On the estimation of survival time and contributory risk factors in the elderly participants in the Tehran lipid and glucose study. A 10-year follow-up

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ABSTRACT

In the increasing population of the elderly in Iran, so far no prospective health studies have been undertaken. This study was conducted to identify the risk factors of survival time of the elderly of ages above 60 years. Material and Methods: Individuals above 60 years old were recruited in the primary phase of the Tehran Lipid and Glucose Study (TLGS) during 1998-2001. They were followed up for 10 years and their vital status were registered (1998-2008). Age and sex mortality rates for age groups (60-69, 70-79, 80^{+}) were calculated and by using Cox proportional hazard model the hazard rates were estimated. Results: Out of 929 males, 154 (17%) and out of 869 women 85(10%) died during the follow-up years. Cox model showed that diabetes on an average reduces 4.4 years and 2.5 years and smoking reduces 5 and 6.6 years of males' and females' survival time, respectively. BMI>33Kg/m^2 and dis-lipoproteinemia reduce 4.5 years and 4 years of women's life span. Tehranian native men on an average live 3 years shorter than other male residents. In addition, hypertension and history of MI, stroke or sudden death of father, brother or son reduce 3.3 years and 4.1 years of men's life time. Conclusion: The elderly population is in need of a healthy ageing to be gained from prevention and intervention. Identification of life time reducing risk factors of elderly helps the policymakers to develop some protocols to increase the life span of the population.

Keywords: Elderly; Hazard rate; Mortality rate; Survival analysis; TLGS

INTRODUCTION

Changes in the age distribution of the population in favor of the elderly have lead us to a new era of research work[1]. Across the world, there are substantial but missed opportunities for promoting health of elderly population and extending the healthy life span. Current approaches to health care rely on late detection and treatment of disease, and some of the most expensive systems of care have population health outcomes that are poor to mediocre. Geriatrics medicine is currently aim at prolongation of human being life time by implementing some research. A majority of deaths and disabilities result from progression of preventable chronic diseases for which human behaviors are major contributing factors. The impact of various risk factors like hypertension, smoking, diet, physical activity and diabetes on survival time in the elderly has been studied extensively [2-9], although most of them are based on traditional statistical methods like comparison of the proportional mortality ratios or sex-age specific mortality rates. According to the literature review a longitudinal, prospective cohort study conducted in Dubbo, NSW was only found as a new approach to identify the impact of some factors on survival time in the elderly [10]. Participants were men and women aged 60 years or over living in the community, first assessed in 1988–1989 and followed for 15 years. The result of the study showed that the coronary heart disease was the main cause of death among the Australian elderly. Smoking, diabetes and hypertension were

found as significant risk factors reducing life time. No similar researches were found in the literature for the same purpose. About survival time of Iranian elderly population also no prospective studies have been conducted so far. Due to the considerable lack of investigations on this issue and the importance of identification of risk factors on life time in the elderly in each specific community, in this paper we aimed at analyzing the effect of different determinants like marital status, smoking cigarette, Tehran nativeness, hypertension, dis-lipoproteinemia, blood pressure medication, diabetes, history of MI and obesity on survival time in the elderly participants of the prospective Tehran Lipid and Glucose Study [11] (TLGS). The results of this research may be used as a baseline for further geriatrics research in Iran and also may help the policymakers to implement an adequate elderly health promotion program.

MATERIALS AND METHODS

The prospective TLGS is a community-based epidemiological survey conducted to study not only the prevalence and incidence of diabetes, hyperlipidemia, hypertension, cigarette smoking and other cardiovascular risk factors but also to investigate the trend of the factors in the course of time. The initial phase of the project was conducted between 1998 and 2000. Methods and measurements have been described in detail elsewhere [11]. Briefly, the study population consists of individuals aged 3 years and older under coverage by Tehran East Health Center. Sample of 14,280 individuals were selected, and invited for interview. For each case, in addition to all background data, the result of medical examinations and anthropometric measurements were reported. Blood samples were taken for measuring lipids and glucose. For those 20 years and over, a two-hour post glucose blood sample measurement and electrocardiography were performed as well.

In this paper, first we present the age-sex proportional mortality ratios and age-sex mortality rates. In order to estimate the proportional mortality ratio, we divide the number of death due to a specific cause to the total number of death, while for estimating age-sex mortality rate we divide the number of death due to a specific cause to the number of population of same age and sex group. Comparing the ratios describes the most hazardous disease for age 60 and above in our community.

Similar to all longitudinal studies that interested "event" may happen for a case (called as uncensored observation) or may not (called as censored observation); Here also within 10 years of follow up death event did not occur for all the cases. Therefore in order to identify the significant predictors of survival time, Cox proportional hazard model was employed. We refer interested readers to the following references [12-17].

In addition to censored observation we face with missing data as well. The data which we are not aware of their status, died or alive. In this case we assume that missing is independent of death event. Analysis was done by using SPSS(16).

RESULTS

In the framework of the TLGS we selected $age \geq 60$ years individuals consist of 929 males (52%) and 869 females (48%). Over the 10 years, 154 (17%) males and 85(10%) females died. Proportional mortality ratios and sex and age mortality rates are summarized in Table 1. As table 1 shows, within 10 years, 12% of males in the baseline age group (60-69 years), 28% in the age group (70-79) and 31% in the age group (80+) passed away. These rates were 7%, 18% and 44% in three female age groups, respectively. Among men, heart diseases including CHD, cardiovascular diseases, MI, sudden cardiac death and unstable angina have the highest mortality ratio 42%(65/154) and among women after other causes of death 42%(35/85) heart diseases have the highest mortality ratio, 38%(33/85). Stroke mortality ratio is higher among men than women (21% vs. 7%). Cancer is reported with the same mortality ratio for males and females (12%). Comparison between 3 decades shows that those causes of death which actively affect the life of the elderly in the first decade may not that much active in the second or third decade and vice-versa.

Table 1. Proportional mortality ratios of different causes of death and sex and age mortality rates in the Tehran Lipid and Glucose Study, 1998-2008.

Men	**60-69 years (N*=661)**		**70-79 years (N=242)**		**80+ years (N=26)**		**Total (N=929)**	
Cause of Death	**No. of Death (d)**	**Proportional mortality ratio (d/D) %**	**No. of Death (d)**	**Proportional mortality ratio (d/D) %**	**No. of Death (d)**	**Proportional mortality ratio (d/D) %**	**No. of Death (d)**	**Proportional mortality ratio (d/D) %**
Heart Diseases	37	47	25	38	3	38	65	42
Stroke	11	14	9	13	1	12	21	14
Cancer	11	14	8	12	0	0	19	12
Other	20	25	25	37	4	50	49	32
Total death) (D)	**79**	**100**	**67**	**100**	**8**	**100**	**154**	**100**
All cause age-sex mortality rate (D/N)	**12%(79/661)**		**28%(67/242)**		**31%(8/26)**		**17%(154/929)**	
Woman	**(N=680)**		**(N=171)**		**(N=18)**		**(N=869)**	
Cause of Death	**No. of Death**	**Proportional mortality ratio %**	**No. of Death**	**Proportional mortality ratio %**	**No. of Death**	**Proportional mortality ratio %**	**No. of Death**	**Proportional mortality ratio %**
Heart Diseases	21	45	10	33	2	25	33	38
Stroke	4	8	2	7	1	12	7	8
Cancer	5	11	5	17	0	0	10	12
Other	17	36	13	43	5	63	35	42
Total death) (D)	**47**	**100**	**30**	**100**	**8**	**100**	**85**	**100**
All cause age-sex mortality rate (D/N)	**7%(47/680)**		**18%(30/171)**		**44%(8/18)**		**10%(85/869)**	

*No. of participants

Heart Diseases: CHD, CVD, MI, sudden cardiac death, unstable angina.

In order to identify the impact of risk factors on survival time, different factors are considered to be tested by Cox proportional hazard model. Baseline information is presented in the first part of Table 2 (Study entry time). Accordingly, 97% of males are

Table2. Cox-model hazard ratios for all cause mortality over a 10-year period of the TLGS with respect to underlying risk factors

	Study entry time		Hazard ratio(95% CI)	
	Men (N=929)	Women (N=869)	Men	Women
Age(years)	Mean, 67.3 (SD,5.5)	Mean, 66.0 (SD, 5.1)	1.4(1.35-1.5)	1.29(1.21-1.37)
Married	97%	61%	1.28(0.5-2.9)	1.18(0.8-1.8)
Years residing in Tehran	Mean,51.8 (SD, 1.4)	Mean, 50.6 (SD, 1.6)	1.0(0.996-1.004)	1.01(1-1.02)
Tehran Nativeness	28%	33%	1.4(1-2)	0.7(0.4-1.1)
Body mass Index(kg/m^2)	Mean, 26.1 (SD,3.9)	Mean, 28.4 (SD, 4.9)	1.0(1.0-1.1)	1.0(0.9-1.0)
Current Smoker	15%	2%	2.1(1.4-3.2)	2.6(0.9-7)
Taking BP medication	15%	29%	2.6(1.1-5.9)	1.0(0.4-2.3)
BP(systolic, diastolic) 140-159 or 90-94 160-199 or 95-99 $\geq 200\ or\ \geq 100$	 22% 11% 9%	 27% 17% 8%	 1.0(0.6-1.5) 1.1(0.9-1.4) 1.1(0.9-1.3)	 0.7(0.4-1.2) 0.8(0.6-1.1) 1.1(0.9-1.4)
Diabetes mellitus	30%	33%	2.3(1.7-3.2)	1.7(1.1-2.7)
Dis-lipoproteinemia	61%	76%	0.9(0.7-1.3)	2.0(1.1-3.5)
Hypertension*	47%	61%	1.3(1.0-1.9)	0.9(0.6-14)
History of MI, stroke or sudden death, in mother's/ sister's/ daughter's past medical history	6%	11%	0.4(0.1-1.4)	1.4(0.7-2.7)
History of MI, stroke or sudden death, in father's/ brother's/ son's past medical history	8%	10%	1.6(1-2.9)	1.4(0.7-2.8)
Prior ischemic heart disease	16%	14%	1(0.6-1.5)	1(0.5-1.7)
Prior non-ischemic heart disease	2%	10%	1.1(0.4-3.5)	1.6(0.8-3.3)

*Diabetes = FBS>126 or 2HPG>200 or Hyperglycemia history.

*Dis-lipoproteinemia = Cholesterol>240 or TG>400 or LDL>160 or HDL<35 or drug consumption.

*Hypertension defined as systolic>=140 or diastole>=90 or having treatment for hypertension.

married, 15% are current smokers, 15% take blood pressure medicines, 30% are diabetics, 61% suffering from dis-lipoproteinemia and 29% take blood pressure medicines, 33% are diabetics, 76% have dis-lipoproteinemia and 61% have hypertension. The results of Cox model including the hazard rates and related 95% confidence intervals for the risk factors with respect to sex are presented in the second part of Table 2. It shows. BMI, smoking, diabetes and dis-lipoproteinemia were found as significant risk factors for women ($P<0.05$) whereas, Tehran nativesness, smoking, diabetes, hypertension and history of MI among siblings were found as significant predictor of life time of men ($P<0.05$).

47% have hypertension. On the other hand as Table 2 shows for females, 61% are married, smoking habit is not the major problem (2%),

Table 3 shows the average reduction in survival time associated with various risk factors. Findings show that diabetic men and women live 4.4 years and 2.5 years shorter than non-diabetics and smoking reduces the life time of men and women 5 years and 6.6 years, respectively. Tehran nativeness 3 years, hypertension 3.3 years, history of MI, stroke or sudden death, in father's/ brother's/ son's past medical history 4.1 years reduce men's lifetime. BMI>33kg/m2 reduces 4.5 years and dis-lipoproteinemia 4 years of women's survival time.

Table 3. Average reduction in survival time associated with various risk factors with respect to sex

Variable	Men (N=929)	Women (N=869)
Tehran Nativeness	3	ns
BMI>33kg/m2	ns	4.5
Smoking	5	6.6
Diabetes	4.4	2.5
Dis-lipoproteinemia	ns	4
Hypertension	3.3	ns
History of MI, stroke or sudden death, in father's/ brother's/ son's past medical history	4.1	ns

ns: Not significant

DICSUSSION

We found that heart diseases have the highest mortality ratio among elderly males and females. In addition we found that diabetes and smoking reduce life span of elderly females and males significantly. BMI>33Kg/m^2 and dis-lipoproteinemia reduce elderly women's life time, while hypertension, history of MI, stroke or sudden death of father, brother or son and Tehran nativeness reduce elderly men's survival time.

Our findings showed that diabetic males and females live 4.4 years and 2.5 years shorter than non diabetics, while the result of Dubbo study shows only 1.5 years reduction of survival time of diabetics either for males or for females. According to our study, smoking reduces 5 years and 6.6 years of life time of males and females while in Dubbo study this reduction is 15 months for males and 22 months for females. Reduction of survival time because of hypertension was found 3.3 years for males in our study and 16 months in Dubbo study, which indicates a considerable and visible poor elderly care system in our society.

The reduction in survival time in elderly citizens demonstrated in the presence of risk factors like smoking, diabetes, dis-lipoproteinemia, obesity and hypertension

highlights a potential benefit to healthy ageing to be gained from prevention and intervention.

As a basic study, we tested the impact of a few factors on survival time while considering cultural and behavioral features of Iranian community there are some other factors like physical activity, diet, quality of life and so on may affect the life time of elderly. Study the impact of interaction of two or more factors on survival time also is left for further studies.

Compared to Dubbo study which reported 54% death for males and 40% for females within 15 years follow up, our study showed a considerable under report of death (17% for males and 10% for females within 10 years follow up). More research in this regard is required.

Assumption of independence of missing data with death event, may not be true. We suggest more investigations for testing the same.

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