Causes and Predictors of Hospital-Death among Elderly Patients in Western Iran; a Hospital-Based Cross-Sectional Study

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Abstract

Introduction: Identifying the death reasons amongst elderly, may help prioritizing the research projects and interventions.

Objective: This study purpose was to determine the death pattern and causes, and also its likely associated factors, in a mega hospital in western Iran.

Method: This retrospective cross-sectional study, conducted on elderly died from April 2011 to March 2016, in Imam Reza hospital in Kermanshah, Iran. The data were collected about the demographic characteristics, medical information, and the main death causes. The causes-of-death was classified adopting the International Classification of Diseases, Tenth Revision (ICD–10). The relationships between outcome and predicting variables were assessed by using Chi-square and Tukey's test in SPSS.

Results: Totally, 2415 died elderly were registered during the study period. The participants mean age at the time of their death was 75.35±9.15 years old. The diseases of circulatory system (dominancy of stroke), infectious diseases (leading by septicaemia and septic shock, respectively), and respiratory system diseases were the most common death causes, respectively. Age was the most important associated factor for the all-cause mortality related to the cardiovascular diseases (p=0.001).

Conclusion: The majority of deaths were the premature, which requires paying more attention. Although, cardiovascular diseases were the leading death causes and that is predictable, but the fatality of infectious diseases is still causing concerns.

Key words: Aged; Death; Epidemiologic Studies; Hospital Mortality; Iran

INTRODUCTION

Aging is a crucial stage in a human's life, which requires special attention and disorders prevention. Because, it is affecting the physical, sexual, psychosocial, economical, and the health dimensions directly and indirectly (1). According to the World Health Organization (WHO) definition, the chronological age group of 65 years old are considered as elderly or older person, however, many researches consider the age group of 60 for less developed countries (2).

Due to the advance medical technics and developed heath care system in all over the world, elderly population growing is unavoidable. Evidence indicates that 461 million people are in the age of 65 years old and above that in 2004, and this population will reach to the 2 billion in all over the world by the year of 2050 (3). Population aging in Eastern Mediterranean Region (EMR) countries including Iran is growing rapidly, due to improving the life expectancy and declining birth rate (4).

Elderly population in Iran increased from 6.7% to 8.2%, during a 5-year period from 2007 to 2011 (5). Iranian elderly population is predicted to have 31.0% increase in 2050 (6, 7).

On the other hand, ageing has changed the epidemiologic diseases pattern, shifting from infectious diseases toward the non-communicable diseases (8). Evidence presents a significant difference in the death causes for older age groups in comparison with younger age groups (9). Increasing elderly population by increasing the age-related disorders number like cardiovascular diseases, cancers, and Alzheimer's disease can intensify adverse consequences and complications such as physical and mental disability dependency and death along with a high care costs (10, 11).

The death rates and the detailed information about people who were died are critical issues for health policy makers, health care givers, and also researchers in order to prioritizing their funding

for health research and interventional programs. Additionally, clarifying death pattern and causes not only can help estimating the burden death and showing the amount of premature mortality, but also indicates the medical mistakes and hospital failures, which resulted in taking more efforts in improving the care quality and quantity of.

We have few information about the causes of in-hospital death, especially related to age causes, particularly for elderly, in Iran. Consequently, this research was conducted in order to examine the in-hospital mortality amongst elderly patients to arrange death pattern and causes, and also about its probable associated factors.

METHODS
Study design and setting
This retrospective cross-sectional study, was conducted on elderly people who died from April 2011 to March 2016, in Imam Reza hospital in Kermanshah, Iran. This hospital is a mega general hospital, with 750 active beds, providing advanced medical and health care services in almost all medical fields. The Research Ethics Committee of Kermanshah University of Medical Sciences (KUMS) approved this study protocol (IR.KUMS.REC.1395.211). In addition, individual personal information has been kept privately.

Study Population
All patients ≥ 60 years old who died in the hospital during this 5-year study period were selected to be included in the study by using census sampling. Those participants with incomplete personal or medical information were excluded.

Instrument and data collection
Data were collected by two trained nurses, and also by using a checklist, which developed based on the study objectives. The checklist was evaluated and approved by expert opinions by cooperating a statistician, an internal specialist medical doctor, and a PhD in public health.

The checklist consisted of three following parts:

(i) Socio-demographic characteristics including age (young old, old and oldest old), gender (female, male), work status (worker or farmer, staff or business, jobless or retired, driver and housewife), marital status (unmarried, married, divorce).

(ii) Medical characteristics including; comorbidity (non, hypertension, diabetes, renal failure, stroke, COPD, heart disease, etc.), admitted ward (ICU, PCCU & CCU, internal medicine, Infection ward, surgical ward, general ward, etc.), hospitalization length (days), and insurance (e.g., private).

(iii) The causes of death, classified adopting the International Classification of Diseases, Tenth Revision (ICD–10).

We attained the data from both paper research records and also electronic medical records (hospital information system) in order to move the bias from abstracting records. Also, the results were examined together with checking the hospital managerial information.

Statistical analysis
Data analysis was performed by using SPSS (Version 23.0; IBM Corporation, Chicago, USA). Variables had normal distribution and were described by using mean ± the standard deviation (SD), and qualitative/categorical expressed as frequencies and percentages. The Chi-square test was used in order to assess any relationship between death causes, and possibly explanatory factors like age, gender, occupation, comorbidity, and marital status. Tukey's test was used for overall comparisons. A p-value with the amount of less than 0.05 was considered as statistically significant.

RESULTS
A total of 4746 deaths were registered during this research period, from them 2415 deaths occurred in persons with the age of 60 years old and more than that. The mean age at the time of death was 75.35±9.15 years old, ranged from 60 to 101 years old. Mean age for females at the time of death was 74.85 ± 8.55 years old, and it was 75.67 ± 9.03 years old for males. Demographic and the patients baseline characteristics were summarized as in the table 1. Nearly about 45.0% of them had the age of less than 75 years old, mostly were (57.4%) male, and approximately 92% married, 38.6% were housewife, and also 30.9% of the participants were jobless or retired. The mean length of hospital stay (LOS) was 4.71 days. About 98.4% had at least one of the comorbidity disease. The most frequent occupied hospital wards by participants were; ICU (29.1%), internal medicine (17.7%) and surgical ward (17.0%), respectively. About 87% of cases had public health insurance.

Causes of death are reported in table 2, due to ICD10. The circulatory system diseases, infectious diseases, and the respiratory system diseases accounted for 47.5%, 18.4%, and 12.4% mortality, respectively. The less responsible cause of death was related to the congenital malformations and chromosomal abnormalities (0.01%).

Stroke was the most common diagnosis, accounting for 10.6% of deaths. Septicemia and septic shock resulted in 9.6% and 8.4% of deaths,

Table 1: General information come from hospital records about patients ≥ 60 years died in Imam Reza Hospital, during 5 years, from 2011 to 2016, west of Iran (n=2415)

Characteristic	Subgroup	Number (%)	Missing data
Age (year)	Young old (60-74)	1081 (44.8)	0 (0)
	Old (75-84)	921 (38.1)	
	Oldest old (≥85)	413 (17.1)	
Gender	Male	1386 (57.4)	15 (0.6)
	Female	1014 (42.0)	
Work status	Worker or Farmer (blue collar)	121 (4.6)	128 (5)
	Staff or business (white collar)	480 (19.9)	
	Jobless or retired	747 (30.9)	
	Driver	7 (0.3)	
	Housewife	932 (38.6)	
Marital status	Single	151 (6.3)	42 (1.7)
	Married	2210 (91.5)	
	Divorce	12 (0.6)	
Comorbidity	None	39 (1.6)	305 (12.6)
	Hypertension	507 (21.0)	
	Diabetes	190 (7.9)	
	Renal failure	120 (5.0)	
	Stroke	89 (3.6)	
	COPD	98 (4.1)	
	Heart disease	161 (6.7)	
	Other	1004 (41.0)	
Admitted ward	ICU	703 (29.1)	25 (1)
	PCCU & CCU	226 (9.3)	
	Internal medicine	427 (17.7)	
	Infection ward	122 (5.1)	
	Surgical Ward	410 (17.0)	
	General Ward	302 (12.5)	
	Others	200 (8.3)	
Length of hospital stay (days)	-	4.71	-
Insurance	Public	2105 (87.2)	114 (4.7)
	Private	196 (8.1)	

Table 2: Causes of death according to ICD10 among elderly patients admitted to Imam Reza Hospital, western Iran 2011-2016 (n=2415)

Causes of death	Number (%)
Diseases of the circulatory system	1146 (47.5)
Infectious & parasitic diseases	445 (18.4)
Diseases of the respiratory system	300 (12.4)
Diseases of the digestive system	143 (5.9)
Diseases of the genitourinary system	116 (4.8)
Neoplasms	97 (4.0)
Diseases of the nervous system	48 (2.0)
Diseases of the blood & blood-forming organs & certain disorders involving the immune system	29 (1.2)
Injury, poisoning & related causes	28 (1.2)
Endocrine, nutritional & metabolic diseases	18 (0.7)
Diseases of the musculoskeletal system & connective tissue	6 (0.2)
External causes of morbidity and mortality	5 (0.2)
Congenital malformations, deformations and chromosomal abnormalities	1 (0.01)
Total	**2415 (100.0)**

respectively. Other death causes were brain hemorrhage by 8.2%, myocardial infarction by 6.7%, and also cardiac arrest by the rate of 4.2%. Less frequent causes of deaths were grouped as others.

The death causes were not significantly associated with gender (p=0.674), occupation (p=0.162), comorbidity (p=0.523), and marital status (p-value= 0.09). Age was significantly associated with the causes of death (p=0.001). According to Tukey's test, the circulatory system diseases were more common in old and oldest population.

DISCUSSION
This retrospective study purpose was to evaluate the major causes of death and the other likely associated factors amongst the Iranian children, in a mega hospital in western Iran, during 2010-2015. We used an open-ended questionnaire developed based on the study's objectives in order to collect

data about patients' socio-demographic and medical characteristics, and their causes of death.

The results presented that the mean age at the time of death was 75.35 years old. Although, this age is quite similar to the life expectancy at birth in Iran, but majority of them are premature death and require to be paid attention. It is plausible that in our study the higher mean age at the time of death is because of the living standards improvement, also along with the better socioeconomic facilities, and community health improvement process (4).

Another important finding in this study was that male deaths constituted 58% of mortality in our results, and also mean age at the time of deaths in males was lower in comparison with the females. The evidences indicated that in-hospital deaths in older males, are more compared to the peer females, and also those females tend to live longer and consequently they would use health-care facility more than males (12).

The study demonstrated that the circulatory system diseases, infectious diseases, and the respiratory system diseases were the top death causes amongst elderly patients based on ICD10, respectively. Our results are in agreement with the earlier research findings. Oppewal and his colleagues reported that the respiratory system diseases and also diseases of the circulatory system, respectively, were the largest group of primary causes of death amongst older people with intellectual disability in Netherlands in 2018 (13). a survey done by Sanya in Nigeria, investigated that the infectious diseases are accounted for most of the mortality rates in 2011 (14). Similarly, Brunnstrom and Englund indicated that the circulatory and respiratory system diseases were the dominating death causes amongst patients with dementia disorders in Sweden by the year of 2009 (15). In a research by Buchow et al. it was shown that the major causes of death are circulatory diseases for the people with the age of 65 years old and older (65+), (16). Reporting circulatory system diseases on the top of mortality causes was predictable; however, the infectious diseases fatality is concerning, and it requires serious attention. In fact, circulatory system diseases (e.g. CVD) are progressively going to become more prevalent in the developing countries, due to the changes in their lifestyle and dietary habits, in consequent upon the influence of western culture.

This study results presented that stroke was the most common death cause. The second and third common diseases were septicemia and septic shock, respectively. The results were in agreement with the earlier researches results conducted by Sanya et al. (14) and Porapakkham et al. (17), which have observed that the most common diagnoses resulted in deaths were stroke and sepsis. Consequently, the intervention and prevention efforts concentrating on the reduction of the growing cardiovascular risk factors tide are recommended. Providing better prevention, early diagnose, and treatment for elderly patients are strongly needed, due to the role of ageing in increasing the serious infectious diseases like septicemia.

This study results indicated that multimorbidity was prevalent in the study population. These results are also consistent with the earlier researches. Schiltz and his colleagues from United States of America, have stated that the multimorbidity was very common amongst the older adults in 2018 (18). A study conducted by Barnett has shown that multimorbidity was frequent amongst those with the age of 65 years old, and those with the age of higher than that in 2012 (19). Up to our knowledge, aging is associated with the physiological changes like some changes in the renal and hormonal regulatory systems, lung function, muscular performance, and energy balance, etc. On the other hand, our study population were with the age of 60 years old and higher than that. Consequently, the high multimorbidity rate in this study might be explained by the possible negative effect of age on the health; the older people are more likely to have age-related disorders.

Additionally, as reported by Nobili et al. we found that the main comorbidity diseases at hospital admission were hypertension, diabetes mellitus, heart disease, and COPD, respectively (20). Similarly, Marengoni et al. from Sweden reported that cardiovascular diseases (e.g. stroke, heart disease, hypertension, etc.) were the most common comorbidity disorders (21). Correspondingly, a research which was conducted by Prince et al. indicated that cardiovascular diseases accounted for 30·3% of the total disease burden in people with the age of 60 years old, and older (11).

This study demonstrated that the age was the most important associated factor for all-cause mortality related to the cardiovascular diseases. We observed that the cardiovascular diseases risks were higher in those with age of older than 75 years old. A study conducted by Blom reported that by increasing age, the cardiovascular diseases risks were also increased (22).

According to the evidence, enlisting the cardiovascular diseases on the top of mortality causes was predictable, however, the infectious

diseases fatality is concerning, and requires serious attention from our health care system as well as researchers. Although, majority of deaths are preventable throughout reducing the cardiovascular risk factors by changing the individuals' lifestyle, but still the infectious diseases need more attention from health service givers. Providing early diagnos and appropriate treatment for elderly patients are strongly recommended, due to the role of ageing in increasing the serious infectious diseases like septicemia.

Limitation

The most important limitation of this study was poor documentation in the past recorded medical information. In order to move the bias from abstracting records, we attained the data from both paper researches records, and also from electronic medical records (hospital information system). Besides, the results were examined along with checking hospital managerial information. Another limitation was lack of detailed patients' information, which might be considered useful in order to examine the associated factors for concluding the study results appropriately.

CONCLUSIONS

The results of our study have shown that asymptomatic patients with PTI with negative initial evaluation, and no deterioration at intervals approaching 1 hour may be sufficient for detection of clinically significant pathology, considered for safe and early discharge. Our study suggests that extending the time between initial and final evaluation to 3 hours in these patients provides no additional significant information that is not available on the 1hour evaluation and shortening the observation period after asymptomatic PTI to 1 hours could be safe, maybe cost-effective, and may help the quality of care benefits in busy EDs.

REFERENCES

1. Lee TW, Ko IS, Lee KJ. Health promotion behaviors and quality of life among community-dwelling elderly in Korea: A cross-sectional survey. Int J Nurs Stud. 2006 Mar;43(3):293-300.

2. Organization WH. Definition of an older or elderly person. 2014.

3. Kinsella KG, Phillips DR. Global aging: The challenge of success: Population Reference Bureau Washington, DC; 2005.

4. Noroozian M. The elderly population in iran: an ever growing concern in the health system. Iran J Psychiatry Behav Sci. 2012 Fall;6(2):1-6.

5. Sadegh Moghadam L, Foroughan M, Mohammadi F, Ahmadi F, Farhadi A, Nazari S, et al. Aging Perception in Older Adults. Salmand. 2016;10(4):202-9.

6. Hosseini SR, Moslehi A, Hamidian SM, Taghian SA. The relation between chronic diseases and disability in elderly of Amirkola. Salmand. 2014;9(2):80-7.

7. Goharinezhad S, Maleki M, Baradaran HR, Ravaghi H. A qualitative study of the current situation of elderly care in Iran: what can we do for the future? Glob Health Action. 2016;9:10.3402/gha.v9.32156.

8. Grundy E. Mortality and morbidity among the old. Br Med J (Clin Res Ed). 1984;288(6418): 663–4.

9. Ruth K, Pring A, Verne J. Variations in place of death in England: inequalities or appropriate consequences of age, gender, and cause of death. Report, National End of Life Care Intelligence Network, London. 2010.

10. Center E-W. The future of population in Asia. East-West Center; 2002.

11. Prince MJ, Wu F, Guo Y, Robledo LMG, O'Donnell M, Sullivan R, et al. The burden of disease in older people and implications for health policy and practice. Lancet. 2015;385(9967):549-62.

12. Redondo-Sendino Á, Guallar-Castillón P, Banegas JR, Rodríguez-Artalejo F. Gender differences in the utilization of health-care services among the older adult population of Spain. BMC Public Health. 2006;6:155.

13. Oppewal A, Schoufour JD, van der Maarl HJ, Evenhuis HM, Hilgenkamp TI, Festen DA. Causes of Mortality in Older People With Intellectual Disability: Results From the HA-ID Study. Am J Intellect Dev Disabil. 2018;123(1):61-71.

14. Sanya EO, Abiodun AA, Kolo P, Olanrewaju TO. Profile and causes of mortality among elderly patients seen in a tertiary care hospital in Nigeria. Ann Afr Med. 2011;10(4):278-83.

15. Brunnström H, Englund E. Cause of death in patients with dementia disorders. Eur J Neurol. 2009;16(4):488-92.

16. Buchow H, Cayotte E, Agafitei L. Circulatory Diseases–Main Causes of Death for Persons Aged 65 and More in Europe, 2009. Eurostat Statistics in Focus 7/2012.

17. Porapakkham Y, Rao C, Pattaraarchachai J, Polprasert W, Vos T, Adair T, et al. Estimated causes of death in Thailand, 2005: implications for health policy. Popul Health Metr. 2010;8:14.

18. Schiltz NK, Warner DF, Sun J, Smyth KA, Gravenstein S, Stange KC, et al. The Influence of Multimorbidity on Leading Causes of Death in Older Adults With Cognitive Impairment. J Aging Health. 2019;31(6):1025-42.

19. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. Lancet. 2012;380(9836):37-43.

20. Nobili A, Licata G, Salerno F, Pasina L, Tettamanti M, Franchi C, et al. Polypharmacy, length of hospital stay, and in-hospital mortality among elderly patients in internal medicine wards. The REPOSI study. Eur J Clin Pharmacol. 2011;67(5):507-19.

21. Marengoni A, Winblad B, Karp A, Fratiglioni L. Prevalence of chronic diseases and multimorbidity among the elderly population in Sweden. Am J Public Health. 2008;98(7):1198-200.

22. Blom J, De Ruijter W, Witteman J, Assendelft W, Breteler M, Hofman A, et al. Changing prediction of mortality by systolic blood pressure with increasing age: the Rotterdam study. Age. 2013;35(2):431-8.