence

The annual numbers of incident invasive cancer cases in each of the four population groups are shown in Table 2. For the most part, the time periods were similar and overlapped for the four population groups. Only the time period for BC Iranian immigrants extended over a longer interval because of the smaller population size.

The ASRs for the three most common cancer sites in the four population groups are shown in Table 3 for males and Table 4 for females. The top three cancer sites accounted for 54%, 29%, 46% and 55% of the ASR for all cancers in males from Ardabil, Kerman, BC Iranian immigrant and BC general populations, and 52%, 36%, 46% and 55% in females, respectively. In BC Iranian male immigrants, the ASR for all cancers was low and very similar to that found for Kerman; however the ranking of common cancer sites was more like that for the BC general population, with prostate being the leading site. The rankings of specific sites for males were similar in Ardabil and Kerman provinces, except that esophagus ranked high in Ardabil. In BC Iranian

Table 2. Annual Number of Incident Cancer Cases* by Gender and Age Group (Excluding Non-Melanoma Skin)

		Ardabil 1996-1999	Kerman 1996-2000	BC Iranians 1988-2003	BC Gen 2001
Males	<15	14.5	54.4	0.3	49
	15-24	14.5	31.6	0.3	68
	25-34	21.5	31.6	0.2	172
	35-44	28.3	57.0	0.9	351
	45-54	56.3	72.4	0.8	932
	55-64	132.5	121.4	1.8	2039
	65-74	176.5	164.6	2.3	3187
	>75	58.3	38.6	1.2	3144
	Total	401.8	571.6	8.2	9942
Females	<15	11.5	29.6	0.1	41
	15-24	15.0	31.2	0.3	61
	25-34	16.8	42.6	0.7	202
	35-44	37.5	71.8	3.1	642
	45-54	58.8	95.0	4.4	1384
	55-64	76.8	89.6	2.6	1572
	65-74	74.3	91.4	2.1	1943
	>75	26.3	35.6	1.4	2892
	Total	317.0	486.8	14.6	8737

* Cases with invasive disease and known age only

Table 3. Age Standardized Rates* (/100,000) for the Three most Common Cancers, and for All Sites, for Males

Ranking	Ardabil	Kerman	BC Iranians	BC General Pop.
First	Stomach 49.1 (4.6)	Stomach 10.2 (1.8)	Prostate 25.2 (15.0)	Prostate 96.1 (2.7)
Second	Esophagus 15.4 (2.6)	Lung 7.1 (1.5)	Colorectum 10.1 (9.6)	Lung 41.6 (1.8)
Third	Lung 7.9 (1.9)	Bladder 6.7 (1.5)	Bladder 3.3 (5.5)	Colorectum 38.1 (1.7)
Total cancers	133.6 (3.4)	83.9 (2.4)	83.4 (28.3)	322.3 (4.9)

* Using the World Standard Population; standard errors are shown in parentheses.

Table 4. Age Standardized Rates* (/100,000) for the Three most Common Cancers, and for All Sites, for Females

Ranking	Ardabil	Kerman	BC Iranians	BC General Pop.
First	Stomach 25.4 (3.1)	Breast 16.9 (2.4)	Breast 68.5 (30.3)	Breast 81.4 (2.5)
Second	Esophagus 14.4 (2.3)	Colorectum 5.9 (1.4)	Colorectum 11.6 (11.5)	Lung 29.8 (1.6)
Third	Breast 7.6 (1.8)	Stomach 5.1 (1.3)	Stomach 6.5 (8.7)	Colorectum 26.6 (1.6)
Total cancers	90.7 (3.1)	78.4 (2.2)	140.7 (42.0)	257.6 (4.6)

* Using the World Standard Population; standard errors are shown in parentheses.

female immigrants, the ASRs for all cancers, and for specific cancer sites, were intermediate between those found for Iran and for the BC general population. The ranking of specific sites was the same as for Kerman, with breast being the leading site. Differences were found in rankings of specific sites for females between the Ardabil and Kerman provinces, again esophagus ranked high in Ardabil.

Discussion

Changes in incidence and mortality of specific cancer sites are now being observed in Iran, including a doubling in breast cancer incidence in the last 30 years (Yavari et al., 2003; 2005) and dramatic increase in gastric cancer (Sajdadi et al., 2005). Cancers of the stomach, esophagus and colorecturm are now the three leading types of cancer found in males, and cancers of the breast, esophagus and stomach in females in some areas of Iran (Sadjadi et al., 2005). There are clear regional differences in these cancer patterns within Iran. We found regional differences in ASRs and cancer site rankings between two Iranian provinces. In men, while stomach cancer is the most common cancer in both provinces, esophageal cancer ranks second in Ardabil and it is not among the first three most common cancers in Kermanrather beingreplaced by bladder cancer In women, stomach and esophageal cancers are most common in Ardabil, followed by breast cancer. However, in Kerman, breast cancer was most common, followed by colorectal and stomach cancers.

Our results do not support the findings of Balzi et al (1995) and Flood and Schatzkin (2000) who reported greater increase in cancer risk for male immigrants as compared to female immigrants. We found an increase in cancer incidence among Iranian female immigrants as compared to women in Iran, approaching that of the BC general population. This increase is not found in Iranian male immigrants, who had lower cancer incidence as compared to males in Iran and in the BC general population. This difference may be explained by the fact that Iranian male immigrants often return to their home country in order to support the immigrated family, resulting in a lower registration of vital events, such as cancer detection. Also, we used female clients in the SMPBC to generate the name list for linkage and this may have resulted in missing the identification of some Iranian male immigrants in the BC cancer registry.

The common cancer sites for Iranian female immigrants were similar to those for the BC general population, the main difference being that lung cancer was infrequent in Iranian female immigrants.

Common cancer sites for Iranian male immigrants were more similar to the BC general population than in Iran., Stomach cancer was replaced by prostate cancer as most common. The increasing incidence of colorectal cancer in Iranian immigrants was another interesting finding of this study. Esophageal cancer was not included among the most common cancer in Iranian male immigrants.

These differences in patterns of cancer, both over time and in different geographic areas, are likely to be largely due to differences in lifestyle, environmental factors and screening practices. Brennfleck reported a direct correlation between national levels of economic development and rates of colon, lung, breast and prostate cancer (Brennfleck 2001). The observed differences in female breast cancer and male prostate cancer between Iran and BC immigrants can be attributed in part to changes in lifestyle and better cancer detection in BC immigrants. The same explanation can be made for higher rate of colorectal cancer in Iranian immigrants. Likewise, changes in environmental and lifestyle factors, especially food habits, may explain the decrease in stomach and esophageal cancers in immigrants of both sexes.

Cultural and lifestyle changes among immigrants depend on many factors. Acculturation tends to increase with number of generations and years since immigration. It has been reported that exposures in the country of origin may be most important in the development of cancer among first-generation immigrants, who tend to be less acculturated

(Hemminki et al., 2002; Hemminki and Li, 2002).

To study the role of immigration in changing cancer rate, there is the need to understand the history and immigration patterns of the population group of interest in order to guide in specific methodological decisions, such as the choice of the geographic area and the definition of the target group. Also, care is needed in deciding upon the appropriate variable for defining the target group when using census data to determine the denominator for the calculation of rates, be it place of birth, language spoken in the home, or some other variable. Since there is a need to obtain data from various cancer registries, it is important that this data be collected in a compatible format for comparisons, such as using ICDO codes for cancer sites and similar age groupings.

An important limitation of our study was that information was not available in the BC cancer registry on ethnicity or immigration status. We used the telephone directory and SMPBC as sources of Iranian names and this may be a source of misclassification error of cancer cases and affect comparing rates for BC Iranian immigrants to those in Iran. Also, because acculturation is difficult to measure, the number of generations since immigration is often used to measure cultural and lifestyle changes. Studies involving linkage with immigrant databases which contain information on years since immigration and the number of generations since immigration would be very helpful in future investigations.

This study is a preliminary study of immigration and cancer risk in Iran. There is need to extend the time period of study and to examine specific lifestyle and environmental factors, especially for the common cancers, stomach and breast.

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