

## SHORT COMMUNICATION

## Risk of Kaposi Sarcoma Among Immigrants to Sweden

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Kaposi sarcoma (KS) is a locally aggressive endothelial tumour that is classified into 4 clinico-epidemiological forms: classic KS affecting lower limbs in elderly Mediterranean or East European men; endemic KS occurring in extremities among Equatorial African middle-aged men and children; iatrogenic KS involving lower limbs in immunosuppressive patients; and AIDS-associated (epidemic) KS observed among homo- and bisexual HIV-1-infected young men (1, 2). The world-wide epidemiology of KS has changed by spreading of HIV infection (1). For example, KS represented 7% of all cancers in Sub-Saharan African men in the 1960s, whereas in the 1980s the rate increased to 50%. Furthermore, the age distribution of KS has changed from elderly (in classic form) to the late thirties (in epidemic form). KS is a rare tumour in Nordic countries; the incidence is 0.1–0.2/100,000 according to the Cancer Incidence in Five Continents (CI5) report (3). According to this source, the rate in many Asian countries is <0.5/100,000, whereas African American men have a rate of 6.2/100,000. The highest rate is in men from Zimbabwe (52.2/100,000) (3).

Human herpesvirus 8 (HHV-8) is the recognised cause of all forms of KS (2). There is discrepancy between the prevalence of HHV-8 and KS incidence in some populations suggesting underreporting of KS or the existence of some unknown protective factors for KS (1). Migrant studies provide data on international differences in cancer rates (4). Furthermore, studies on immigrants may provide supplementary and confirmatory data on the incidence of cancer in countries without local cancer registries. A few available studies on immigrants have focused only on classic KS (5, 6). In the present study, we report mean age at diagnosis and KS rates by site in first-generation immigrants to Sweden.

## MATERIAL AND METHODS

We used the Swedish Family-Cancer Database which includes population-based data from the national censuses, the Swedish Cancer Registry, and death notifications (7, 8). Native Swedes were defined as those who, along with their parents, were born in Sweden. First-generation immigrants were defined as those born outside Sweden without identified parents in the Database. We classified the immigrants according to birth country, number of cases, and geographical setting into 8 groups. Whenever feasible, large immigrant populations, for example immigrants from Finland were kept as separate groups: Finland, Norway and Denmark, Eastern Europe, other Europe, Africa, Middle East, Latin America, and other immigrants.

A code for histological subtype (WHO/HS/CANC/24.1 Histology Code, “PAD”) has been used since 1958, which defines the histology in subgroups for KS (PAD=566) (8). The International Classification of Disease, revision 7 (ICD-7) has also been used in the Database since 1958. We used this classification to define the site of KS as lower limbs (codes 1917 and 1973), upper limbs (1916 and 1972), and face and genitalia (1419, 143, 144, 1450, 1457, 1459, 1911–1913, 1923, and 1790). Oral and mucosal involvement is typically more common in AIDS-associated KS. These were included in the group of “face and genitalia”. Because of the lack of data on HIV (AIDS) in our Database, we used this clinico-epidemiological classification to suggest possible AIDS association.

The start of follow-up was defined as birth year, the date of immigration, or January 1, 1958, whichever came latest. The end of follow-up was defined as the date of cancer diagnosis, death or emigration, or the closing date of our study, December 31, 2008, whichever came earliest. Standardised incidence ratios (SIRs) were calculated as the ratio of observed to expected number of cases. The expected numbers were calculated from age, sex, period, and region for the native Swedes as the reference population. A *p*-value of <0.05 was considered statistically significant. To reduce chance findings, associations were also reported according to 0.01 significance level (9). Confidence intervals (95% and 99% CI) were calculated assuming a Poisson distribution. SAS software ver.9.2 (SAS software version 9.2; SAS Institute Inc., Cary, NC, USA) was used for the data analysis.

## RESULTS AND DISCUSSION

The Swedish Family-Cancer Database included 552 cases of KS in Swedes and 119 cases in immigrants (Table I). Immigrants were diagnosed at an earlier age (47.5 years) than Swedes (65.6); Eastern Europeans showed a high diagnostic age (60.1). All immigrant groups had increased risks of KS compared to Swedes. Africans (SIR=9.64) and Latin Americans (5.69) had the highest significant risk. Eastern Europeans (4.32), Africans (15.5), and Middle Easterners (3.73) had an increased KS risk in lower limbs, while the increased risk in upper limbs were observed only among Africans (18.46). Finns (4.44) and Middle Easterners (5.31) had an increased KS risk in face and genitalia; the SIR of 7.94 for Africans was of borderline significance (2 cases).

It is known that all KS forms can involve lower limbs, whereas upper limbs are observed more specifically in endemic form. Children and middle-aged men in Africa are risk groups for the endemic form (2). Our data showed a high KS risk in upper limbs among Africans diagnosed at an mean age of 32 years. Furthermore, we observed a mean age of 50–54 years at diagnosis among Finns and

Table I. Mean age at diagnosis and standardised incidence ratios (SIRs<sup>a</sup>) for Kaposi sarcoma among immigrants to Sweden by site

Birth region	All sites			Lower limbs			Upper limbs			Face and genitalia		
	n	Mean age (SD)	SIR (95% CI)	n	Mean age (SD)	SIR (95% CI)	n	Mean age (SD)	SIR (95% CI)	n	Mean age (SD)	SIR (95% CI)
Sweden	552	65.6 (19.1)	1.00 (Ref)	276	73.7 (15.0)	1.00 (Ref)	41	62.4 (19.7)	1.00 (Ref)	45	55.9 (18.2)	1.00 (Ref)
Finland	25	47.0 (15.3)	<b>2.31 (1.50–3.42)</b>	9	50.2 (17.1)	2.17 (0.99–4.12)	2	34.7 (6.1)	2.16 (0.26–7.82)	5	50.2 (13.5)	<b>4.44 (1.44–10.37)</b>
Norway and Denmark	13	48.2 (15.3)	<b>1.97 (1.05–3.38)</b>	4	52.5 (17.0)	1.34 (0.36–3.42)	1	49.9 (0.0)	1.82 (0.05–10.16)	1	47.7 (0.0)	1.60 (0.04–8.94)
Eastern Europe <sup>b</sup>	20	60.1 (15.0)	<b>3.29 (2.01–5.08)</b>	9	60.3 (14.7)	<b>4.32 (1.98–8.21)</b>	1	54.7 (0.0)	1.96 (0.05–10.95)	1	40.2 (0.0)	1.46 (0.04–8.13)
Other Europe <sup>c</sup>	8	46.1 (9.4)	1.79 (0.77–3.52)	2	51.3 (15.1)	1.12 (0.14–4.06)	1	40.6 (0.0)	2.67 (0.07–14.89)	2	56.0 (5.1)	4.28 (0.52–15.46)
Africa	18	38.2 (9.6)	<b>9.64 (5.71–15.24)</b>	6	44.8 (12.7)	<b>15.5 (5.69–33.73)</b>	3	31.8 (5.3)	<b>18.46 (3.81–53.96)</b>	2	34.8 (5.7)	7.94 (0.96–28.67)
Middle East <sup>d</sup>	17	52.9 (13.7)	<b>2.37 (1.38–3.79)</b>	6	54.7 (10.6)	<b>3.73 (1.37–8.12)</b>	3	55.3 (20.9)	4.69 (0.97–13.70)	5	54.1 (15.2)	<b>5.31 (1.72–12.40)</b>
Latin America <sup>e</sup>	10	34.7 (6.9)	<b>5.69 (2.73–10.46)</b>	1	29.4 (0.0)	2.41 (0.06–13.44)	0			0		
Other immigrants <sup>f</sup>	8	46.1 (13.5)	2.29 (0.99–4.51)	2	31.4 (4.7)	1.68 (0.20–6.09)	1	57.5 (0.0)	3.42 (0.09–19.04)	1	57.8 (0.0)	2.63 (0.07–14.64)
All immigrants	119	47.5 (15.0)	<b>2.29 (1.90–2.74)</b>	39	51.2 (15.4)	<b>2.20 (1.56–3.00)</b>	12	44.9 (14.2)	<b>2.73 (1.41–4.76)</b>	17	48.3 (12.3)	<b>2.90 (1.69–4.64)</b>

<sup>a</sup>The ratios were adjusted for age (5-year bands), sex, period (10-year bands from 1958 to 2008), and region (Large cities, Northern, Southern, and other Swedish regions). Bold type: 95% confidence interval (CI) does not include 1.00 and underlined ratios were significant at 99% CI. <sup>b</sup>Russia, Former Yugoslavia, Poland, Romania, Latvia, Lithuania, Slovakia, Czechoslovakia, and Czech Republic. <sup>c</sup>France, Greece, UK, and Germany. <sup>d</sup>Turkey, Lebanon, Iran, Iraq, and Syria. <sup>e</sup>Caribbean Islands, Chile, Colombia, Brazil, Peru, Uruguay, Argentina, Bolivia, and Paraguay. <sup>f</sup>China and Thailand.

Middle Easterners, respectively for KS in face and genitalia. Whether high-risk populations from those countries immigrated to Sweden is an unproven possibility. Furthermore, involvement of face and genitalia are more common in the epidemic form, which is usually observed in the thirties (1). Hence, further studies are warranted to investigate the differences on age at diagnosis of KS by site among different populations.

Our novel findings originated from a nationwide data having information on the birth country, the date of immigration, and the site of KS for all subjects. We found that immigrants had a higher risk than Swedes. An increased KS risk in lower limbs among Eastern Europeans, Africans, and Middle Easterners, in upper limbs among Africans, and in face and genitalia among Finns and Middle Easterners was observed. The overall observed difference in KS risk is in line with that cited in the CI5 report (3). We found that Finns, Norwegians, and Danes had a higher KS risk than Swedes, while a study on KS in the Nordic countries before the AIDS epidemic (1980) reported a higher KS rate among Swedes than among other Nordics (10). Whether the risk difference in the Nordic countries were due to the geographical distribution of HHV-8 remains unanswered because most immigrants entered Sweden decades ago (11). Recent serological analyses from Finland showed that the HHV-8 infection is rare in Finland and it may be lower than the infection rate in Sweden (12). A contributing factor to the high KS rates in Nordic immigrants may be their mobile life-style which includes frequent visits to the country of origin. Our study most likely shows that the incidence in KS in immigrants may differ from the rate in the country of origin.

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