Age at death in the Turkish Adult Risk Factor Study: Temporal trend and regional distribution at 56.700 person-years' follow-up

TEKHARF Taramasında ölüm yaşı: 56700 Kişi-yıllık izlemede dönemsel eğilim ve bölgesel dağılım

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Objectives: We analyzed the temporal trend and regional distribution of age at death due to all-causes and the sex-specific and age range defined by coronary mortality in the 18-year follow-up of the Turkish Adult Risk Factor Study.

Study Design: The participants of the Turkish Adult Risk Factor Study who have been examined in even years were last surveyed in August 2008. A total of 1,582 individuals were surveyed, which constituted half of the surviving participants of the overall cohort. Information on death was obtained from first-degree relatives and/or health personnel of local health offices. Survivors were evaluated by history, physical examination, and 12-lead electrocardiography. The cumulative follow-up was 56,700 person-years.

Results: Of 1582 participants, 868 (431 men, 437 women) were examined, in 604 subjects information was gathered, and 47 participants (26 men, 21 women) were ascertained to have died. Twenty-two deaths were classified as being of coronary origin. Cumulative assessment of the entire cohort in the age range of 45-74 years disclosed coronary mortality to be 7.64 per 1000 person-years in men and 3.84 in women and persisted to be the highest among 30 European countries, whereas overall mortality declined at a greater proportion. Overall mean ages at death were deferred within a 12-year period by 7.4 years in men and 6 years in women, to 71.9 and 74.8 years, respectively. The extension of this mean survival was similar among urban-rural areas and geographic regions.

Conclusion: Coronary mortality declined modestly, but life expectancy of Turkish adults rose by a mean of nearly seven years in the 12 years to 2003-08 without showing major differences in sex, urban-rural dwelling or geographic regions.

Key words: Coronary disease/mortality; life expectancy; mortality/trends; Turkey/epidemiology.

Amaç: TEKHARF Çalışması'nın 18 yıllık takibinde tüm nedenli ölümdeki yaş verilerinin zaman dilimine ve bölgelere bağlı değişimi ve cinsiyete özgü ve belirli yaş kesimindeki koroner mortalite değerlendirildi.

Çalışma planı: TEKHARF Çalışması'nın çift yıllarda taranan kohortu 2008 Ağustos ayında yeniden izlendi. Taramaya giren kohortun toplam sayısı 1582 kişi idi ve ülke genelinde hayatta bulunan izlenecek TEKHARF kohortunun yarısını oluşturuyordu. Ölüm konusunda birinci derece akraba ve/veya sağlık ocağı personelinden bilgi alındı; yaşayanlarda bilgi edinmekten başka, fizik muayene ve 12-derivasyonlu EKG kaydı yapıldı. Toplam takip süresi 56700 kişi-yılıydı.

Bulgular: Örneklemin 868'i (431 erkek, 437 kadın) muayene edildi, 604 kişi hakkında bilgi edinildi ve 47 kişinin (26 erkek, 21 kadın) öldüğü belirlendi. Ölümlerin 22'si koroner kalp hastalığı (KKH) kökenli sayıldı. Tüm kohortun 18 yıllık takibinde 45-74 yaş kesiminde KKH kökenli ölümler erkeklerde 1000 kişi-yılında 7.64, kadınlarda 3.84 düzeyinde bulundu ve böylece 30 Avrupa ülkesi içinde en yüksek seviyede süregeldiği gözlemlendi; oysa, genel mortalitedeki gerileme daha yüksek orandaydı. Ortalama ölüm yaşı Türkiye genelinde 12 yıl içerisinde erkeklerde 7.4 yıl, kadınlarda altı yıl ertelenerek, 2003-08 döneminde sırasıyla ortalama 71.9 ve 74.8'e ulaştı. Ortalama ömürdeki bu uzama kentsel ve kırsal kesimler ile coğrafi bölgelerde benzerdi.

Sonuç: Yetişkinlerimizde koroner mortalite az gerilemiş,ama ömür süresi son 12 yılda yedi yıla varan belirgin uzama göstermiştir; bu uzamanın erkek-kadın, kent-kır sakinleri ve coğrafi bölgelerde önemli farklar sergilemediği gözlenmiştir.

Anahtar sözcükler: Koroner hastalık/mortalite; yaşam süresi; mortalite/eğilim; Türkiye/epidemiyoloji.

Data of the Turkish Adult Risk Factor (TEKHARF) study, which includes the respective cohort is still in demand regarding mortality of coronary heart disease (CHD) and death due to all-causes in Turkish adults.[1] Within this context, time-related temporal trends and regional distribution at death-age should also be followed up. On the other hand, proper evaluation of individuals examined and followed up during annual screening visits is both an important responsibility and beneficial measure for further surveys.

In this study, evaluation of the TEKHARF study which consisted of half of the cohorts and whose last survey was in August 2008 from five different geographical regions was as follows: (i) disclosing the exact number of deaths due to coronary diseases and overall mortality of Turkish adults recorded recently; (ii) determining the incidence of mortality due to general causes and CHD among 45-74 year-olds, and particularly (iii) evaluating death due to all-causes at more than 56,000 person-years' follow-up in terms of time-related temporal trend and regional distribution. This analysis confirms positive findings of the life expectancy of Turkish adults attained within a short time. The number of individuals recruited recently from four regions and candidates to be surveyed later will also be explained.

PATIENTS AND METHODS

Dwellings and individuals surveyed. Individuals from the Aegean, Mediterranean, Southeast and Eastern Anatolia and the Black Sea regions[2] examined in even years were re-surveyed in August 2008. Together with these regions, the Dokmetepe village (Tokat) and the districts of Vefa-Kocamustafapasa, Kurtulus, Besiktas and Levent in Istanbul took part in the survey instead of Gure, Kutahya, Kaynasli and Zonguldak where the survey was conducted last year. Follow-up of the cohort consisting of 48 individuals in Van, Kars, Karapinar was performed by one of the authors (M.T.) in our study. The total number of the cohort to be followed up was 1,582 in the survey, corresponding to half of the cohort of the TEKHARF[3] study who survived and were to be followed up. One thousand thirty nine of these (65.7%) were former participants, 280 were in the cohort of 1998 and 263 were in the cohort of 2002.

The overall follow-up period, as reported by reliable participants concerning the health of those who were examined and considered dead was evaluated.

Method of gathering information. Medical history, examination and electrocardiogram were used to gather information in the survey. Current medical information regarding individuals who could not be examined was obtained via telephone calls or through their relatives and neighbors. The date of information obtained was recorded and individuals were included in a follow-up period of less than 23 months.

Determination of mortality and definitions. Information regarding the approximate date, place, type and cause of death was obtained as much as possible. Sudden death was defined as death which occurred within 24 hours of the onset of symptoms and was generally associated with cardiac causes in the absence of any other information.

The proportion of Turkish adults and our samples. The number of individuals in the TEKHARF study who were available for follow-up in 2007-2008, apart from the new cohort was 3,090. Based on the assumption that the total population of individuals ?38 years old was 26 million (12,2 millions male population; 13,8 millions female population), our sample represented 1/8,400 in this age range across the population.
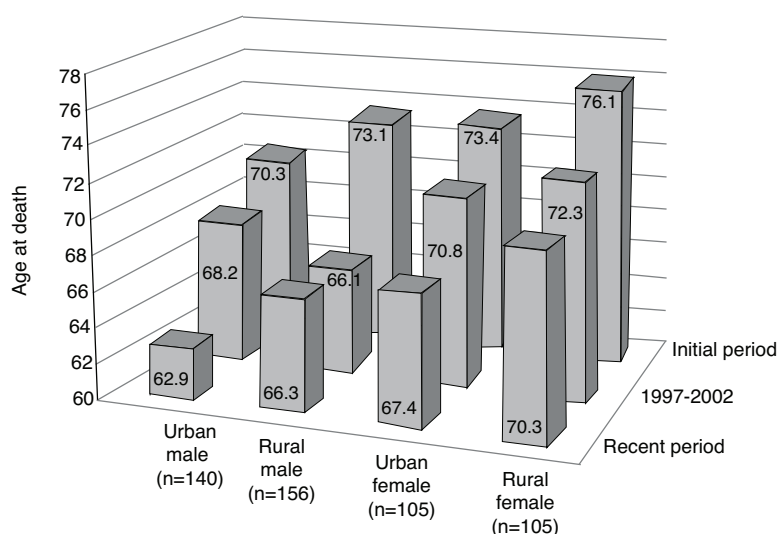
RESULTS

A.Final follow-up data

A total of 868 (431 males; 437 females) of the 1,582 individuals were examined and 47 were ascertained to have died. Two hundred one individuals who were not previously examined during the 2006 survey were examined. The information alone of 604 individuals was gathered, whereas information was not available for 63 individuals. The ages of individuals whose information alone was obtained (mean age 56.5 ± 11.6) and of those who were examined (mean age 56.1 ± 10.8) were similar. Overall duration of follow-up was 2,953 person-years. Individuals determined as dead and those examined consisted of 60% of the total number of individuals to be followed up. Forty seven death events corresponded to 16.4 per 1000 person-years. On the other hand, a total of 222 individuals from

Table 1. Distribution of mortality according to cohorts and periods in the TEKHARF study

	Mortality (n)	Follow-up period	Annual (per 1000)
Initial cohort	506	48,250	10.5
1990-97/98	204	21,500	9.5
97/98-02/03	139	13,600	10.2
2002/03-07/08	163	13,150	12.4
1997/98 cohort	50	6,150	8.1
97/98-02/03	20	3,100	6.5
2002/03-07/08	30	3,050	9.8
2002/03 cohort	12	2,300	5.2
All cohorts	568	56,700	10.0

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Figure 1. Distribution of age at death according to sex, urban-rural dwelling and a-6-year time period in 506 death events of initial participants in TEKHARF study

four different geographical regions (mean age 54.1±8.1) were included in the cohort.

Twenty one of the individuals who died were females, while 26 of them were males. Twenty two death events were associated with coronary diseases; six with cerebrovascular events; six with cancer; and one death event each with aortic dissection; bilateral bundle branch fibrosis; pulmonary embolism; core pulmonale; diabetic nephropathy; sepsis; Alzheimer's disease; suicide; drug abuse; suspicion of excessive drug use, and vascular causes. However, the reason for two death events could not be determined. Total coronary mortality during this period was found to be 7.45 per 1000 person-years (8.2 for males; 6.7 for females).

B.Eighteen-years follow-up analysis

Overall mortality and age at death. The distribution of 568 deaths which occurred in all cohorts at certain periods and mortality rate of the TEKHARF study per 1000 person-years are shown in Table 1. The mortality rate of the relatively young cohort with a mean age of 46 was 10.0 per 1000 person-years during the period. Mean age of the initial cohort in which 506 death events occurred within 18 years was 68±13 and 72±11 for male and female individuals, respectively. However, distribution of age at death according to sex, urban-rural dwelling and period is shown in Figure 1, as the mean age was different for each period. Age at death increased across the country, from 64.4±14.0 in 1990-1996 to 71.9±12.4 in 2003-2008 in males, while it increased from 68.6±12.4 to 74.8±10.9 in females. In other words, death events were postponed for 7.4 and 6 years in male and female individuals, respectively within 12 years. Rural-urban cohorts were both affected by this postponement. Regional distribution of age at death demonstrated that with the exception of the Black Sea region, mortality of every region during the initial period was observed at an advanced age compared to the final period, in the Marmara regions (3.3 years) and Southeast Anatolia (15.9 years) (Table 2).

Table 2. Distribution of age at death according to annual periods of six months each and regions of initials cohort of the TEKHARF study

	Overall mortality	Age at death		
		1990-1996	1997-2002	2003-2008
Regions	506	66.2±13.0	69.3±12.0	73.1±11.7
Marmara	111	65.5±11.5	70.0±10.5	68.8±10.3
Central Anatolia	111	65.2±15.7	68.9±13.5	73.5±12.1
Aegean	76	68.9±12.9	68.4±12.0	73.9±13.4
Black Sea	68	69.4±11.4	66.7±14.9	69.2±13.2
Mediterranean	47	70.7±10.2	70.0±13.6	75.0±14.2
Eastern Anatolia	55	65.2±15.2	71.2±11.6	75.2±6.7
Southeast Anatolia	38	65.0±14.8	68.6±12.2	80.9±14.8

Table 3. Death which occurred in 17.5 years and prevalence of CHD in the cohort of the age range of 45-74 in TEKHARF study

	Total			Male			Female		
	Follow-up (year)	Death (n)	Annual (per 1000)	Follow-up (year)	Death (n)	Annual (per 1000)	Follow-up (year)	Death (n)	Annual (per 1000)
All death events									
Turkey, 1990-2000	11,514	191	16,6	5,705	116	20,3	5,809	75	12,9
Turkey, 2000-2008	14,466	165	11,4	6,995	107	15,3	7,471	58	7,8
Turkey, 1990-2008	25,980	356	13,7	12,700	223	17,6	13,280	133	10,0
Death events due to CHD									
Turkey, 1990-2000	11,514	73	6,3	5,705	46	8,0	5,809	27	4,7
Turkey, 2000-2008	14,466	75	5,2	6,995	51	7,36	7,471	24	3,2
Turkey, 1990-2008	25,980	148	5,7	12,700	97	7,64	13,280	51	3,84

Death due to all-causes and CHD in the age range of 45-74. All death events due to all-causes and CHD in the age range of 45-74 according to sex and duration of follow-up are shown in Table 3. Death events at this age range was 13.7 (17.6 for males; 10.0 for females) per 1000 person-years.

Death due to CHD within this age range was 7.64 and 3.84 per 1000 person-years in males and females, respectively, since the survey was first initiated. Coronary mortality was found to decrease from 8 in the 1990s to 7.36 per 1000 person-years in the 2000s; the rate decreased in women from approximately 1/3 to 3.2 per thousand person-years.

New cohort from four different regions. A total of 222 individuals (of which 100 were women), predominantly from urban areas, apart from the Black Sea region were also included in the new cohort due to the temporal trends in regional distribution of our population. Of the participants 26 were from Malatya, 12 from Icme, 23 from Diyarbakir, 15 from Akziyaret (Culmen, Urfa), 24 from Gaziantep, 17 from Sambayat (Adiyaman), 28 from Denizciler (Hatay), 17 from Tomuk (Icel), 16 from Aydincik, 19 from Manavgat, and 25 from Izmir. Median age of the cohort was 55 in both the current participants and new cohorts.

Annual participant loss and the number of cohorts available for future follow-up at the end of the survey. A total number of 1,328 individuals from three cohorts died in the course of time. Regarding overall duration of follow-up with combined calculation, the annual rate of 2.3% is attained. This means that 75 of the 3,300 individuals making up a cohort are expected to be excluded per year, apart from death events.

The regional distribution and periods of participation of the current cohort consisting of 3,374 individuals (1,641 males; 1,733 females) and who were examined and found to be available for follow-up at the end of 2008 are shown in Table 4.

DISCUSSION

This analysis of the TEKHARF study focused on age-related findings of all death events registered during the initial cohort for the 18-year period and the coronary mortality rate of individuals within the age

Table 4. Cohorts available for future follow-up and regional distribution

Cohorts	Population (%)	Cohort (%)	Total	Follow-up in 2010	Follow-up in 2009
Initial			1977	967	1010
1997/98 cohort			588	267	321
2002/03 cohort			449	244	205
2007/08 cohort			360	222	138
Regional total			3374	1700	1674
Marmara	28,7	27,0	910	130	780
Central Anatolia	15,5	20,5	691	39	652
Aegean	13,0	11,2	379	275	104
Black Sea	10,6	11,0	369	231	138
Mediterranean	13,1	12,0	403	403	
Eastern Anatolia	8,9	8,3	280	280	
Southeast Anatolia	10,2	10,1	342	342	

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range of 45-74. We found that mean ages of the 506 individuals who died in the initial cohort significantly increased within 12 years (7.4 years in males; 6 years in females). The increase in the mean survival rate was similar between rural and urban areas. Mean age at death during the 2003-2008 period was found to be 71.9 and 74.8 in males and females, respectively. The increase in the survival rate was more significant among cohorts of Southeast Anatolia, Eastern Anatolia, and Central Anatolia compared to those in other regions. All death events in the age range of 45-74 decreased from 16.6 per 1000 person-years in 1990s to 11.4 in 2000s, while death events due to CHD decreased from 6.3 only to 5.2 per 1000 person-years during the same period. 47 death events detected during the follow-up survey in 2008 were interpreted as 16.4 per 1000 person-years. Events were mostly associated with coronary and cerebrovascular diseases.

Age at death and overall mortality. The mean survival is known to have increased in Turkey by 19 years, from 52 years in 1961-1965 to 71 years in 2001-2005. It suggests that life expectancy increases by one year biennially. According to the data of Turkish Statistical Institute (TSI) in 2007, the mean life expectancy is 69.5 and 74 years in females and males.[4] These data are consistent with the findings of 30-year-old individuals; so much that a postponement of approximately 7 year in the age at death within 12 years and a mean age at death which we found to be 1-2 higher than the TSI data may be said to be associated with the lack of death events in infants and younger people.

In line with the postponement of age at death, we found a significant decline in death due to all-causes in the age range of 45-74. We observed a 25% decline in the mortality for males and 40% for females within 9 years between the two periods. The cumulative data of the entire cohort in the age range of 45-74 attained in European countries in 2000 has recently been announced.[5] The decline in Turkey may be interpreted as positive when compared to the decline in overall mortality observed in European countries.[5-7] The median mortality in the age range of 45-74 in 30 European countries has been reported as 13.2 and 7.3 per 1000 person-years in males and females, respectively.[6] The rates are higher in Turkey by about one-third in 17.6 and 10.0 per 1000 person-years in males and females, respectively. Furthermore, the overall mortality of women in Turkey is still lower than the rates in Romania, Bulgaria, Hungary and Baltic states, and it is also lower for men than the rates in Croatia, Czech Republic, Slovakia and Poland.

Coronary mortality rate does not adequately decrease. The decrease in coronary mortality between the two periods has remained below 20% (from 6.3 to 5,2 per 1000 person-years). A significant decrease in the rate of mortality due to CHD was attained compared to the rates of 10 years ago in most Eastern and Northern European countries. Data collected from the 30 countries show that the median CHD mortality rate per 1000 person-years was 2.3 in females and 0.72 in males. Accordingly, the rate of coronary mortality in Turkey is still 3-fold and 5-fold high in men and women, respectively. Although data from Russia and Ukraine were not included in the recent evaluation, it may be suggested that the rate of coronary mortality is the highest in women and also in men, except that of Latvian.

It is remarkable that we could not observe a decline in coronary mortality as much as that observed in death due to all-causes. When it is confirmed through other means that we cannot prevent death due to coronary diseases in Turkish adults (i.e. we cannot postpone death event), as much as it is the case with death due to other causes it may be assumed that serum proteins[8] such as HDL cholesterol, apolipoprotein A-I and adiponectin which are responsible for the prevention of CHD may play a role in this association.

New cohort and regional distribution. A total of 360 individuals from four different regions were included in the survey, together with the 138 participants from Istanbul in 2007. Therefore we believe that there is no need for new participants for the next 4-5 years. The number of male subjects was required to be a little more in order to show consistency of age with the existing cohort. It can be seen that the latest state of the cohort represents the regional distribution very well, when compared to estimated distribution of population according to geographic regions as showed in Table 4. Although a new cohort from Central Anatolia was not included in the survey, the presence of any shortfall in the Aegean, Mediterranean and Marmara regions may be interpreted as over representation from the Central Anatolian region. The current cohort of TEKHARF study represents middle-aged or elderly Turkish adults in terms of age and sex.

In conclusion, the TEKHARF study has shown that the life expectancy of Turkish adults has risen by a mean of nearly 7 years within the past 12 years, without showing major differences in sex, urban-rural dwelling or geographical regions. From the beginning of the study, all death events due to CHD in the age range of 45-74 have been at the rate of 7.64 and 3.84 per 1000 person-years in males and females, respectively, maintaining higher rates compared to European countries for both sexes.

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