

## A comparison on the ratio of deaths from cardiovascular disease on holidays and working days at Ali-ibn Abi Talib Hospital in Rafsanjan, Iran, in 2010-2014

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### Abstract

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**Background:** Every year, eating, exercise, work, and travel patterns change during the holidays and these behavioral changes at a larger scale may cause death due to cardiovascular disease (CVD). Considering the importance of CVD, the present study was conducted for the first time in Iran to determine the differences in the ratio of deaths due to CVD on holidays and working days.

**Materials and Methods:** This was a descriptive study. The study population consisted of all hospitalized cases of CVD in the city of Rafsanjan, Iran, during the years 2010-2014. Data on individuals were collected through electronic systems available at Ali-ibn Abi Talib Hospital, Rafsanjan. Holidays were specified using the official Iranian calendar and the number of deaths caused by CVD on holidays and working days were extracted. Finally, the collected data were entered into SPSS software and were analyzed using independent t-test, chi-square, and logistic regression model.

**Results:** Within 5 years, about 11124 cases of hospitalizations due to CVD were studied. Among the total hospitalized cases, 993 deaths were reported. Of these cases of death 3.5% occurred on Iranian New Year holidays, 4.5% on Islamic and National holidays, 11.5% on Fridays and 80.5% on the ordinary days of the year ( $P < 0.001$ ). The results of logistic regression model have revealed that after considering the effects of other variables the odds ratio of death due to CVD was 1.913, 1.477 and 1.572 respectively in Iranian New Year holidays, Islamic and National holidays and Fridays compared with the ordinary days of the year.

**Conclusions:** The results of this study showed that the holidays in Iran may have an additive effect in relation to deaths from cardiovascular disease.

**Keywords:** Hospital, Cardiovascular Diseases, Holidays, Iran.

### Introduction

Cardiovascular disease (CVD) is the leading cause of death in most countries. In addition, CVD is associated with significant morbidity and disability. Moreover, CVD is the main cause of death and disability among humans in most countries of the world (1-3). Of the 56 million deaths globally in 2012, 38 million were due to

non-communicable diseases such as CVD, cancer, respiratory disease, and chronic kidney disease (1, 4).

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CVD accounted for the most deaths in 2012 (17.5 million cases of death, meaning 46.2% of all deaths from non-communicable diseases). Moreover, 80% of deaths due to these diseases occur in low and middle income countries. The burden of these diseases is also increasing in low income countries (1). The prevalence of these diseases in developing countries, including Iran, is increasing and the burden of CVD and its consequences are considerable. CVD is the leading cause of death in Iran (5-7). Hypertension, hypercholesterolemia, smoking and reduced physical activities are among the most important risk factors for CVD (8 & 9).

Eating, exercise, work, and travel patterns are factors which affect the incidence of CVD. These factors could be affected by living conditions during the different days of the year. A study in Los Angeles found a higher frequency of deaths due to CVD on holidays and especially on Christmas holidays and the first days of the year (10).

In another study in Los Angeles, it was shown that the rate of deaths from CVD reached its peak during the holidays (11). The role of holidays in the increased incidence of and deaths due to various diseases, including CVD, respiratory diseases, traumatic brain injury, stroke, and suicide, has been considered in studies conducted in Western countries (12-15).

Therefore, on the one hand CVD is the leading cause of death in Iran. Furthermore, CVD imposes a significant social and economic burden on communities and families in Iran (5, 16).

On the other hand, most of the studies on the impacts of holidays on CVD have been carried out in developed countries in which official holidays and weekends are different from Iran. As a result, the present study was conducted for the first time in Iran with the aim to determine the differences in the ratio of deaths due to CVD on holidays and working days.

## Materials and Methods

This descriptive study was conducted in the city of Rafsanjan, Iran. Rafsanjan is one of the major cities of Kerman Province. The target population of this study consisted of all age groups living in the city of Rafsanjan. Subjects included all those who were hospitalized (n = 11124) due to CVD during the years 2010-2014 and their information was collected from Ali-ibn Abi Talib Hospital, Rafsanjan. Ali-ibn Abi Talib Hospital is the largest hospital in Rafsanjan. Demographic data including age, gender, marital status, race, cause of hospitalization, hospitalization date, date of death, and the patient codes were extracted using electronic systems at Ali-ibn Abi Talib Hospital.

The holidays were specified using the official calendar of Iran and the number of deaths caused by CVD on holidays and working days were determined. It should be noted that based on the official calendar of Iran holidays can be categorized as: Iranian New Year holidays, Islamic and National holidays and Fridays which are the weekend holidays. The collected data were encoded based on the holidays and working days and were entered into SPSS software (version 21, SPSS Inc., Chicago, IL, USA) for analysis. The inclusion criteria included admittance to Ali-ibn Abi Talib Hospital in Rafsanjan for CVD from 2010 until the end of 2014. The collected data were analyzed using independent t-tests, chi-square, and logistic regression model.

## Results

Within 5 years, about 11124 cases of hospitalizations due to CVD were studied. Among the total hospitalized cases, 993 deaths were reported. Statistical analysis of demographic data showed that 480 (48.30%) deaths occurred in men and 513 (51.70%) occurred in women. Mean and standard deviation of the age of the deceased was  $71.70 \pm$

13.72. The minimum and maximum age of the male patients was 6 years and 95 years, respectively. The minimum and maximum age of the female patients was 9 years and 93 years, respectively. Mean and standard deviation of

the age of men was  $70.21 \pm 14.73$  and for women was  $73.10 \pm 12.56$ . Table 1 depicts the age and gender distribution of the deceased due to CVD.

**Table 1:** The age and gender distribution of the deceased due to CVD

	Man	Woman	Total
	N (%)	N (%)	N (%)
0-14	4 (0.8)	33 (0.6)	7 (0.7)
15-64	158 (32.9)	97 (18.9)	255 (25.7)
65-74	86 (17.9)	134 (26.1)	220 (22.2)
75-79	82 (17.1)	103 (20.1)	185 (18.6)
80 ≤	150 (31.3)	176 (34.3)	326 (32.8)
Total	480 (100)	513 (100)	993 (100)

Table 2 also depicts the distribution of deceased patients due to CVD based on other variables. Based on this table 3.5% of deaths occurred on

Iranian New Year holidays, 4.5% on Islamic and National holidays, 11.5% on Fridays and 80.5% on the ordinary days of the year ( $P < 0.001$ ).

**Table 2:** Distribution of deceased patients due to CVD based on other variables

Variables	Groups	N	%	P-Value
Marital status	Single	123	12.4	0.001
	Married	837	84.3	
	Divorced	33	3.3	
Holidays/Non-holidays	Iranian New Year holidays	35	3.5	0.001
	Islamic and National holidays	45	4.5	
	Fridays	114	11.5	
	Weekdays (Non-holidays)	799	80.5	
Months	April	87	8.8	0.039
	May	89	9	
	June	77	7.8	
	July	81	8.2	
	August	74	7.5	
	September	71	7.2	
	October	89	9	
	November	67	6.7	
	December	97	9.8	
	January	98	9.9	
	February	100	10.1	
	March	63	6.3	
Years	2010	210	21.1	0.445
	2011	192	19.3	
	2012	194	19.5	
	2013	186	18.7	
	2014	211	21.2	
Race	Iranian	955	96.2	0.043
	Afghan	38	3.8	

Furthermore, the largest proportion of deaths was observed in 2014 (n=210, 21.2%) and the lowest in 2013 (n=186, 18.7%) (P=0.445). Moreover, the largest proportion of deaths occurred in February (n=100, 10.1%) and the lowest in March (n=63, 6.3%) (P=0.039). After the initial analysis, data were analyzed using the logistic regression model. The results showed that after considering the effects of other

variables including: age; sex; marital status and race, death from CVD had a significant relationship with holidays. The odds ratio of death due to CVD was 1.913, 1.477 and 1.572 respectively in Iranian New Year holidays, Islamic and National holidays and Fridays compared with the ordinary days of the year (Table 3).

**Table 3:** Results of logistic regression model on CVD patients

Variables	Groups	OR	95% CI		P-Value
			Lower level	Upper level	
Holidays	Weekdays (Non-holidays)	1			
	Iranian New Year holidays	1.913	1.282	2.854	0.001
	Islamic and National holidays	1.477	1.051	2.075	0.025
	Fridays	1.572	1.255	1.968	0.000
Age	0-14	1			
	15-64	0.254	0.101	0.639	0.004
	65-74	0.714	0.282	1.809	0.478
	75-79	1.472	0.580	3.737	0.416
	80 ≤	2.496	0.988	6.307	0.053
Sex	Woman	1			
	Man	0.848	0.739	0.973	0.018
Marital status	Single	1			
	Married	0.652	0.424	1.003	0.051
	Divorced	0.715	0.447	1.146	0.164
Race	Afghan	1			
	Iranian	0.597	0.413	0.861	0.006

**Discussion**

This study aimed to determine the changes in the ratio of deaths from CVD on holidays and working days. The results showed that after considering the effects of other variables including: age; sex; marital status and race, death from CVD had a significant relationship with holidays. The odds ratio of death due to CVD was significantly higher in Iranian New Year holidays, Islamic and National holidays and Fridays compared with the ordinary days of the year. The results of the present study were consistent with the results of studies conducted

in different countries. A study was conducted in 1988 on 1919 individuals with the aim to investigate the effect of holidays and social relations on death (17). The effects of the seasons and race were considered as confounding factors, and thus, were excluded. The results showed an increase in morbidity in relation to holidays that was consistent with the present study (17).

A study that was performed in America in 1999 showed that the death rate from CVD reached its peak during the winter holidays (18). In this study, the effect of air temperature in the cold

season was not considered. In addition, the average number of deaths was reported; most deaths were reported in the months of December with 1925 cases and January with 1808 cases, which coincides with the New Year and Christmas holidays. The lowest rates were reported in September (1371), June (1402), July (1424), and August (1418). Whilst the results of the present study showed that the largest proportion of deaths occurred in February (n=100, 10.1%) and the lowest in March (n=63, 6.3%).

In a study conducted in Canada in 2001, data from 378991 patients admitted to the emergency ward during the years 1987-1988 were analyzed (19). The results showed that the rate of deaths on weekends was much higher than other days of the week and this result was consistent with the present study (19). A study assessed the relation between death from CVD and Christmas holidays and the first days of the year (20). This study reviewed all deaths with a focus on CVD mortality during a long time interval (1973-2001). The results showed that the number of deaths caused by CVD and the number of deaths from other causes had increased during the Christmas holiday period and the early days of the New Year. In this study, there was a 4.65% increase in deaths from CVDs in the course of the holidays. It also showed that with increase in the duration of the holidays, the death rate also increased. Finally, the researchers concluded that the Christmas holidays and New Year's days could be a risk factor for death from CVD (20).

Based on a study conducted in 2002, a perceptible rise in deaths from CVD was seen on weekends. This study aimed to determine the rates of mortality and hospitalization in connection with the holidays in the South East of England. It examined the hospital admissions in the South East of England during a long period of time (1989-2001). The rate of hospital admissions had declined by 50% and emergency admissions by 20% in relation to the holidays.

The results also showed that despite the decline in admissions, the mortality rate had increased in relation to holidays over the years (15). A retrospective cohort study was conducted in 2002 and data were analyzed for 29084 individuals. Based on the results, higher death rates were also reported on weekends (21).

A study was conducted in 2004 to determine the cause of the higher frequency of cases of heart attack and death from CVD in the months of December and January and whether this difference was due to the decrease in temperature in winter or Christmas holiday and New Year holidays (10). The results showed that during the holidays there was an increase in the proportion of deaths caused by CVD that is consistent with the present study results (10).

In a study conducted in Canada in 2005, data related to the hospitalizations due to stroke in the years 2003-2004 were analyzed. A total of 67627 cases of stroke were hospitalized in 606 hospitals. Of these cases, 24.8% were related to the weekends and 75.2% were related to other days of the week. This study showed that the chances of death from stroke were significantly higher during weekends, which is consistent with the present study (22).

A study was conducted in Kuwait in 2006 with the aim to investigate the effect of the Islamic holidays (Eid Al Fitr) on acute myocardial infarction (AMI) for 6 consecutive years. In this study, a total of 964 admissions with mean age of 55 years were examined during the holiday season. The results showed that the admission rate of AMI in the holiday season had significantly increased (23). These results are consistent with the present study results.

A study was conducted in 2007 in England and it discussed all the cases of death of patients at the emergency wards of public hospitals between 2005 and 2006. The possible confounding factors, such as age, gender, and socioeconomic class, were adjusted. From a total of about 866317 cases admitted to the

emergency room, 54215 cases had died. Of these deaths, 5.2% had occurred on weekends and 4.9% on other days of the week. The results of the study showed that the risk of death was higher during the weekend for all the admissions and were consistent with the results of the present study (24).

Another study was conducted in New Jersey in 2008 to compare death rates from AMI during the weekend and other days of the week for 4 years (2002-2007). In this study, no significant difference was observed in the demographic characteristics of patients admitted on weekends and other days of the week. In the present study, hospitalization had no relationship with gender and age, while it had a significant relationship with marital status. The results of this studies showed that the proportion of deaths was significantly higher on weekends (25).

A retrospective cohort study was conducted in America in 2008, in which data related to patients with heart failure in 18 emergency departments in New Jersey and New York during the years 1996 to 2004 were analyzed. The results of this study showed that there was a significant increase in the admission and visit of patients with heart failure after the Christmas and New Year holiday period. However, most cases of hospitalization in this study were seen in January and February before the New Year holiday (26).

A study was conducted in Australia in 2008 with the aim to determine the seasonal patterns of CVD. The results of this study showed that most deaths occurred during the Christmas holidays and New Year (27). The results of the study by David Phillips et al. in 2010 suggested an increased risk of mortality during the holidays. The aim of this study was to determine the death rate on holidays and working days. The results showed that the rate of death on Christmas and New Year's days, after removing the effects of winter weather, was higher than other days. Finally, the researchers concluded that holidays

can be considered as a risk factor for many diseases in some age groups (28).

A study was conducted in 2010 which examined 24 studies in America, Europe, and Asia. According to the study, patients' admission to the intensive care unit (ICU) during night was not significantly associated with mortality. Admission during the weekend was associated with significant increase in the risk of death (29).

A study conducted in the Netherlands in 2010 investigated the death of ICU patients in association with non-office hours. Data on 149894 patients were analyzed. The results showed no statistically significant difference in the death rate on weekdays between office hours and non-office hours. However, this difference was significant on the weekends compared to the other days of the week. The researchers concluded that hospital deaths increased during weekends, which was consistent with the results of the present study (30).

It should be noted that all mentioned studies had been conducted in countries in which official holidays especially Christmas and New Year holidays, weekends, and other occasions are quite different compared to the New Year holidays, weekends, and other occasions, especially religious occasions, in Iran. However, the results of these studies showed that the proportion of deaths from CVD was higher on holidays compared to working days. Part of the differences in the proportion of death due to CVD on holidays and working days could be due to changes in eating, exercise, work, and travel patterns during the holidays, and these behavioral changes at a larger scale may increase the death risk from CVD (10). Moreover, changes in lifestyle such as excessive consumption of food and beverages, delay in receiving medical care, reduced amount of manpower and healthcare workers at health centers, and increased stress and personal emotions could play a role in the increase in

death rate during the holidays compared to working days. Furthermore, factors such as fatigue of healthcare workers, delay in performing complex diagnostic tests, and delays in the completion of treatment over the weekends could explain the increased mortality proportion (29).

### Conclusion

The results showed that after considering the effects of other variables including: age; sex; marital status and race, death from CVD had a significant relationship with holidays. The odds ratio of death due to CVD was significantly higher in Iranian New Year holidays, Islamic and National holidays and Fridays compared with the ordinary days of the year. Based on the results of this study, the holidays in Iran could be considered as an effective factor in the increase in deaths from CVD. Given that this was the first study which was carried out on this topic in Iran further research in this area is warranted.

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**Conflict of Interest:** None declared

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