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Transition in cancer patterns among Turks residing in Germany

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Abstract

Cancer mortality among the 2.1 million Turks residing in Germany is assumed to change from a pattern typical for a developing country towards one of an industrialised country. To test this hypothesis, we compared age-standardised cancer mortality rates among Turkish residents and (West) Germans using death registration data. In addition, we assessed proportional cancer incidence ratios among Turkish cases ($n=144$) in a German population-based cancer registry. All-cancer mortality 1992–1997 (per 100 000) was 34.8 ($n=4192$) among Turkish men (Germans: 72.3) and 21.5 ($n=1862$) among Turkish women (Germans: 52.4). Over time, gastric and lung cancer mortality increased among Turkish men, as did breast cancer mortality among Turkish women. The proportional cancer incidence (PCIR) for stomach cancer among men was 2.9 (95% Confidence Interval (CI): 1.7–4.8), and that for breast cancer among women was 0.7 (95% CI: 0.4–1.1). Turks had an increased proportional incidence ratio for non-Hodgkin's lymphoma. Our findings partly support a transition of cancer patterns among Turks in Germany.

Keywords: Cancer; Mortality; Transients and migrants; Health transition; Turkey; Germany

1. Introduction

People from Turkey first came to Germany in large numbers as work migrants in the 1960s and since 1973 have been followed by family members. A second, and even third, generation was born or brought up in Germany. The majority have kept Turkish nationality and today, 2.1 million Turkish nationals are residing in (West) Germany, constituting the largest group among the 7 million non-German residents in the country [1].

Turkish residents experience a lower all-cause [2] and cardiovascular mortality [3], relative to Germans. Very little is known about their cancer incidence and mortality. Since the proportion of elderly Turks living in Germany is increasing, cancer is bound to become a prominent health problem. Data on cancer mortality and morbidity among Turkish residents would be useful to inform resource allocation in the health services and the planning of focused preventive activities.

Apart from genetic determinants, cancer rates among migrants are shaped by factors operative in the country of origin and in the host country. Persons migrating from less developed to industrialised countries initially have lower rates of cancers related to a diet rich in animal products (e.g. bowel cancers). Over time, with changing life-style, these rates tend to converge towards the higher rates of the host population. The rates of cancers associated with carcinogenic food contaminants or infectious agents (e.g. stomach cancer) are usually higher, but tend to converge towards the lower rates of the host population [4]. The transition in cancer risk may not be immediately reflected in the mortality rates as some recent migrants may return to their country of origin when diagnosed with cancer [5].

Cancer rates in Germany are typical of an industrialised country, with a high incidence of, and mortality

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from, breast and colon cancer among women, and lung, prostate and colon cancer among men. Reliable data on cancer mortality in Turkey are lacking. World Health Organization (WHO) estimates derived from survival information indicate that lung, laryngeal and stomach cancer are the leading causes of cancer death among men; among women, these are breast, colorectal and stomach cancer [6]. A recent report from the population-based cancer registry in Izmir provides the first useful incidence data from Turkey [7]. The most common cancers sites were lung, bladder and larynx among men; and breast among women. The incidence rates of tobacco-related cancers among men were high, while the incidence of breast cancer among women was low.

In this paper, we examine the presumed transition in cancer patterns among Turks residing in Germany. We present cause-specific cancer mortality rates and new estimates of cancer incidence for this group and interpret them relative to the respective data for the German population and for Turks in Turkey.

2. Patients and methods

2.1. Mortality

We obtained numbers of cancer deaths among Germans and Turkish nationals residing in (former) West Germany in the period 1980–1997 from official death registration records. We calculated corresponding mid-year population figures as the mean of the population on 31 December of the actual and preceding year, based on annual population projections (see Ref. [2] for details). Turkish population and death figures in the age groups below 25 years are compiled in non-matching age intervals, so we performed an interpolation. We excluded deaths at ages above 64 years from the analysis, as no matching age-stratified population data by nationality are available (in 1997, only 1.7% of Turks in Germany were above 64 years). We calculated sex-specific, age-standardised mortality rates for all cancer sites with more than 100 reported deaths among Turks during the 18-year study period. Rates were directly standardised using the World standard population [8]. To examine mortality trends over time and to limit the effect of annual variability due to low numbers of deaths, we divided the study period into three time periods of equal length (1980–1985, 1986–1991, 1992–1997).

2.2. Incidence

Our study base comprised all incident cancer cases reported to the Saarland cancer registry in 1970–1998. This registry is the only population-based cancer registry in (West) Germany with fairly complete reporting (above 95% for most cancers [9]). The Saarland has a population of 1 million, including 16 000 Turkish nationals in 1995 (Statistical Office of the Saarland 1997). Information on the nationality of cases is incomplete, so we used a name-based algorithm to retrieve Turkish cases [10]. Briefly, a name database containing 15 000 Turkish surnames and first names was linked to the 'identified' part of the cancer registry. With this highly specific algorithm, approximately 85% of Turkish cases in the registry could be identified, independent of cancer site and outcome [11].

As a matching population denominator is not available, we could not compute incidence rates. Instead, we calculated the proportional cancer incidence ratio (PCIR) which relates the proportion of cases due to a specific cancer observed in a study group to the expected proportion of cases in a comparison population. Expected proportions of specific cases were calculated from a stratified random sample ($n = 3865$ cases) of the total registry. We obtained age-adjusted PCIRs and 95% confidence intervals (CIs) [12] by adjusting the distribution of cases to the mean age structure of the Turkish population in the Saarland (provided by the local Statistical Office). All analyses were performed using Stata 6.0 [13].

3. Results

3.1. Mortality

Between 1980 and 1997, 4192 cancer deaths were reported among Turkish men (mean annual population: 927 000) and 1862 among Turkish women (mean annual population: 726 000) aged below 65 years and resident in West Germany. An additional 384 deaths among men (8.4% of male cancer deaths) and 179 deaths among women (8.8%) in the age group above 64 years were excluded from the analysis. Table 1 shows the number of deaths by sex and cancer site among Turks in Germany. Lung cancer is the most common cause of a cancer death among men, and breast cancer among women. Leukaemias are the second most common cancers for both sexes, with myeloid leukaemia as the predominant histological subtype.

Tables 2 and 3 show age-standardised mortality rates per 100 000 population for Turks in Germany and Germans. Mortality rates among Turks are lower than among Germans for the majority of cancer sites; the rate ratio ranges from 1:5 (colorectal cancer: men) to 1:1 (leukaemia, non-Hodgkin's lymphoma (NHL)). The total cancer mortality among Turks in Germany shows a slightly increasing trend over the three time periods (1980–1985, 1986–1991, 1992–1997), contrasting with the declining mortality among Germans. Turkish men seemed not to participate in the substantial decline in mortality from stomach cancer observed among the

Table 1
Number of cancer deaths by sex and selected diagnoses among Turks aged 0–64 years residing in West Germany, 1980–1997

Cancer diagnosis (ICD)[a]	Men n	Women n
Oral cancer (140–149)	101	19
Stomach (151)	333	143
Colo-rectal (153–154)	173	107
Liver (155)	119	18
Pancreas (157)	168	51
Larynx (161)	68	2
Lung (162)	1467	127
Breast (174)	–	372
Urogenital (188–189)	139	28
Brain (191)	258	133
Cervix uteri (180)	–	57
Ovaries, other female genital (183–184)	–	106
Non-Hodgkin's lymphoma (200/ 202)	204	87
All leukaemias (204–208)	375	224
All other	787	388
Total	4192	1862

[a] International Classification of Diseases (ICD), 9th revision.

German men (from 6.7 in 1980–1985 to 4.2 in 1992–1997). Conversely, stomach cancer rates among Turkish men increased (albeit non-significantly) from 2.0 to 3.0 over the same time periods. Similarly, lung cancer mortality increased among Turkish men, while it declined among German men.

Among the Turkish women, mortality from breast cancer increased from 2.0 to 4.4/100 000, in contrast to the stable, but markedly higher, rates among the German women. Lung cancer mortality is increasing both among German and Turkish women, but more markedly among the latter. Trends in mortality from NHL are similar among Turks and Germans of both sexes. In the 18-year study period, only 57 cervical cancer deaths were reported among Turkish women; we did not compute the mortality rates due to the small number of deaths.

3.2. Incidence

We identified a total of 163 incident cancer cases among Turkish residents of the Saarland (0.1% of all registered cases, 154 327). We excluded 17 non-malignant tumours

Table 2
Age-standardised mortality rates (ages 0–64 years) for selected cancers among Turkish men in West Germany and among German men, 1980–1997

Period	Diagnosis (ICD-9)	Turkish men		German men	
		ASMR	(95% CI)	ASMR	(95% CI)
1980–1985	All cancers (140–208)	27.4	(23.9–30.8)	76.5	(76.1–76.9)
1986–1991		33.1	(30.7–35.4)	77.8	(77.4–78.1)
1992–1997		34.8	(33.2–36.4)	72.3	(72.0–72.6)
1980–1985	Stomach (151)	2.0	(1.2–2.9)	6.7	(6.6–6.8)
1986–1991		2.4	(1.8–3.1)	5.4	(5.3–5.5)
1992–1997		3.0	(2.5–3.5)	4.2	(4.1–4.3)
1980–1985	Liver (155)	0.6	(0.3–0.9)	1.7	(1.7–1.8)
1986–1991		1.0	(0.6–1.4)	1.8	(1.8–1.9)
1992–1997		1.0	(0.7–1.3)	1.9	(1.8–1.9)
1980–1985	Colon/rectum (153/154)	1.4	(0.5–2.3)	7.6	(7.4–7.7)
1986–1991		1.2	(0.7–1.6)	7.6	(7.5–7.7)
1992–1997		1.7	(1.3–2.0)	7.5	(7.4–7.6)
1980–1985	Pancreas (157)	1.5	(0.4–2.6)	3.7	(3.6–3.8)
1986–1991		1.4	(0.9–1.9)	3.7	(3.6–3.8)
1992–1997		1.4	(1.1–1.8)	3.7	(3.6–3.8)
1980–1985	Lung (162)	8.6	(6.7–10.5)	22.3	(22.1–22.5)
1986–1991		12.2	(10.7–13.7)	22.9	(22.7–23.1)
1992–1997		13.2	(12.2–14.2)	20.7	(20.5–20.9)
1980–1985	Bladder/kidney (188/189)	1.2	(0.3–2.2)	4.8	(4.7–4.9)
1986–1991		1.4	(0.9–2.0)	4.1	(4.0–4.2)
1992–1997		1.2	(0.9–1.5)	3.5	(3.5–3.6)
1980–1985	Brain (191)	0.9	(0.6–1.2)	2.6	(2.5–2.6)
1986–1991		1.9	(1.4–2.3)	3.0	(2.9–3.1)
1992–1997		2.1	(1.7–2.4)	3.2	(3.2–3.3)
1980–1985	NHL (200/202)	1.3	(0.4–2.2)	1.5	(1.5–1.6)
1986–1991		1.6	(1.1–2.0)	2.0	(1.9–2.1)
1992–1997		1.6	(1.3–2.0)	2.0	(1.9–2.0)
1980–1985	All leukaemias (204–208)	2.3	(1.8–2.8)	3.2	(3.1–3.3)
1986–1991		2.1	(1.6–2.6)	3.0	(2.9–3.1)
1992–1997		2.5	(2.1–2.9)	2.7	(2.6–2.8)

CI, Confidence Interval; NHL, non-Hodgkin's lymphoma; ICD, International Classification of Diseases. ASMR, age-standardised mortality rates (using the world standard population, per 100 000).

and two cases with missing age details. Among Turkish men ($n=91$ cases), we observed significantly elevated PCIRs for stomach cancer (2.9; 95% CI: 1.7–4.8), pancreatic cancer (2.6; 95% CI: 1.0–6.3), other gastro-intestinal cancers (2.4; 95% CI: 1.4–4.1) and NHL (2.0; 95% CI: 1.0–3.7). The PCIR for cancers of the lung and the urogenital tract were not elevated. Among Turkish women ($n=53$ cases), PCIRs for tumours of the brain/nervous system (2.9; 95% CI: 1.7–5.1) and for NHL (3.9; 95% CI: 1.5–10.1) were significantly elevated, while breast cancer showed a decreased incidence ratios. Table 4 shows age-adjusted PCIR for selected cancer sites.

4. Discussion

We present here for the first time, comprehensive information on cancer among Turks living in Germany, supporting an analysis of mortality trends based on death registration data from (West) Germany with regional incidence data from the Saarland, using a novel approach to identify cases.

Turkish residents in Germany experience a lower, but increasing, age-adjusted all-cancer (and also lung and breast cancer) mortality, relative to Germans. This is largely consistent with the postulated transition in cancer patterns among Turks. The PCIR is elevated for stomach cancer, a tumour associated with unfavourable living conditions in childhood [14], and lower for breast cancer, a tumour possibly associated with a high dietary energy intake [15]. Comparable patterns have been observed among Turkish migrants to Australia [16]. They probably reflect a lasting effect of factors operative in the country of origin.

Lung cancer is the most frequent cause of cancer death among Turkish men in Germany, and mortality rates are increasing in both sexes. The absolute level of mortality is still lower than among Germans, as is the PCIR, indicating a lower, but growing, contribution of lung cancer to the total cancer burden. This reflects smoking trends. Smoking is highly prevalent in urban

Table 3
Age-standardised mortality rates (ages 0–64 years) for selected cancers among Turkish women in West Germany and among German women, 1980–1997

Period	Diagnosis (ICD-9)	Turkish women		German women	
		ASMR	(95% CI)	ASMR	(95% CI)
1980–1985	All cancers (140–208)	19.1	(15.5–22.6)	57.2	(56.9–57.6)
1986–1991		18.4	(16.6–20.3)	55.3	(55.0–55.7)
1992–1997		21.5	(19.9–23.0)	52.4	(52.1–52.7)
1980–1985	Stomach (151)	1.8	(0.5–3.2)	3.5	(3.4–3.6)
1986–1991		1.7	(1.0–2.4)	2.9	(2.9–3.0)
1992–1997		1.8	(1.4–2.3)	2.4	(2.3–2.4)
1980–1985	Colon/rectum (153–154)	2.3	(0.7–3.8)	6.2	(6.1–6.3)
1986–1991		0.6	(0.3–0.8)	5.7	(5.6–5.8)
1992–1997		1.3	(0.9–1.6)	5.1	(5.0–5.2)
1980–1985	Pancreas (157)	1.4	(0.1–2.6)	2.0	(1.9–2.0)
1986–1991		0.3	(0.1–0.6)	2.0	(1.9–2.0)
1992–1997		0.8	(0.5–1.1)	2.0	(1.9–2.0)
1980–1985	Lung (162)	0.4	(0.1–0.7)	3.3	(3.2–3.4)
1986–1991		1.4	(0.9–1.9)	4.2	(4.1–4.3)
1992–1997		2.1	(1.6–2.7)	5.2	(5.1–5.3)
1980–1985	Breast (174)	2.0	(1.0–3.0)	14.6	(14.4–14.8)
1986–1991		4.1	(3.2–5.0)	15.4	(15.3–15.6)
1992–1997		4.4	(3.7–5.1)	14.9	(14.8–15.1)
1980–1985	Ovaries (183)	1.7	(0.7–2.8)	4.5	(4.4–4.6)
1986–1991		0.6	(0.4–0.9)	5.5	(5.3–5.6)
1992–1997		1.4	(1.0–1.9)	3.3	(3.3–3.4)
1980–1985	Brain (191)	1.4	(0.4–2.4)	1.8	(1.7–1.9)
1986–1991		1.4	(0.9–1.9)	2.1	(2.0–2.2)
1992–1997		1.3	(1.0–1.7)	2.2	(2.2–2.3)
1980–1985	NHL (200/202)	0.4	(0.2–0.6)	0.9	(0.8–0.9)
1986–1991		0.9	(0.5–1.3)	1.1	(1.1–1.2)
1992–1997		1.1	(0.8–1.5)	1.2	(1.2–1.3)
1980–1985	All leukaemias (204–208)	1.9	(1.3–2.5)	2.4	(2.3–2.4)
1986–1991		1.8	(1.4–2.2)	2.1	(2.0–2.1)
1992–1997		1.9	(1.5–2.3)	1.9	(1.8–2.0)

ICD, International Classification of Diseases; NHL, non-Hodgkin's lymphoma; CI, Confidence Interval; ASMR, age-standardised mortality rates (using the world standard population, per 100 000).

Turkey [17] and among Turkish men in Germany [18]; however, while *per capita* tobacco consumption in Germany reached its peak in the 1970s and has been declining since the 1980s, consumption in Turkey was 30–50% lower and has reached and surpassed German levels only in the 1990s (OECD 2000). Again, these findings support the transition model.

Breast cancer, albeit comprising almost 20% of incident cancer cases in our data set, was comparatively less frequent among Turkish than among German women, as would be expected from the transition model. The respective mortality rates, as well as findings from Australia and from the cancer registry in Izmir/Turkey, underline that breast cancer is the most common malignancy among Turkish women. The raised PCIR for brain cancer among Turkish women should be re-evaluated when more data are available to rule out misclassified brain metastases.

The findings on gastric cancer are difficult to interpret. The increased PCIR for stomach cancer is consistent with the high prevalence of *Helicobacter pylori* among Turks in Germany [19], and with findings among Turkish immigrants in Australia [20]. These observations support the transition model. However, the low (but increasing) mortality rates observed among Turks in Germany contrast with this interpretation and may reflect an increasing propensity over time to stay in Germany after being diagnosed with cancer.

Several migrant studies report increased incidence of, or mortality from, hepatic cancer, particularly among men [16,21]; this has been linked to a population prevalence of Hepatitis-B carrier state above 2% [22], as is common in many countries of origin of migrants. While no published data on Hepatitis B surface antigen (HBs-antigen) prevalence among Turks in Germany is available, estimates among children and pregnant women in Turkey range from 4 to 7% [23]. Yet, we found no evidence for a high liver cancer mortality among Turks in Germany. The incidence data were uninformative due to the small numbers.

Mortality from haematopoietic cancers is of comparable magnitude among Turkish residents and Germans, indicating a proportionally larger contribution of these cancers to total cancer mortality among Turks. The raised PCIR for NHL is in accordance with the mortality data. Data from Izmir show a rather low NHL incidence in Turkey (age-standardised incidence rate for males 3.4/100 000 versus 8.6/100 000 in the Saarland 1994). In view of our consistent findings, this might reflect under-ascertainment. The high proportion of gastrointestinal lymphomas among all NHL found in Turkey and other Arab countries [24] was not observed in our data. On the whole, the findings concerning NHL are not explained by the transition model.

Our mortality study has limitations. We had to restrict the analysis to the age groups below 65 years. This should not materially influence the representativeness of our results as the number of Turkish residents aged above 64 years is still low. However, cancer mortality rates, as well as patterns, may change as the Turkish population in Germany ages. Their currently low cancer mortality remains paradoxical, given their

Table 4
Observed and expected cases and age-adjusted[a] PCIR for selected cancers among Turks in the Saarland, Germany, 1970–1998[b]

Cancer sites (ICD-9 codes)	Observed cases	Expected cases	PCIR	(95% CI)
Men				
Stomach (151)	11	3.8	**2.9**	**(1.7–4.8)**
Colon/rectum (153/154)	9	6.9	1.3	(0.7–2.4)
Other gastro-intestinal (150, 155–159)	10	4.2	**2.4**	**(1.4–4.1)**
Lung (162)	10	12.6	0.8	(0.5–1.3)
Urogenital (185–189)	11	17.3	0.6	(0.4–1.1)
Non-Hodgkin's lymphoma (200/202)	8	4.1	**2.0**	**(1.0–3.7)**
Others	32	42.2	–	–
Total	91	91.0	–	–
Women				
Stomach (151)	3	1.6	1.0	(0.6–5.6)
Other gastro-intestinal (150–159)	6	6.4	0.9	(0.5–1.8)
Breast (174)	10	15.3	0.7	
Female genital (179–183)	11	10.2	1.1	(0.4–1.1)
Brain/nervous system (191–192)	6	2.1	**2.9**	**(1.7–5.1)**
Non-Hodgkin's lymphoma (200/202)	3	0.8	**3.9**	**(1.5–10.1)**
Others	14	16.7	–	–
Total	53	53	–	–

PCIR, proportional cancer incidence ratio; CI, Confidence Interval; ICD, International Classification of Diseases.
[a] Adjusted to the mean age distribution of Turks in Saarland, Germany.
[b] Bolded numbers: PCIR significantly different from 1.

often unfavourable socio-economic situation and minority status. Inaccuracies in Turkish population figures appear to play only a minor role [25] and cannot explain the low mortality among migrants as a similar advantage has been observed in a panel study [26]. Differential errors in the causes of death assignment are unlikely, given the long and well-documented disease history that usually precedes a cancer death. A (self-)selection of healthy persons into migration (the 'healthy migrant effect') might explain an initially lower mortality. This advantage tends to wear off over time [27], which could partly explain the convergence of cancer mortality rates observed in our study. The available data sources do not allow to control for duration of stay, with age and time since the end of work migration in 1973 being the only proxy. A study of survival times among non-Swiss individuals in the cancer registry of Geneva/Switzerland yielded results consistent with a re-migration of cancer patients to their country of origin, at least when they were recent immigrants, came from neighbouring countries, and suffered from a cancer with a poor prognosis [5]. Among Turks in Germany, re-migration to Turkey of seriously ill individuals cannot be ruled out, thus artificially lowering mortality rates among Turks in Germany. However, health care is perceived as better and more affordable in Germany compared with Turkey, and severe illness may be an explicit reason to stay in Germany rather than to return to Turkey (data not shown). A study on the mortality of Latino immigrants to the US found that neither the "healthy migrant effect" nor a presumed preferential re-migration of critically ill immigrants to their country of origin could explain the observed low mortality [28]. This leaves differences in the mortality risks and patterns between the country of origin and host country as a likely explanation, in line with Thomas and Karagas' model of a transition in cancer mortality among immigrants [4].

Our incidence analysis is not affected by possible remigration. Its main limitation is the small number of cases, which is due to the small number and young age of Turkish residents in the Saarland. Accordingly, CIs are wide and information on rare cancers is restricted. Our technique of case retrieval yields an unbiased sample [11], but allows only PCIRs to be calculated which are more difficult to interpret than incidence rates. The observation that incidence and mortality data do not always match is partly explained by the varying case fatality rates for the different cancers.

In conclusion, the greater part of our findings supports the model of an ongoing transition in cancer patterns and rates among Turkish residents in Germany. We found evidence showing that cancer already is, or is increasingly becoming, an important cause of death in this group. Examples of particular public health concern are the increasing mortality rates from lung and breast cancers. The observed increasing trend in mortality from gastric cancer could mean that problems originating in the home country persist on top of 'new' cancers due to lifestyle changes; or that fewer patients return to Turkey. Either way, the cancer case load among Turks in Germany is likely to substantially increase in the near future. As a next step, more information should be collected on possible socio-cultural barriers affecting uptake and quality of clinical treatment among Turkish migrants.

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