Cancer mortality among immigrant populations in Ontario, 1969 through 1973

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Ontario is home to a sizeable, recently established immigrant population whose cancer mortality has until now remained unexamined. The province's six largest immigrant groups (British, Italian, German, Dutch, Polish and Soviet) were investigated to compare their cancer mortality experience with that prevailing in Ontario and in their countries of birth for the period 1969 through 1973. Standardized mortality ratios (SMRs) were computed from data from Statistics Canada and the World Health Organization (for 1971) for five sites of cancer.

The rates of death from stomach cancer were significantly higher for the immigrant groups (except the Germans) than for the Canadian-born (SMRs 158.6 to 256.1) and were significantly lower for the immigrants (except the Dutch) than for the populations of their countries of birth (SMRs 26.5 to 72.9). The rates of death from colorectal cancer and cancer of the breast tended to be lower among the immigrants. Most male immigrants had high rates of death from lung cancer relative to the Canadian-born, whereas their female counterparts had relatively low rates. For most of the immigrant groups the rates of death from prostate cancer closely resembled those prevailing in the country of birth. Displacement of cancer mortality experience towards that in Ontario was most evident for Polish immigrants. It may have been too soon to see trends among the more recent immigrants (Italian, German and Dutch), who, for the most part, had not yet reached the age of highest cancer risk.

Ontario should provide a valuable resource for further studies of lifestyle and environmental determinants of cancer.

L'Ontario abrite une importante population immigrante d'installation récente dont le taux de mortalité dû au cancer n'a pas jusqu'à maintenant été étudié. Les six plus gros groupes d'immigrants dans la province (Britanniques, Italiens, Allemands, Hollandais, Polonais et Soviétiques) ont fait l'objet d'une étude comparant leurs taux de mortalité dûs au cancer à ceux qui prévalaient en Ontario et dans leurs pays d'origine pendant la période de 1969 à 1973. Les taux de mortalité standardisés (TMS) ont été calculés à partir de données de Statistique Canada et de l'Organisation mondiale de la santé (pour 1971) pour cinq sièges de cancer.

Le taux de mortalité dû au cancer de l'estomac était significativement plus élevé pour les groupes d'immigrants (sauf pour les Allemands) que pour les Canadiens d'origine (TMS de 158,6 à 256,1); il était cependant significativement plus faible pour les immigrants (sauf les Hollandais) que pour les populations correspondantes vivant dans leurs pays d'origine (TMS de 26,5 à 72,9). Les taux de mortalité dûs au cancer du côlon et du rectum et au cancer du sein avaient tendance à être plus bas parmi les immigrants. La plupart des immigrants de sexe masculin avaient, par rapport aux Canadiens d'origine, de plus hauts taux de mortalité dûs au cancer du poumon, alors que les femmes avaient des taux relativement faibles. Chez la plupart des groupes d'immigrants le taux de mortalité dû au cancer de la prostate se rapprochait sensiblement de celui qui prévalait dans leur pays d'origine. Un déplacement des taux de mortalité dûs au cancer vers les chiffres prévalant en Ontario était particulièrement évident pour les immigrants d'origine polonaise. Il était peut-être trop tôt pour constater des tendances parmi les immigrants arrivés plus récemment (Italiens, Allemands et Hollandais), qui, pour la plupart, n'avaient pas encore l'âge où l'on enregistre le risque le plus élevé de cancer.

L'Ontario devrait être une source importante de renseignements pour étudier les facteurs relatifs au style de vie et à l'environnement qui interviennent dans le cancer.

Studies of immigrant populations are useful in helping to relate shifts in disease risk to changes in lifestyle and environment. The province of Ontario, with its substantial foreign-born population, provides a very suitable population base for such a study: 22% of its residents in 1971 had been born outside of Canada. While there has been no previous analysis of Ontario's cancer mortality by place of birth, Cook and colleagues[1] reported differences in cancer incidence rates among groups of various national origins, defined according to the surname recorded on hospital discharge reports.

In 1971 the British-born (517 495 people) made up the largest group of Ontario's foreign-born; they were followed by the Italian-born (254 150). Other major immigrant groups included those born in Germany (102 945), the Netherlands (78 905), Poland (78 370)

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and the Soviet Union (70 615). We conducted the following study to determine the cancer mortality experience of these six immigrant groups relative to that of the Ontario Canadian-born population and that of the population in each country of birth. For each of the cancer sites considered, at least one of the countries of birth has mortality rates substantially different from those in Canada[2] (Fig. 1); therefore, one should be able to detect a shift in mortality in the immigrant populations.

Subjects and methods

Immigrant groups

Over three quarters of the above-mentioned immigrants arrived in Canada after World War II. Their patterns of arrival in Canada and their age distributions in 1971 varied according to country of birth (Figs. 2 and 3). The majority of the immigrants from Italy, Germany and the Netherlands had arrived more recently and were younger than the immigrants from Britain, Poland and the Soviet Union.

Historically, the British were given preference over other groups seeking admission to Canada. This preference was based on their having the same language as the majority of native-born Canadians and on their having a similar culture. On entering Canada they tended to be of a higher social class and to have a greater income than immigrants from other countries.[3]

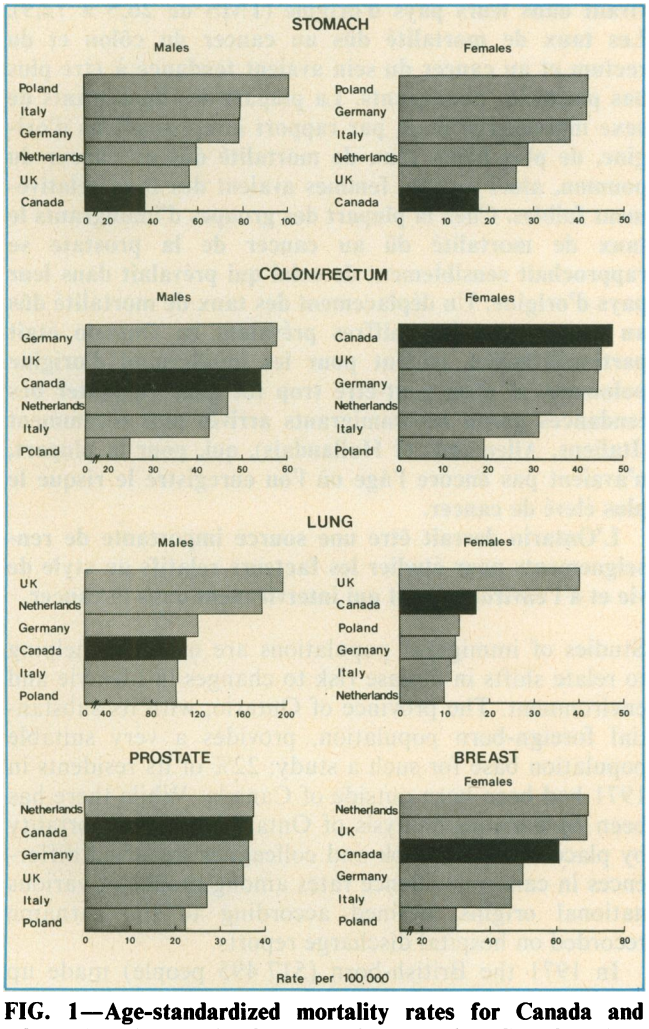

FIG. 1—Age-standardized mortality rates for Canada and other selected countries for selected cancer sites. Based on data for 1971[2] standardized to truncated world population for age groups from 35 years.

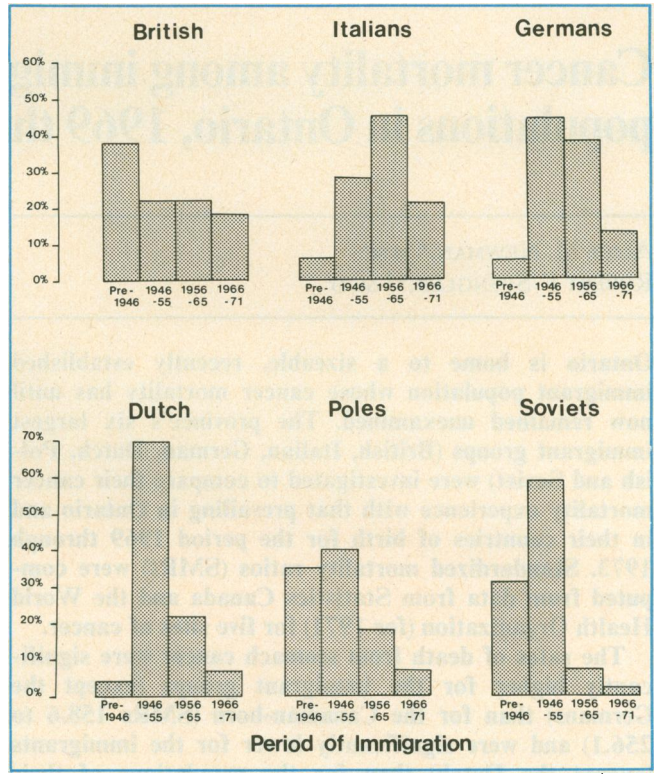

FIG. 2—Distribution of year of arrival in Canada for selected immigrant groups in Ontario in 1971.

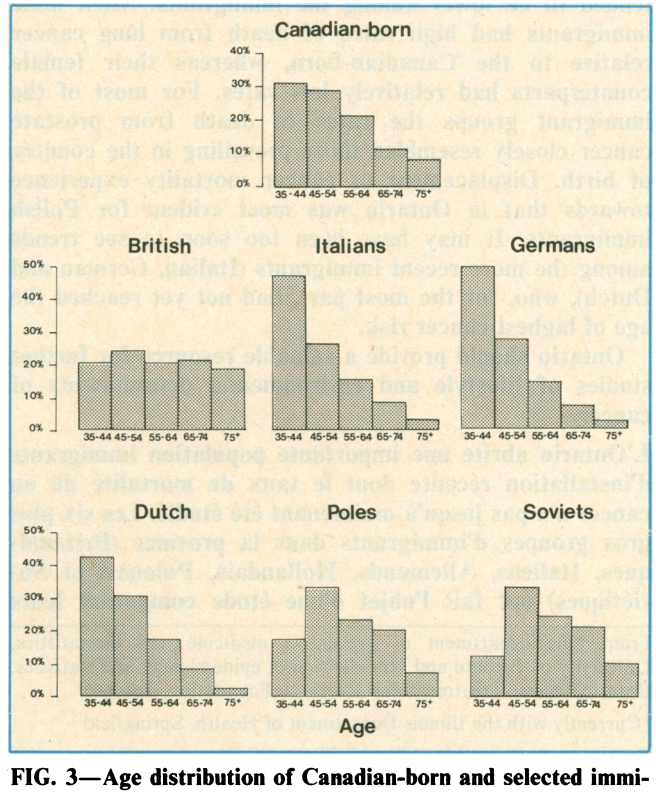

FIG. 3—Age distribution of Canadian-born and selected immigrant groups in Ontario in 1971.

Large-scale immigration of Italians to Canada began around 1950 and peaked in 1959.[4] Nearly 80% of the Italians who immigrated to North America came from southern Italy, Sicily and Sardinia — rural, poorer parts of the country, where the people were less likely to be educated.[5] A high proportion of Italian immigrants settled in Toronto, making it the fifth largest Italian-speaking city in the world (*The Globe and Mail*, Toronto, Dec. 13, 1980, page 3).

The earliest German communities in Ontario were established by the Mennonites who migrated from Pennsylvania after the American Revolution in the late 18th century. German immigrants continued to arrive throughout the 19th century and became Canada's third largest ethnic group (*The Globe and Mail*, Toronto, Jan. 3, 1981, page 3). The two world wars, the Depression and Canadian government policies were major factors in decreasing the flow of Germans to Canada between 1914 and 1950.[6] In the early 1950s substantial immigration from Germany resumed after the ban on admitting immigrants from former enemy nations was lifted.[4] These more recent German immigrants tended to assimilate quite rapidly into Canadian society (*The Globe and Mail*, Toronto, Jan. 3, 1981, page 6).

Emigration from the Netherlands during the years following World War II was precipitated by conditions existing in that country, which included a rapidly increasing population, a deteriorating economy and rising dissatisfaction among farm workers. Canada readily accepted Dutch immigrants because of their much needed agricultural skills. Over one half of the Dutch immigrants to Canada settled in southern Ontario.[7]

The end of World War II also brought to Ontario many emigrants from Eastern European countries, such as Poland and the Soviet Union. Prior to World War I there had been a substantial influx to Canada of Eastern Europeans, mainly landless peasants who were motivated to migrate for economic reasons. In contrast, the majority of the postwar immigrants were educated urban professionals who came to Canada to escape politically dangerous situations in their homelands. Ukrainian and Polish communities in Ontario are very conscious of preserving their culture, since there is no new wave of immigrants arriving to replace them (*The Globe and Mail*, Toronto, Jan. 17, 1981, page 3).

Materials and methods

Mortality and population data for Ontario residents were obtained from Statistics Canada. Each mortality record included year of death, age at death, sex and site of cancer, coded according to the "International Classification of Diseases, Adapted for Use in the United States".[8] Country of birth was routinely coded in Ontario only for the years 1950 through 1952 and 1964 through 1973. The period 1969 through 1973 was chosen for this study in order to coincide with the coding of country of birth and to allow the census year 1971 to be the midpoint. The country-of-birth information for this period was about 99% complete. Age- and site-specific rates of death from cancer for the countries of birth were available from the "World Health Statistics Annual, 1971".[2] Data for the Soviet Union were not available, and the rates for Germany were based on statistics from the Federal Republic of Germany only. Cancer incidence, which is a preferable measure of risk, was not analysed, since country-of-birth information was not available for cases in Ontario.

The cancer sites analysed were stomach, colon/rectum, lung, prostate and breast. These relatively common sites were expected to provide sufficient numbers of deaths among the immigrant groups to allow statistically meaningful comparisons. If fewer than 10 deaths were observed in an immigrant group for a particular site, no further analysis was done. The analysis was limited to immigrants who were 35 years of age or older, since for the selected cancer sites the number of deaths occurring in immigrants younger than 35 was negligible.

Age-, sex- and site-specific mortality rates were computed for each of the six immigrant populations for the age groups 35 to 44, 45 to 54, 55 to 64, 65 to 74, and 75 years and over. Since individual rates were often based on small numbers of deaths and subject to substantial chance variation, standardized mortality ratios (SMRs) were calculated to summarize the general pattern of rates for immigrants relative to those for the Ontario Canadian-born population and those for the population of each country of birth. Computation of the SMRs involved dividing the number of deaths observed in an immigrant group by the number of deaths that would have been expected on the basis of the age-, sex- and site-specific mortality rates of a standard population. Two sets of SMRs were calculated, one with the mortality rates for the Ontario Canadian-born population during the period 1969–73 as a standard, the other with the 1971 country-of-birth rates (multiplied by five to conform to the 5-year period of observation) as a standard. Ninety-five percent confidence intervals for the SMRs were computed with use of the tables prepared by Bailar and Ederer,[9] which assume a Poisson distribution for the number of cancer deaths.

In order for the death records and census data to be compatible, the United Kingdom, Germany and the Soviet Union had to be considered as indivisible units (i.e., the data for immigrants from Scotland could not be analysed separately). This report uses the term Soviet immigrants, although the majority are believed to be Ukrainians.

Results

The calculated SMRs for each cancer site and each sex are presented in Tables I and II for the immigrant groups relative to the Ontario Canadian-born population (SMR_c) and to the population of each country of birth (SMR_b). An SMR greater than 100 indicates an excess of deaths relative to the reference population, whereas a value less than 100 indicates a deficit. Significant departures among immigrant groups from the mortality experience prevailing in Ontario or in the country of origin are summarized in Table III; an SMR was considered significant when its 95% confidence interval did not include 100.0.

Table I—Standardized mortality ratios (SMRs), with 95% confidence limits, for specific cancer sites for groups of male immigrants aged 35 years and over in Ontario compared with Canadian-born residents of Ontario and the population of each country

Country of birth* and variables†	Cancer site			
	Stomach	Colon/rectum	Lung	Prostate
United Kingdom				
Deaths	480	697	1703	495
SMR_c	158.6 (144.7, 173.5)	100.3 (93.0, 108.0)	161.2 (153.6, 169.1)	95.4 (87.2, 164.1)
SMR_b	71.4 (65.1, 78.1)	100.1 (92.9, 107.8)	77.7 (74.0, 81.5)	110.0 (100.5, 120.1)
Italy				
Deaths	108	94	190	49
SMR_c	189.1 (155.0, 228.4)	66.6 (53.9, 81.5)	79.2 (68.3, 91.3)	65.6 (48.4, 86.8)
SMR_b	59.1 (48.4, 71.4)	94.0 (76.0, 115.1)	75.1 (64.8, 86.6)	86.0 (63.5, 113.8)
Germany				
Deaths	24	33	85	17
SMR_c	131.9 (84.6, 196.3)	76.1 (52.3, 107.0)	104.4 (83.5, 129.2)	79.9 (46.5, 127.8)
SMR_b	26.5 (17.0, 39.4)	78.2 (53.7, 110.0)	92.4 (73.9, 114.4)	77.4 (45.0, 123.8)
Netherlands				
Deaths	41	30	100	20
SMR_c	227.8 (159.1, 309.3)	68.9 (46.6, 98.4)	120.2 (97.7, 146.2)	97.6 (59.5, 150.9)
SMR_b	96.2 (67.2, 130.6)	89.7 (60.6, 128.1)	70.0 (56.9, 85.2)	95.2 (58.0, 147.1)
Poland				
Deaths	104	122	283	49
SMR_c	183.4 (150.7, 222.3)	91.6 (76.2, 111.3)	122.1 (108.2, 137.2)	59.8 (44.2, 79.1)
SMR_b	44.3 (36.4, 53.7)	215.1 (178.8, 261.4)	117.6 (104.3, 132.1)	93.9 (69.4, 124.2)
Soviet Union				
Deaths	100	116	265	55
SMR_c	160.8 (130.7, 195.6)	80.4 (66.4, 96.5)	112.7 (99.5, 127.2)	86.6 (65.1, 113.6)

*For compatibility of data, the United Kingdom, Germany and the Soviet Union were considered as one country each.
†Deaths = number of deaths observed among the immigrants in the years 1969 through 1973. SMR_c = the SMR calculated by comparing 1969–73 data for the immigrants and the Canadian-born, the ratio for the latter being taken as 100.0. SMR_b = the SMR calculated by comparing 1969–73 data for the immigrants with 1971 data for the population of the country of birth, the ratio for the latter being taken as 100.0. Data for the population of the Soviet Union for 1971 were not available.

Table II—SMRs, with 95% confidence limits, for specific cancer sites for groups of female immigrants aged 35 years and over in Ontario compared as in Table I

Country of birth and variables*	Cancer site			
	Stomach	Colon/rectum	Lung	Breast
United Kingdom				
Deaths	351	804	327	850
SMR_c	182.1 (163.5, 202.1)	94.7 (88.3, 101.5)	145.7 (130.2, 162.4)	109.6 (102.3, 117.2)
SMR_b	72.9 (65.4, 80.9)	102.8 (95.8, 110.2)	73.0 (65.2, 81.4)	92.4 (86.2, 98.8)
Italy				
Deaths	48	51	20	100
SMR_c	198.3 (146.0, 263.1)	46.0 (34.2, 60.5)	46.5 (28.4, 71.9)	65.1 (52.9, 79.2)
SMR_b	57.6 (42.4, 76.4)	72.6 (53.9, 95.5)	75.3 (45.9, 116.4)	87.9 (71.5, 106.9)
Germany				
Deaths	17	26	17	42
SMR_c	170.0 (98.8, 272.0)	56.5 (36.9, 82.8)	90.9 (52.8, 145.4)	61.5 (44.3, 83.2)
SMR_b	33.8 (19.6, 54.1)	63.9 (41.8, 93.7)	146.0 (84.9, 233.6)	78.7 (56.7, 106.5)
Netherlands				
Deaths	17	21	5†	45
SMR_c	246.4 (143.3, 394.2)	62.7 (38.7, 95.9)		82.9 (60.5, 111.0)
SMR_b	100.3 (58.3, 160.5)	81.2 (50.1, 124.2)		76.6 (55.9, 102.5)
Poland				
Deaths	42	78	21	73
SMR_c	191.8 (138.2, 259.5)	77.9 (61.6, 97.3)	62.1 (38.3, 95.0)	65.5 (51.4, 82.4)
SMR_b	49.3 (35.5, 66.7)	206.3 (163.2, 257.6)	81.2 (50.1, 124.2)	139.0 (109.1, 174.8)
Soviet Union				
Deaths	63	63	32	70
SMR_c	256.1 (196.8, 327.9)	56.4 (43.4, 72.2)	91.2 (62.3, 128.8)	52.9 (41.3, 66.9)

*See the footnotes in Table I.
†Since fewer than 10 deaths were observed, SMRs were not computed.

Stomach cancer

The rates of death from stomach cancer were consistently higher for the foreign-born of both sexes than for the Canadian-born, the SMR_cs ranging from 131.9 for male German immigrants to 256.1 for female Soviet immigrants. The excess was significant for all the immigrant groups except the Germans. In all the immigrant groups except the Dutch the mortality rates were substantially lower than the levels prevailing in the country of birth, the SMR_bs ranging from 26.5 to 72.9.

Colorectal cancer

Significant deficits in the rates of death from colorectal cancer relative to those for the Canadian-born were noted for all the groups of female immigrants except the British, the SMR_cs ranging from 46.0 to 77.9. The rates for the male immigrants other than British were also below those for the Canadian-born but less so. The Polish immigrants showed a twofold excess of deaths from colorectal cancer compared with the population of Poland, yet the mortality rates for the male Polish immigrants approximated those for the Canadian-born men (SMR_c = 91.6). Among the Italian, German and female Dutch immigrants the mortality rates were lower than those for both the Canadian-born and the population of the country of birth.

Lung cancer

For the male German and Dutch immigrants and for the British immigrants of both sexes the rates of death from lung cancer exceeded those for the Canadian-born but were lower than those in the country of birth. The rates for the female German immigrants were also between those for the two reference populations, but the gradient of risk was in the opposite direction. Among the German, Polish and Soviet immigrants the rates exceeded those of the Canadian-born for the men but fell below those of the Canadian-born for the women. The rates for the male Polish immigrants significantly exceeded those for both the Canadian-born and the population of Poland, the SMRs being 122.1 and 117.6 respectively. The female Polish immigrants and the Italian immigrants of both sexes had lower rates than both the Canadian-born and the countries of birth.

Table III—Immigrant groups with significant SMRs*

	Immigrant groups			
	Compared with Ontario residents born in Canada		Compared with population of country of birth	
Cancer site	Excess of deaths	Deficit of deaths	Excess of deaths	Deficit of deaths
Stomach	British Italians Dutch Poles Soviets			British Italians Germans Poles
Colon/ rectum		Italians Germans (W) Dutch Poles (W) Soviets	Poles	Italians (W) Germans (W)
Lung	British Poles (M)	Italians Poles (W)	Poles (M)	British Italians (M) Dutch (M)
Prostate		Italians Poles	British	
Breast	British	Italians Germans Poles Soviets	Poles	British

*An SMR was considered significant, showing an excess or a deficit of deaths, when the 95% confidence interval did not include 100.0. W = women only. M = men only.

Prostate cancer

Except for the British immigrants, who showed a significant excess of deaths from prostate cancer compared with the population of the United Kingdom (SMR_b = 110.0), the immigrant groups tended to have somewhat lower mortality rates than both the Canadian-born and the populations of the country of birth. The Italian and Polish immigrants displayed a significant deficit in deaths from prostate cancer compared with the Canadian-born, the SMR_cs being 65.6 and 59.8 respectively. For most of the immigrant groups the SMRs indicated that the mortality rates for cancer at this site closely resembled those prevailing in the country of birth.

Breast cancer

Only data for women are presented for this cancer site, as the numbers of deaths from breast cancer in men were too few to analyse. The Italian, German, Polish and Soviet female immigrants all showed a significant deficit in the breast cancer mortality rate compared with the Canadian-born women, the SMR_cs ranging from 52.9 to 65.5. Of these four groups of immigrants, only the Polish women demonstrated a significant excess of deaths from breast cancer compared with women in their country of birth (SMR_b = 139.0). The British immigrants were characterized by a significant excess of deaths from breast cancer relative to the Canadian-born but a lower-than-expected mortality rate when compared with women in the United Kingdom.

Discussion

Before trying to interpret the results of any study of immigrant populations, one must keep in mind some inherent limitations. Immigrants may not be representative of the population in their country of birth since they were subject to many selection factors related to economic, political and health status. These factors may have influenced both their decision to emigrate and their acceptance by immigration authorities. In addition, most immigrant groups settle in urban areas. This makes comparison with the composite urban and rural population of the country of birth imprecise when one is considering cancer sites that show an urban–rural gradient.[10] Furthermore, the use of national rates may be misleading if substantial regional differences exist,

such as between urban and rural areas, Scotland and England, and northern and southern Italy. Another drawback is the possible lack of uniformity between countries regarding standards of diagnosis and death certification.

Classification of immigrant groups based solely on the place of birth could also limit the interpretation of results. First, the country of birth may not always indicate the place of longest permanent residence or the ethnic group. Second, by virtue of being born in Canada, the descendants of immigrants were included in one of the reference populations in our study when, in fact, they may have been quite different from the remainder of the Canadian-born in factors relating to cancer mortality. This may have masked any differences between the foreign- and native-born.

Stomach cancer

In Ontario the immigrant groups we studied (except the Dutch) had significantly lower rates of death from stomach cancer than the populations in their countries of birth. However, in two studies of European immigrants to the United States the rates of death from stomach cancer were found to have remained at the high level of the countries of birth.[11,12] This difference may be related to the period of immigration. Since the information for the United States was based on data from 1950, it was likely that the majority of the immigrants had arrived during the wave of immigration between the turn of the century and World War I. In contrast, the largest proportion of immigrants in Ontario arrived after World War II. Staszewski and associates,[12] who looked at predominantly postwar immigrants in Australia, and Lillienfeld and coworkers,[13] who examined cancer mortality among the foreign-born in the United States for the period 1959–61, also reported a marked decline in the rates of death from stomach cancer among immigrants relative to the populations of their countries of birth.

The connection between period of immigration and changes in the rate of death from stomach cancer may be explained in part by the difference in the degree of assimilation for pre- and postwar immigrants. Among Polish immigrants, for example, the prewar group tended to remain more isolated within their communities, whereas the postwar immigrants integrated more readily into Canadian society.[14] This readiness to assimilate could well have brought about changes in dietary habits that the earlier immigrants did not experience.

Another possibility is that the postwar immigrants were, in general, healthier and thus better able to meet immigration health requirements than those remaining in their country of birth. This selection bias may have been less important for the earlier immigrants because immigration to North America was virtually unregulated until after World War I.[4,15]

Colorectal cancer

Cancers of the colon and rectum were considered together for this analysis despite the evidence for different etiologic factors.[16,17] Support for combining the two sites comes from the fact that a high proportion of deaths from colon or rectal cancer were coded to a nonspecific region of the large intestine. Furthermore, the number of deaths from rectal cancer were too few to be analysed separately.

The rates of death from colorectal cancer were greater among Polish immigrants in Ontario than in Poland and approached the higher rates of the Canadian-born in Ontario. Since similar shifts in mortality had been observed in Polish immigrants to the United States[11] and Australia,[12] it is unlikely that our observations were due to special selection criteria affecting immigration to Ontario. This pattern of adopting the host country's mortality rates within one's lifetime is strong evidence that environmental factors are of primary etiologic importance in colorectal cancer.

Among the more recent immigrants (the Italians, the Germans and the Dutch) the rates of death from colorectal cancer remained significantly below those for the Canadian-born and in some instances also appeared to be lower than the rates in the country of birth. It is possible that those who emigrated were healthier than those who stayed behind, or that the former had lived in relatively low-risk regions of their country. Colorectal cancer has been positively correlated with beef intake,[18] and low rates may exist in areas where poor inhabitants consume less meat; this explanation may apply to the Italian immigrants, most of whom originated from such a region of Italy.[5]

Lung cancer

The excess of deaths from lung cancer among the male immigrants relative to the Canadian-born may have been the result of some environmental exposure before emigration. However, removal from the harmful environment before the lung damage was too great may have protected against progression of the disease. This would be reflected by the significantly lower rates of death from lung cancer among the immigrants from high-risk populations (men and women in the United Kingdom and men in the Netherlands). An occupational factor may explain why the excess mortality in some immigrant groups was limited to the men.

The pattern displayed by the male Polish immigrants, whose rates of death from lung cancer exceeded the rates in both home and host countries, was also noted by Staszewski and Haenszel.[11] Since the prevailing rates in Poland did not differ much from those in Ontario for the Canadian-born, one explanation for the excess might be that the immigrants largely came from or settled in urban industrial areas. Although this does not explain the relatively low rates noted among the female Polish immigrants, the number of deaths from lung cancer in this group was generally too small to generate stable rates.

Prostate cancer

The upward shift in the risk for prostate cancer observed among the Polish immigrants in the United States[11] was not seen among the Poles who settled in Ontario. The occurrence of this disease late in life

implies an extremely long induction period;[10] hence, it may be too early to notice any effect among the postwar Polish immigrants in Ontario. Haenszel[10] suggested that endogenous factors were likely to be more important than environmental factors in explaining variations in risk for prostate cancer.

Breast cancer

The shift in the rates of death from breast cancer for female Polish immigrants towards the higher rates for the Canadian-born was similar to the experience of the Poles who immigrated to the United States and to Australia.[11,12] In contrast, German and Italian immigrants experienced no such increase. For these two groups in Ontario the rates were significantly below those for the Canadian-born and somewhat below the rates in Germany and Italy, as with the findings for colorectal cancer. It may have been too early to detect a change in cancer mortality among these immigrants, who, on the average, were younger and had arrived in Ontario more recently than the Poles. Since hormonal and genetic factors are also associated with breast cancer, it is possible that these could account for some of the differences seen. It is unlikely, however, that differences in fertility could entirely account for the lower rates of death from breast cancer in the immigrant groups, since Kalbach[19] noted that the child:woman ratio was lower among foreign-born women even though they were more concentrated in the young-adult age group than were the native-born women. The positive correlation of breast cancer mortality and fat intake observed in Japan[20] suggests that the upward shift in mortality rates among Polish immigrants may be related to dietary changes.

Conclusion

This study was somewhat limited by the small number of cancer deaths among the groups that immigrated more recently. In 1980 Ontario resumed coding place of birth from death certification information. With this new body of data one should be able to repeat these analyses in a few years, when a greater proportion of the immigrant population will have reached the age groups of highest cancer risk. At that time it would also be useful to examine the rates of death from cancer among non-European immigrants in Ontario, who began arriving in large numbers around the mid-1960s.

Immigrant populations are clearly of value in studying the relation between cancer and lifestyle and environmental characteristics. Canada, with its sizeable and recently established immigrant populations, should prove to be a valuable resource for such studies. Immigrant populations should be especially useful in studying diet since, unlike a stationary population, which would tend to share eating habits, immigrants are likely to vary in the time and degree of transition to the dietary customs of their new country of residence. Further research should include case–control studies to investigate the role of specific dietary and environmental factors, occupation, age at immigration, and duration of residence in Ontario and in the country of birth.

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