

The Turkish Adult Risk Factor survey 2009: similar cardiovascular mortality in rural and urban areas

TEKHARF 2009 taraması: Kırsal kesim ve kentlerde benzer kardiyovasküler ölüm riski

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Objectives: We analyzed the 2009 survey of the Turkish Adult Risk Factor (TARF) Study to assess the distribution of all-cause and cardiovascular mortality in urban and rural areas and gender-specific coronary mortality in the age-range of 45 to 74 years.

Study Design: The Marmara and Central Anatolian regions have been surveyed every odd year in the TARF Study. In 2009, 1,655 participants were surveyed. Information on the mode of death was obtained from first-degree relatives and/or health personnel of local health office; 960 participants underwent physical examination and ECG recording, and 572 subjects were evaluated on the basis of information obtained regarding health status.

Results: In the survey, 23 men and 20 women were ascertained to have died. Twenty-one deaths were attributed to coronary disease and four deaths to cerebrovascular events. Assessment of the entire cohort in the age range of 45-74 years after a 19-year follow-up disclosed a high coronary mortality with 7.5 per 1000 person-years in men and 3.9 in women. In a Cox regression analysis comprising 405 deaths (235 cardiovascular) and over 24,000 person-year follow-up, age-adjusted cardiovascular mortality was similar in rural and urban participants. All-cause mortality was higher in females living in urban areas than those living in rural areas (HR 1.41; 95% CI 1.02-1.96).

Conclusion: Cardiovascular mortality both in absolute terms and as a share of overall mortality persists to be high among Turkish adults, with similar rates in urban and rural areas. Age-adjusted all-cause mortality rate is higher among urban versus rural women.

Amaç: TEKHARF Çalışması'nın 2009 sonbaharında gerçekleştirilen tarama verileri incelenerek koroner/ kardiyovasküler ve tüm-nedenli ölümlerde kırsal kesimkent farklılıkları ve 45-74 yaş kesiminde mortalitenin cinsiyete göre dağılımı değerlendirildi.

Çalışma planı: TEKHARF Çalışması kapsamında Marmara ile İç Anadolu bölgeleri tekli yıllarda taranmaktadır. 2009 yılında 1655 kişi bu amaçla tarandı. Ölüm nedeni ve şekli konusunda birinci derece akraba ve/veya sağlık ocağı personelinde bilgi alındı. Örneklemden 960 kişi fizik muayene ve 12-derivasyonlu EKG ile incelendi; 572 kişinin sağlık durumu hakkında bilgi edinildi.

Bulgular: Taramada 23 erkek ile 20 kadının öldüğü belirlendi. Ölümlerin 21'i koroner hastalığa, dördü serebrovasküler olaya bağlandı. Tüm kohortun 19 yıllık takibinde, 45-74 yaş kesiminde koroner kalp hastalığı kökenli ölümler erkeklerde 1000 kişi-yılında 7.5, kadınlarda 3.9 düzeyinde bulundu. Toplam 405 ölümü (235 kardiyovasküler ölüm) ve 24 bin kişi-yılına aşan izlemi kapsayan Cox regresyon analizinde, kırsal alanda ve kentlerde oturanlar benzer yaş-ayarlı ölüm oranları sergiledi. Kentli kadınlarda, kırsalda yaşayan hemcinslerine göre genel mortalite daha yüksek bulundu (HR 1.41; %95 GA 1.02-1.96).

Sonuç: Kardiyovasküler mortalitenin hem mutlak, hem de genel ölümdaki payı yüksek olmayı sürdürmektedir; bu konuda kır-kent farkı gözlenmedi. Kentte yaşayan kadınlarda yaş-ayarlı tüm nedenli ölüm oranı, kırsal alan hemcinslerine göre daha yüksektir.

Key words: Cardiovascular diseases/mortality; coronary disease/mortality; mortality/trends; Turkey/epidemiology.

Anahtar sözcükler: Kardiyovasküler hastalık/mortalite; koroner hastalık/mortalite; mortalite/trend; Türkiye/epidemioloji.

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The cardiovascular mortality difference between inhabitants of urban and rural areas is not well known since Ministry of Health data concerning mortality and morbidity rates of coronary heart diseases (CHD) in Turkey are mostly based on hospital records and also because data of the Turkish Statistical Institute are limited to provincial and district centers.¹ Although basic observations of the cohort the TARF study demonstrates that the mortality rate in rural areas are higher,^{2,3} there is a need for further investigation based on new data since this evaluation did not include adjustments for age and the follow-up duration.

In this article, two analyses of the TARF study conducted at the beginning of the autumn of 2009 were performed involving the Marmara and Central Anatolian regions which consisted of half of the cohort: (i) publication of the number of all-cause mortality and mortality of coronary origin of adults recorded during the last stage of the survey, (ii) identification of the frequency of all-cause mortality and mortality due to CHD in the age-range of 45 to 72 years. Another objective of this study was to evaluate rural-urban differences in relation to mortality due to cardiovascular diseases and all-cause mortality observed in the entire TARF cohort since the 1997/98 survey.

SAMPLE SIZE AND METHODS

Residential units and individuals involved in the survey. The Marmara and Central Anatolian regions surveyed in the odd years of the TARF study were re-evaluated between 23 September and 14 October 2009, using the usually implemented course modification.³ The residential units to be surveyed were consistent with the previous survey.⁴ There was a total of 1655 individuals in the cohort which consisted of approximately half of the surviving TARF cohort to be surveyed in the entire country.⁴

Participants who were considered dead in terms of death rate, those who underwent physical examination and those from whom reliable information about their health status was obtained were individually identified and the total follow-up duration calculated. On the other hand, the Cox proportional hazard regression analysis included only the time period until the last examination of participants.

Method of obtaining information. During the survey, information was obtained directly by history taking, physical examination and electrocardiogram. Information on those who could not be examined was obtained directly from the individuals concerned by telephone, or from relatives and neighbor about whether or not they were alive. The date of the information obtained was recorded and a follow-up period of 18 months or less was allocated for the individuals concerned instead of the 25 months.

Determination of mortality and certain definitions. Information was obtained as much as possible about the date, place, manner and the cause of death. Death was attributed to a cardiovascular origin based on information and determinants of the previous surveys and also on information related to the last months of life. Death was considered as being of cerebrovascular origin in the presence of any previous or last day findings of or knowledge about stroke events, and in the absence of another prominent disease. Death occurring within 24 hours of the onset of symptoms was considered as sudden death, and was attributed to cardiac origin in the absence of other information. All residential areas with less than a population of 10 thousand was defined as a rural areas in the TARF study.⁵

The Turkish adult population and the relationship with sample size. Surviving participants of the TARF study who were suitable for follow-up consisted of 3197 individuals. Considering the fact that individuals ≥ 38 -years old make up a Turkish population of 26 million (12.2 million men and 13.8 women), our sample size consisted of 1 in 8100 of the country's population of this age group.

RESULTS

Latest follow-up data of the survey

Out of a cohort of 1655 individuals 960 (58%) underwent physical examination, while 43 individuals (2.6%) were ascertained to have died. The 181 individuals (10.9%) who were not subjected to physical examination during the 2007 survey were examined. Information alone was obtained from 572 individuals (34.6%), whereas 80 individuals (4.8%) were considered to be missing from the follow-up. The total follow-up duration was 2870 person-years. The 43 deaths identified during the follow-up period corresponded to 15 per 1000 person-years.

Table 1. Distribution of all deaths according to cohorts and periods in the TARF study

	Dead	Follow-up duration (person-years)	Yearly (per 1000)
Previous cohort	531	48660	10.9
1990-97/98	204	21360	9.6
97/98-02/03	137	13000	10.5
2002/03-08/09	190	14300	13.3
1997/98 cohort	61	6550	9.3
97/98-02/03	22	3100	6.5
2002/03-08/09	39	3450	11.3
2002/03 cohort	17	2540	6.7
2007 cohort	2	250	8.0
All cohorts	611	58000	10.5

Table 2. Incidence of all-cause mortality and mortality due to coronary heart disease in the TARF 45-72 year cohort within 18.5 years

	Total			Male			Female		
	Follow-up duration (person-years)	Dead	Yearly (per 1000)	Follow-up duration (person-years)	Dead	Yearly (per 1000)	Follow-up duration (person-years)	Dead	Yearly (per 1000)
All deaths									
Turkey 1990-2000	11514	191	16.6	5 705	116	20.3	5 809	75	12.9
Turkey 2000-2009	16826	187	11.1	8 140	120	14.7	8 686	67	7.7
Turkey 1990-2009	28340	378	13.3	13 845	236	17.0	14 495	142	9.8
Deaths from coronary heart diseases									
Turkey 1990-2000	11514	73	6.3	5 705	46	8.0	5 809	27	4.7
Turkey 2000-2009	16826	88	5.2	8 140	58	7.1	8 686	30	3.5
Turkey 1990-2009	28340	161	5.7	13 845	104	7.5	14 495	57	3.9

Twenty of those who died were women, whereas 23 were men. Twenty-one of the deaths (10 of them women) were attributed to coronary diseases, whereas four (all women) were due to cerebrovascular event (two from embolic origin). 11 deaths were due to cancer, two due to chronic obstructive diseases, and one each due to violence, nephropathy, and non-vascular causes. The causes of two deaths could not be determined. The total coronary mortality during this period was found to be 7.3 per 1000 person-years (7.5 per 1000 in men and 7.2 per 1000 in women). The mean age at death was 72.1 in men and 72.9 in women. 18 of the deaths were registered among the urban cohorts whereas 25 were from rural areas.

Nineteen-year follow-up analysis

Total mortality and age at death. Distribution of all 611 deaths which occurred in the entire TARF cohort during a certain period and the mortality rates per 1000 person-years is shown in Table 1. The mortality rate was 10.5 per 1000 person-years among the relatively young cohort whose mean age was 47 years during the entire period. This corresponds to the 10.9 rate per year of the 531 deaths recorded within 19 years among the original cohort.

All-cause mortality and mortality due to CHD in the

45-74 age group. All-cause mortality and mortality due to CHD recorded among the limited 45-74 age group according to gender distribution and follow-up duration are shown in Table 2. Deaths within this age group were at a rate of 13.3 per 1000 individuals per year (17.0 in men and 9.8 in women).

Deaths due to CHD have been 7.5 per 1000 person-years in men and 3.9 per 1000 person-years in women right from the onset of the survey. The coronary mortality of 8 per 1000 in the 1990s fell to 7.1 in the 2000s in men and from 4.7 to 3.5 in women.

Rural-urban and gender distribution of mortality

About 14% (239/1703) of men and 9.6% (166/1723) of women died during the 11-year period from the 1997/98 to the 2008/09 survey. The mean age (48.4) of the 1007 men among the urban TARF cohort was found to be 0.82 years younger than the rural 696 men in 1998 ($p=0.19$). The mean age of the 1003 urban women (47.9) was also found to be 1.83 years younger compared to the 720 rural women ($p=0.003$). The mean duration of follow-up in urban men (6.42 years) and in urban women (6.67 years) was found to be 1.3 years shorter when compared to their rural counterparts ($p<0.001$, all genders).

Table 3. Gender and rural-urban distribution of all-cause mortality and mortality due to cardiovascular diseases in the entire TARF cohort since the 1997/98 survey

	Persons	Follow-up duration (person-years)	All-cause mortality		Cardiovascular mortality	
			Number	Mortality (1000 person-years)	Number*	Mortality (1000 person-years)
Male						
Urban	1007	6 466	125	19.3 ^a	57+10	10.4
Rural	696	5 394	114	21.1	59+7 [†]	12.2
Female						
Urban	1003	6 694	80	12.0 ^b	38+7	6.7
Rural	720	5 713	86	15.1	35+22 [§]	10.0
Total	3426	24 267	405	16.7	235	9.7

Table 4. Cox regression analysis of age-adjusted mortality and cardiovascular mortality risks according to rural-urban localization in men and women

	Dead (n=405/3426 ^a)		Male (n=239/1703)			Female (n=166/1723)		
	RR	95% CI	RR	95% CI	p	RR	95% CI	p
Overall mortality	(n=405/3426 ^a)		(n=239/1703)			(n=166/1723)		
Age (years)	1.093	1.085; 1.10	1.083	1.07; 1.09	<0.001	1.11	1.10; 1.12	<0.001
Urban dwelling	1.178	0.965; 1.44	1.089	0.84; 1.41	0.51	1.41	1.02; 1.96	0.038
Cardiovascular mortality	(n=235/3420 ^b)		(n=133/1701)			(n=102/1719)		
Age (years)	1.094	1.083; 1.105	1.08	1.07; 1.096	<0.001	1.11	1.10; 1.13	<0.001
Urban dwelling	1.068	0.82; 1.39	1.02	0.72; 1.43	0.93	1.28	0.84; 1.96	0.24

The total number of deaths per 1000 person-year follow-up was found to be 1.16-fold higher in those living in urban areas than in rural dwellers (18 vs 15.6); (Table 3). The values were not found to be significant after adjusting for age ($p>0.05$). However, cardiovascular mortality of coronary and cerebrovascular origin was found to be higher in rural areas (11.1 vs 8.5).

The risk of death was analyzed using the Cox regression analysis according to gender-specificity and age adjustments, due to the rural-urban difference in the follow-up duration (Table 4). Accordingly, the overall mortality rate and the rate of mortality due to cardiovascular events of dwellers in both localizations were observed to be similar. This result was very true for men, but in women the age-adjusted overall mortality was 1.4-fold higher in urban dwellers compared to rural dwellers.

Yearly participation loss and size of the cohort suitable for future follow-up at the end of the survey. A total of 1448 individuals were missing from the 19 years follow-up in the three cohorts. The death rate was 2.2% per year after applying composite measurements of the mean follow-up duration (15.8 years). Accordingly, about 70-75 participants were reported to withdraw from the follow-up per year out of a cohort of 3300 individuals, with the exception of those who died. The 3% follow-up

loss in urban areas compared to the 1.2% loss in rural areas leads to an increase in rural participation.

Participants from whom information was obtained or those who underwent physical examination by the end of the year 2009 and a total of 3197 participants (1555 men and 1642 women) who were considered suitable for future follow-up (those missing and those alive) consisting of the current cohort were distributed according to the period and geographical regions. This was found to be similar to the current population distribution of the country (Table 5).

DISCUSSION

In this analysis of the TARF study the 407 death cases which have occurred since the 1998 survey were found to correspond to 16.8 per 1000 person-years. The Cox analysis did not demonstrate any significant difference in cardiovascular mortality between rural and urban dwellers in terms of age and the duration of follow-up. The overall mortality was similar in men, but was found to be 1.4-fold higher in urban women ($p=0.038$). Mortality due to coronary heart diseases among the 45-74 age group was found to be 7.1 per 1000 person-years in men and 3.5 in women during the last 8.5 years, and was found to be higher than in European countries.⁶ Most of the 45 death cases reported during the 2009 sur-

Table 5. Cohorts suitable for future follow-up and geographical distribution

Cohorts	Population (%)	Cohort share	Total	2010 follow-up	2011 follow-up
Original			1914	995	919
1997/98 cohort			583	266	317
2002/03 cohort			353	201	152
2007/08 cohort			347	209	138
Area total			3197	1671	1526
Marmara	28.7	27.2	869	127	742
Central Anatolia	15.5	19.5	624	37	587
Aegean	13.0	11.8	378	300	78
Black sea	10.6	10.5	335	216	119
Mediterranean	13.1	12.2	391	391	
Eastern Anatolia	8.9	8.5	272	272	
Southeast Anatolia	10.2	10.3	328	328	

vey (n=25) were attributed to coronary and cerebrovascular events. The mortality rate from coronary events was found to be 7.1 per 1000 person-years during the last follow-up period.

Overall and coronary mortality. The 1/3 decrease in the all-cause mortality rate among the 45-74 age group during this century has been attributed to our inability to make considerations alongside coronary mortality. The mortality in this age group is still considered to be higher at 17.0 per 1000 person-years in men and 9.8 in women. However, considering the median CHD mortality rate of the population of 30 European countries to remain at 2.3 per 1000 person-years in men and 0.72 in women,⁶⁻⁸ renders the 3-5-fold high rate in Turkey to be apprehensive. These exorbitant rates were similar to those of the extensive study performed on the overall incidence of CHD.⁹ Our inability to delay adult deaths due to coronary events may be attributed to the abnormal function of protective serum proteins¹⁰ such as HDL, apolipoprotein A-I, C-III and adiponectin.

The role of rural-urban differences and gender in mortality. The 27 residential areas considered as rural areas during the 1990 survey of the TARF study are still maintained under this capacity.⁵ Our previous reports^{2,3} demonstrated that mortality in the urban areas was lower than that among rural dwellers. However, we were able to demonstrate that there was no difference between rural and urban cardiovascular mortality rate in this analysis which included age and follow-up duration in the Cox proportional hazard regression analysis. Our results of a 40% higher overall mortality rate in urban women compared to rural women is of great interest.

The serum triglyceride level is reported to be 7 mg/dL high in urban dwellers and was found to be significant in the female population in one of our recent studies.¹¹ Considering that fact that hypertriglyceridemia is a good indicator of increased inflammation, non-vascular causes (together with the rate of non-significant cardiovascular deaths) particularly cancer, may be considered as more effective in urban women. However, further and extensive investigations are required on this subject.

In conclusion, the 2009 survey of in the TARF study also demonstrated that coronary and cerebrovascular deaths constitute more than have of the overall mortality, which was consistent with our previous observation. The 5.2 high rate per 1000 person-years in deaths due to coronary events observed among the 45-74 age group is reported to be constant. Results from the Cox regression analysis showed that there was no difference between urban and rural dwellers in respect of age-adjusted mortality and also in the overall mortality observed in men. The age-adjusted overall mortality in women was found to be significantly higher in urban areas.

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