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## Cardiovascular mortality patterns in Turkey: What is the evidence?

### Summary

*In Turkey, reliable cause-specific mortality data are not available. It is thus unknown whether ischaemic heart disease (as in western Europe and the US) or stroke (as in the Far East) is the prevailing cause of cardiovascular death. This information, however, is required for planning cardiovascular prevention programmes. We analyse available Turkish national cause-of-death data as well as patterns of cardiovascular mortality in a hospital in Ankara and among Turkish migrants in Germany. According to national statistics, the ischaemic heart disease-to-stroke ratio would be 0.3 among men aged 45–64 years, lower than that in Japan. Hospital and migrant data show this ratio to be 2–4. We demonstrate the implausibility of the national data by assessing the precision of cause-of-death assignment. We then discuss to what degree mortality experience among migrants is representative for their country of origin. Our findings suggest that the pattern of cardiovascular mortality in Turkey is closer to that in western Europe and the US than to that in the Far East. Finally, we discuss options for improving cardiovascular surveillance in Turkey.*

Cardiovascular diseases are responsible for almost half of all deaths in the industrialized nations, and are rapidly emerging as a major public health concern in middle- and low-income countries<sup>1,2</sup>. Cause-specific mortality data based on “passive” surveillance of national vital statistics can provide information on the local magnitude and pattern of the epidemic<sup>3</sup> – if they are available. We here report on the situation in Turkey where a striking information gap regarding mortality data persists<sup>4</sup>; we demonstrate

how in such a situation, other data sources can be used to establish at least the prevailing patterns of cardiovascular mortality.

The prevalence of cardiovascular risk factors like smoking and hypertension in Turkey is as high as, or even higher than, in western European countries<sup>5,6</sup>. Turkish population samples show lower mean plasma cholesterol levels than e.g. those from Scotland<sup>6</sup> but also very low mean HDL cholesterol levels<sup>5</sup> constituting an independent risk factor for ischaemic heart disease

(IHD)<sup>7</sup>. Cardiovascular morbidity data from Turkey are scarce<sup>8</sup>. One countrywide cross-sectional ECG study showed an age-adjusted prevalence of ischaemia or infarction of 3.7% in men<sup>9</sup>, lower than the 4.5–6.3% found in Scotland<sup>6</sup>. Mortality rates from cardiovascular disease are not reported in Turkey<sup>4,10</sup>. Data on the point prevalence of cardiovascular morbidity and risk factor levels alone allow no direct conclusion on the relative contribution of ischaemic heart disease (IHD) and cerebrovascular disease (CVA) to cardiovascular mortality. This information, however, would be desirable when planning and evaluating preventive interventions\*. Comparative data from other countries in the Eurasian region do not provide much help either: In most “western” industrialized countries mortality from ischaemic conditions predominates; IHD causes a larger proportion of deaths than CVA. In many East Asian countries, hypertensive disease and death due to (often haemorrhagic) CVA prevail<sup>11,12</sup>. One example is urban

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China where the CVA risk of males aged 45–64 years is five times that of US males but IHD risk is only one fifth, even in the presence of high smoking rates<sup>13</sup>.

In Turkey, where specific mortality rates are not routinely available, alternative sources of information have to be utilised to establish current patterns of the cardiovascular epidemic. We carried out a numerator analysis based on IHD and CVA deaths obtained from: (i) Turkish national statistics, (ii) a university hospital in Ankara, and (iii) German death statistics relating to Turkish migrants. We critically assess the consistency and reliability of these data sources and discuss what cardiovascular mortality patterns are presently to be expected in Turkey.

## Methods

Published cardiovascular mortality data from Turkey

Turkish national death statistics are published by the State Institute of Statistics (SIS)<sup>4,10</sup>. Numbers of death are reported from 67 (mainly urban) province and district centres in Turkey, covering 53% of the population and only between 30% and 75% of deaths<sup>4,14</sup>. Only numbers of deaths by cause (and not rates) are reported<sup>10,15</sup> because death and denominator data are incomplete. Still, the relative importance of IHD and CVA can be established in a numerator analysis. Underlying assumptions are that reporting of deaths is differential by region but not by cause (i.e. that an IHD death is equally likely to be reported as a CVA death); and that the assignment of cause of death is reasonably precise. We used the proportion of “other” cardiovascular deaths among all cardiovascular deaths and that of „ill defined“ causes among all deaths as indicators to evaluate the precision of cause-of-death assignment.

Cause of death	A-list	B-list	ICD-9	ICD-10
IHD	A 83	B 28	410–414	I20–I25
CVA	A 85	B 30	430–438	I60–I69
“other” heart disease	A 84	B 29	420–429	I30–I52
“ill-defined” causes	(A 137)	B 45	780–799	R00–R99

**Table 1.** Bridge codings used.

Hospital deaths from IHD and CVA in Ankara

Reporting of deaths is presumably complete and cause-of-death assignment precise in tertiary care hospitals with well-developed diagnostic and record keeping facilities. We analysed records of all hospital deaths in 1993–98 at Baskent University Hospital, Ankara. This tertiary centre has 218 beds and 11'100 admissions per year. As the denominator population for tertiary hospitals is difficult to define we again assessed the relative contribution of IHD and CVA deaths by sex and 10-year age groups.

Cardiovascular mortality patterns among Turkish migrants in Germany

Where no reliable cause-specific mortality data are available, the mortality of recent migrants can yield clues to patterns of mortality in the country of origin<sup>16,17</sup>. Between 1963 and 1973, 900'000 Turkish “guest workers” came to West Germany. Many settled and were followed by family members. In 1994, 2 million Turkish nationals resided in Germany; 941'000 were in the age group 25–64 years. We assessed the number of deaths from IHD and CVA in two 7-year periods (1981–1987 and 1988–1994), using national population and death register data<sup>18</sup>. We do not report proportional mortality ratios (PMR)<sup>19</sup> because a German “standard population” would not be informative regarding the situation in Turkey.

Case definition

Reported mortality figures from Turkey follow a list of 150 or of 50 selected causes of death. Baskent hospital mortality data 1993–1995 and German mortality data are coded using ICD-9; Baskent data thereafter follow ICD-10. Table 1 shows bridge codings used.

Numerator analysis: the IHD to CVA ratio

In the absence of a known denominator population, the relative contributions of IHD and CVA to cardiovascular mortality can be measured by the IHD to CVA death ratio (ICR). The ICR is a continuum that varies by geographical region and is age-dependant; it also reflects risk factor patterns in populations. The range of reported ICR varies widely, e.g. between 6 (3) among US-American men (women) and 0.6 (0.3) among Japanese men (women) in the age group 55–64 years<sup>20,21</sup>.

## Results

Review of cardiovascular mortality data from Turkey published by SIS

According to the last figures published internationally, 8.2% of deaths among men aged 45–64 years are recorded as CVA and only 2.5% as IHD (1987). Thus the ICR would be 0.3, implying that three times as many deaths among men are due to CVA than to IHD (Table 2). In 1994, the ICR seems

ICR (based on <i>n</i> ICD + CVA deaths) age group	Men			Women		
	45–54	55–64	65–74	45–54	55–64	65–74
Turks in Turkey, 1987 <sup>15</sup> ( <i>n</i> deaths)	<b>0.3</b> (832)	<b>0.3</b> (1490)	<b>0.1</b> (1465)	<b>0.1</b> (522)	<b>0.1</b> (976)	<b>0.1</b> (1242)
Turks in Turkey, 1994 <sup>10</sup> ( <i>n</i> deaths)	<b>1.8</b> (1706)	<b>1.6</b> (3119)	<b>0.9</b> (2770)	<b>0.5</b> (590)	<b>0.7</b> (1591)	<b>0.4</b> (1755)
Hospital deaths in Ankara, 1993–1998 ( <i>n</i> deaths)	<b>2.0</b> (27)	<b>3.0</b> (32)	<b>2.7</b> (55)	<b>0.7</b> (12)	<b>0.8</b> (25)	<b>1.2</b> (42)
Turks in Germany, 1981–1987 ( <i>n</i> deaths)	<b>3.9</b> (571)	<b>3.3</b> (225)	n/a (–)	<b>0.8</b> (89)	<b>1.0</b> (47)	n/a (–)
Turks in Germany, 1988–1994 ( <i>n</i> deaths)	<b>6.2</b> (762)	<b>3.8</b> (727)	n/a (–)	<b>0.8</b> (172)	<b>1.2</b> (153)	n/a (–)

**Table 2.** IHD to CVA death ratio (ICR) in Turkish national statistics, in Baskent Hospital, Ankara, and among Turks in West Germany.

to have quintupled as compared to 1987, both for men and women. This change is based on an increase in the number of reported IHD deaths among men (all ages) from 3832 in 1992 to 6004 in 1993 (+ 57%); the total number of reported deaths among men increased by only 1.5% in this time period. By 1996, the number of IHD deaths among men had again decreased to 5033. Table 3 shows that consistently, almost 40% of deaths among men aged 45–64 years are recorded as “other heart disease”; the proportion of all deaths due to „ill-defined“ causes is high but decreases over time.

#### Hospital deaths

A total of 191 deaths from IHD and CVA occurred at Baskent Hospital between 1993 and 1998. Table 2 shows that there were 2 to 3 times more deaths from IHD than from CVA among men; among women, the ICR increases with age from 0.7 to 1.2. The proportion of deaths due to “other” heart disease is low, but even in this tertiary hospital 13% of deaths are due to “ill defined” causes (Table 3).

Cardiovascular mortality patterns among Turkish migrants in West Germany

Between 1981 and 1994, 2746 IHD and CVA deaths occurred among Turkish nationals aged 45–64 years and resident in West Germany, 79% in males. Age-adjusted mortality rates among Turkish men (per 100,000) declined from 64 to 53 (–16%) for IHD and from 17 to 12 (–30%) for CVA (German men: –42% and –32%). Table 2 shows that IHD causes 3–4 times more deaths than CVA among

Turkish men resident in West Germany. Among Turkish women, the ICR is around 1.

#### Discussion

The ICR of 0.3 among Turkish men derived from the last internationally published Turkish mortality figures<sup>15</sup> would imply that cardiovascular mortality patterns in Turkey follow those of the Far East rather than those of “Western” countries. This ICR, however, would be lower than that among Japanese men, which is highly

	Proportion of <i>all</i> deaths recorded as “ill-defined” conditions	Proportion of deaths among men aged 45–64 recorded as “other” heart disease
Turks in Turkey, 1987 <sup>15</sup>	12.7%	39.0%
Turks in Turkey, 1994 <sup>10</sup>	8.7%	38.0%
Hospital deaths in Ankara, 1993–1998	13.0%	10.9%
German national death statistics, 1994	2.5%	6.1%

**Table 3.** Quality indicators for the sources of mortality data used.

implausible. A more likely alternative explanation is a low precision of diagnosis in cause-of-death assignment; it is frequently based on relatives' reports and only rarely on a post mortem<sup>4</sup>. The high proportions of "other" cardiovascular deaths (in many cases presumably cardiac arrest, which would be the mode of dying rather than the direct cause of death) and "ill-defined conditions" visible in Table 3 are indicative of this problem. The ICR of 0.3 can therefore be considered an artefact. The sudden peak in the number of reported IHD deaths (and thus in ICR) in 1993 coincided with the death of Turkish president Özal, presumably from myocardial infarction<sup>22</sup>; this event may have temporarily increased attention towards, and thereby reporting of, IHD as cause of death. The analysis of the hospital mortality data yields ICRs within a plausible range but is based on small numbers; furthermore, hospital deaths may not be representative of all deaths due to differential geographical and socio-economical accessibility as well as self-selection of patients. It should be noted, though, that the hospital ICRs are approaching (albeit not quite reaching) those among Turkish migrants in Germany. Can valid conclusions regarding cardiovascular mortality patterns in the country of origin be drawn from the mortality experience of migrants who have spent years (in some cases 2–3 decades) in a host country? Cardiovascular mortality rates among Turkish migrants in Germany will not be representative for Turkey due to selection effects at the time of migration: migrants are on average healthier than the population from which they originate. This "healthy migrant effect" is usually weak but can last for 20 years and more<sup>23</sup>. Yet, migration is unlikely to bias mortality patterns. It usually occurs at young age and thus would not be differential in terms of IHD vs.

CVA risk. Correspondingly, remigration of ill individuals to Turkey would only bias mortality patterns if it were preferential for CVA (as compared to IHD) victims. The cardiovascular risk of migrants is known to be modifiable by environmental and behavioural factors in the host country. Various studies have shown that individuals of similar ethnic background experience different cardiovascular disease rates when living in different geographic and cultural settings<sup>24</sup>. The best known example is the increasing gradient in cardiovascular mortality found among men of Japanese ancestry living in Japan, Hawaii and California<sup>25</sup>. Differences in the coronary heart disease risk factors and morbidity among these groups were investigated in the Ni-Hon-San study. A striking increase in incidence of myocardial infarction was observed in Japanese men who had migrated to the United States<sup>26</sup>. However, migration from Japan to the US had stopped 40 years prior to the onset of the study<sup>17,24</sup>. Furthermore, in the subgroup of Japanese Americans who adhered to a traditional Japanese lifestyle, no increase in IHD incidence was observed<sup>27</sup>. Vietnamese immigrants to the UK continued to show a high CVA mortality and a stable, low IHD mortality 5–10 years after entering the country, thus reflecting patterns from their home country<sup>28</sup>. An analysis of death registry data from California (not controlling for length of residence) reveals differences in mortality among ethnic groups that, to some degree, reflect the situation in their countries of origin. An example is the comparatively high proportion of CVA deaths among ethnic Chinese men<sup>29</sup>; their age-adjusted ICR is 2.5 as opposed to an ICR of 5 among white Californian men<sup>29</sup> and of 0.7 among men in China<sup>30</sup>. In summary, migrants bring their patterns of cardiovascular disease with them, and it may take decades

for these patterns to change<sup>17</sup>. In-between, mortality patterns are likely to be intermediate between the patterns of the host country and the country of origin.

In Germany, male Turkish migrants had an ICR well above 1.0 in 1981–1987 already, and they experienced no secular increase in IHD mortality which would have to be expected if their pattern changed from a high contribution of CVA to the IHD-driven pattern prevalent in Germany. Furthermore, many Turkish migrants of the first generation reportedly adhere to a traditional, "Turkish" lifestyle in Germany. The ICRs among migrants are largely consistent with the ICRs derived from Turkish hospital data. Thus, these ICRs are likely to reflect the prevailing cardiovascular mortality patterns in Turkey.

Our findings suggest that cardiovascular mortality patterns in Turkey are close to those in many "western" industrialized countries: death from IHD contributes substantially to cardiovascular mortality; among men, the contribution of IHD is almost certainly larger than the one of CVA. Health policy in Turkey should therefore continue to promote the prevention, diagnosis and treatment of ischaemic cardiovascular disease<sup>31</sup>.

In order to monitor cardiovascular mortality trends in Turkey, the completeness of death reporting and the precision of cause-of-death assignment would have to be improved<sup>4</sup>. This should become an important public health objective. Possible but expensive alternatives to passive surveillance would be (i) an active monitoring system for cardiovascular risk factors and events<sup>3</sup>, or (ii) intensive demographic surveillance in a defined geographical area, using verbal autopsy to establish cause of death<sup>2</sup>. However, activities to prevent the further spread of the cardiovascular disease epidemic can be initiated even before such monitoring systems are established<sup>2,32</sup>.

**Zusammenfassung****Welche kardiovaskuläre Todesursache herrscht in der Türkei vor? Eine kritische Bewertung**

In der Türkei gibt es keine verlässliche Todesursachenstatistik. Somit ist auch unbekannt, welches die vorherrschende kardiovaskuläre Todesursache ist: ischaemische Herzerkrankung wie in Westeuropa und den USA oder Schlaganfall wie im fernen Osten. Diese Information ist jedoch zur Planung von kardiovaskulären Präventionsprogrammen erforderlich. Wir analysieren daher die vorhandenen nationalen türkischen Mortalitätsdaten sowie das Muster kardiovaskulärer Mortalität in einem Krankenhaus in Ankara und unter türkischen Migranten in Deutschland. Laut nationaler Statistik läge die Verhältniszahl von Herzinfarkt- zu Schlaganfall-Todesfällen bei Männern im Alter von 45–64 Jahre bei 0,3 und damit niedriger als in Japan. Krankenhaus- und Migrantendaten zeigen hingegen eine Verhältniszahl von 2–4. Wir zeigen, dass die nationalen Zahlen aufgrund mangelnder Präzision bei der Todesursachen-Zuschreibung implausibel sind und diskutieren die Übertragbarkeit von Migrantendaten auf das Heimatland. Unsere Ergebnisse legen nahe, dass das Muster der kardiovaskulären Sterblichkeit in der Türkei eher dem in Westeuropa und den USA als dem im fernen Osten ähnelt. Abschliessend diskutieren wir Ansätze für eine verbesserte kardiovaskuläre Surveillance in der Türkei.

**Résumé****Quelle cause de mortalité cardiovasculaire prévaut en Turquie? Une évaluation critique**

En Turquie, il n'y a pas de statistiques fiables sur la mortalité par cause spécifique. Ainsi, nous ne connaissons pas non plus la cause principale de mortalité cardiovasculaire: affection cardiaque ischémique (comme en Europe de l'ouest ou aux Etats-Unis) ou attaque d'apoplexie (comme en Extrême-Orient). Toutefois, cette information est nécessaire pour planifier des programmes de prévention cardiovasculaire. C'est pour cette raison que nous analysons les statistiques nationales de mortalité disponibles en Turquie ainsi que la structure de la mortalité cardiovasculaire dans un hôpital d'Ankara et parmi les immigrants turcs en Allemagne. D'après les statistiques nationales, le ratio entre décès suite à une affection cardiaque ischémique et suite à une attaque d'apoplexie chez les hommes de 45 à 64 ans serait de 0,3 et donc plus bas qu'au Japon. Les données obtenues à travers l'hôpital et les immigrants présentent néanmoins un ratio de 2–4. Nous montrons qu'en raison d'une précision insuffisante lors de l'assignation de la cause de mort, les données nationales manquent de plausibilité. Ensuite, nous débattons de la question de savoir si les données obtenues d'immigrants sont représentatives de leur pays d'origine. Nous concluons que la structure de la mortalité cardiovasculaire en Turquie correspond dans une certaine mesure à celle en Europe de l'ouest et aux Etats-Unis et nous faisons des propositions pour montrer comment il est possible d'améliorer la surveillance cardiovasculaire.

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