ejpmr, 2017,4(12), 22-26

SJIF Impact Factor 4.161

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

DIABETES-RELATED MORTALITY TRENDS IN THE GENDER AND AGE-ADJUSTED AMONG ADULTS IN SOUTH KOREA BETWEEN 2011 AND 2015

Young-Hwan Kwon[1], Hyeong-Ae Bang[2], Myeong-Jin Lee[3] and Won-Chang Lee[4]*

[1]Department of Internal Medicine, Aeromedical Center, Korean Air, Seoul, Korea;.
[2]The Korea Public Health Association/Research Professor of Korea University, Seoul, Korea.
[3]Public Health in Faculty of Health and Nutrition, Otemae University, Osaka, Japan.
[4]Public Health in College of Veterinary Medicine, Konkuk University, Seoul (05029), Korea.

***Corresponding Author: Dr. Won-Chang Lee**

Public Health in College of Veterinary Medicine, Konkuk University, Seoul (05029), Korea.

Article Received on 29/09/2017 **Article Revised on 18/10/2017** **Article Accepted on 08/11/2017**

ABSRACT

Objective: The purpose of this paper is to estimate the epidemiological trends in the gender and age-specific adjusted crude mortality rate (CMR) among Korean adults with diabetes mellitus (DM) by the International Classification of Diseases (Codes of ICD: E10-E14) in the last half-decade between 2011 and 2015. **Methods:** Raw data analyzed in this study were obtained from the website of "the Crude Mortality of Diabetes" of Annual Report on the Cause of Death Statistic between 2011 and 2015 managed by the Korea Statistics Promotion Institute (KSPI). **Results:** There were a total of 10,793 nationwide fatal-cases (FCs) of DM with a CMR of 21.3 per 100,000 populations in 2011, while there were a total of 10,558 FCs with a CMR of 20.5 in 2015; the CMR of DM decreased in 2015 since 2011 ($p<0.01$). The male to female mortality ratio (MFMR) was similar between 2011 and 2015. The distribution of the CMR with DM by age adjusted groups under the 69-year-old groups in 2011 decreased in 2015 ($p<0.01$). However, the age group of over 70-year-old clearly showed higher occurrences in 2015 ($p<0.01$). Trends in FCs and CMR of DM by gender were compared with respect to the 10 key classification of ICD (E10-E14) among men between 2011 and 2015 as follows; DM with ketoacidosis, and renal complications increased in 2015 since 2011, while DM with neurological multiple and unspecified complications decreased ($p<0.01$). During the same period among women, DM with coma renal complications increased in 2015 than those in 2011, while DM with neurological and multiple complications decreased, respectively ($p<0.01$). On the other hand, trends in the age adjusted CMR among adults with DM by the ICD in less than 49 (30-49) year-old age groups between 2011 and 2015; DM with multiple complication was decreased in 2015 than that in 2011 ($p<0.01$), while in over 50 year-old age groups; DM with ketoacidosis, renal, peripheral, other specified, and unspecified complications were statistically significantly increased from 2011 to 2015 ($p<0.05 \sim p<0.01$). **Conclusion:** DM is one of the most severe and relatively common chronic diseases in worldwide including Korea. The number of elderly FCs with a CMR of DM is overwhelmingly increasing in Korea as well as in westernized countries. It is necessary for us to care for the elderly who have DM in order to maintain their function and quality of life.

KEYWORDS: diabetes; fatal cases; gender; age; crude mortality rate; ICD; Korea.

INTRODUCTION

The cases with diabetes is increasing due to population growth, aging, urbanization, westernization of food intake, increasing prevalence of obesity, and physical inactivity.[1,2] Especially, morbidity among Korean adults with diabetes mellitus (DM) and its complications have become a major cause of morbidity and mortality disease.[2-4] Recent in Korea, there were a total of 5,027 nationwide prevalence cases (PCs) with respect to DM with a crude morbidity rate (CMR) of 10.5% in 2011, while there were a total of 4,165 PCs with a crude morbidity rate (CMbR) of 10.6% in 2015; the CMbR of DM increased slightly from 2011 to 2015 in the last half-decade.[3] Therefore, the mortality with DM is becoming a more and more important problems for the health care projects. In Korea, diabetes is still the 5th leading cause of death in the last decade.[2,4,5] On the other hand, in the case of the United States that prevalence of diabetes in 2015, 30.3 million Americans, or 9.4% of the population, had diabetes, and diabetes was the 7th leading cause of death in the U.S. in 2015 based on the 79,535 death certificates in which diabetes was listed as the underlying cause of death. In 2015, diabetes was mentioned as a cause of death in a total of 252,806 certificates.[6]

It is our intention to conduct research on a series of the epidemiological trends in the gender and age-specific adjusted CMR among Korean adults with DM by the

International Classification of Diseases (Codes of ICD-10, WHO, 2016: E10-E14) [7] in the last half-decade between 2011 and 2015, in order to stimulate future strategies for improving the public health sciences.

MATERIAL AND METHODS

Data Extraction

In order to analyze epidemic trends in the mortality of DM among adults (over the age of 30 on death certificates) in Korea between the years of 2011 and 2015, we used raw data of DM obtained from the website by the Korea Health Statistics: Korean National Health and Nutritional Examination Survey (KNHAN VI-3, 2015) by the Korea Center for Disease Control and Prevention (KCDC) [3], and Korea Statistics Promotion Institute (KSPI) (2011-2015): Diabetes. Annual Statistics Report on the Cause of Death, Statistic Korea, 2011 and 2015.[4] The cases of DM in KSPI were classified according to the International Classification of Diseases, tenth revision (ICD-10, WHO; 2016). The code used was for E10-E14; the following fourth-character subdivisions are for use with categories E10-E14: .0 with coma; .1 with ketoacidosis; .2 with renal complications; .3 with ophthalmic complications; .4 with neurological complications; .5 with peripheral circulatory complications; .6 with other specified complications; .7 with multiple complications; .8 with unspecified complications, and .9 without complications, respectively.[7]

Statistical Analysis

In this study, the fatal-cases (FCs) and its distribution, and the crude mortality rate (CMR) per 100,000 populations, male to female mortality ratio (MFMR) were estimated using the criteria established by the WHO, and the upper and lower limits of 95% confidence intervals (CIs) were calculated. Statistically significant differences between the epidemiological aspects and risk factors were determined using the Chi-square test or paired *t*-test, and the data analyses were performed using Excel 2007 statistical software (Microsoft Corp., Redmond, WA, USA). Statistically significant levels were at *p<0.05 and **p<0.01.

RESULTS

Recent trends in the gender and age-specific adjusted CMR among Korean adults with DM between 2011 and 2015 were compared by nationwide, gender and age adjusted group as shown in Table 1. There were a total of 10,793 nationwide deaths (fatal cases: FCs) with a CMR for DM of 21.3 per 100,000 populations in 2011, and a total of 10,558 nationwide CFs with a CMR of 20.5 in 2015; the CMR of DM decreased in 2015 since 2011 (p<0.01). In addition, the CMR of DM among men had significantly decreased from 21.9 per 100,000 in 2011 to 20.4 in 2015 (p<0.01) and that of women was not changed between 2011 and 2015.

The distribution of the CMR among Korean adults with DM by age in 2011 were as follows: in the age adjusted groups of the 30-39, 40-49, 50-59, 60-69 and over 70 years, the CMR of DM were 0.18, 0.68, 2.03, 3.68, and 14.71 per 100,000 populations, respectively (p<0.01), and the CMR of DM by age adjusted groups in 2015 were 0.15, 0.51, 1.70, 2.78, and 15.34 per 100,000 populations, respectively (p<0.01). Moreover, the CMR of DM was the highest in the age adjusted group of over 70-year, and clearly showed a higher occurrence in 2015 than in 2015 (p<0.01) (Fig.1).

Comparative observation of trends in the distribution of FCs and CMR among Korean adults with DM (ICD) by gender between 2011 and 2015 were analyzed and shown in Table 2. The changes in CMR of DM among men were compared with respect to ten key factors (Codes by ICD-10 Version, WHO, 2016) between 2011 and 2015 as follows; DM with ketoacidosis (+0.1), renal (+0.3) complications tended to increase, while DM with neurological (-0.2), multiple (-1.0), unspecified (-0.1) complications, and total CMR of DM (-1.5) decreased in 2015 from 2011, respectively (p<0.01). During the same period among women; DM with coma (+0.1) renal (+0.5) complications tended to increase, while DM with neurological and multiple complications decreased in 2015 from 2011, respectively (p<0.01).

On other hand, trends in the distribution of FCs and CMR among Korean adults with DM by age adjusted for less than 49 and over 50-year-old case groups were compared with respect to ten key factors (Codes by ICD-10 Version, WHO, 2016) between 2011 and 2015. Table 3 shows the changes of CMR in the under-49-year-old cases between 2011 and 2015; DM with multiple complication (-0.33), and the total of MR in T2DM (-0.47) decreased in 2015 from 2011, respectively (p<0.01), while in the over-50-year-old cases were DM with ketoacidosis (+0.1) and renal (+0.5), peripheral (+1.5) other specified (+0.19), unspecified (+0.64) without (+0.79) complications, and the total of CMR in DM (+4.41) tended to increase in 2015 since 2011, respectively (p<0.05~p<0.01).

Table 1: Trends in the gender and age adjusted crude mortality rate (CMR) among Korean adults with diabetes mellitus between 20011 and 2015.

Item	2011		2015	
	FC (%)	CMR (95% CI)	FC (%)	CMR (95% CI)
Nationwide				
Total	10,793	21.3 (20.8-21.8)**	10,558	20.5 (20.1-20.9)
Gender				
Male	5,565 (51.6)	21.9 (21.3-22.5)**	5,250 (49.7)	20.4 (19.8-21.0)
Female	5,228 (48.4)	20.6 (20.0-21.2)	5,308 (50.3)	20.6 (20.0-21.2)
Total	10,793		10,558	
p-value	<0.01		n.s	
MFMR (M/F)	1.06		0.99	
Age adjusted				
30-39	91 (0.8)	0.18 (0.14-0.22)**	77 (0.7)	0.15 (0.12-0.18)
40-49	343 (3.2)	0.68 (0.61-0.75)**	261 (2.5)	0.51 (0.45-0.57)
50-59	1,028 (9.5)	2.03 (1.91-2.15)**	877 (8.3)	1.70 (1.59-1.81)
60-69	1,868 (17.3)	3.68 (3.51-3.85)**	1,434 (13.6)	2.78 (2.64-2.92)
>70	7,463 (69.2)	14.71 (14.4-15.04)	7,908 (74.9)	15.35 (15.01-15.69)**
Total	10,793		10.558	
p-value	<0.01		<0.01	

FC: fatal-cases. CMR: crude mortality rate per 100,000 populations. 95% CI: confident interval of 95%. MFMR: man to female mortality ratio. Statistically significant levels set at *p<0.05 and **p<0.01.

Table 2: Trends in the distribution of fatal cases and CMR among Korean adults with diabetes mellitus (ICD) by gender between 2011 and 2015.

Diabetes mellitus Code (E10-E14)	Male Fatal cases (CMR)		Female Fatal cases (CMR)	
	2011	2015	2011	2015
.0: Coma	147 (0.6)	150 (0.6)	133 (0.5)	142 (0.6)**
.1: Ketoacidosis	98 (0.4)	129 (0.5)**	66 (0.3)	73 (0.3)
.2; Renal complication	818 (3.2)	901 (3.5)**	739 (2.9)	886 (3.4)**
.3: Ophthalmic complication	9	7	5	12
.4: Neurological complication	127 (0.5)**	77 (0.3)	90 (0.4)*	83 (0.3)
.5: Peripheral complication	1321 (5.2)	1266 (4.9)	1289 (5.1)	1370 (5.3)*
.6: Other specified complication	51 (0.2)	59 (0.2)	63 (0.2)	77 ((0.3)
.7: Multiple complication	1477 (5.8)**	1233 (4.8)	1243 (4.9)**	1002 (3.9)
.8: Unspecified complication	468 (1.8)*	439 (1.7)	401 (1.6)	456 (1.8)
.9: Without complication	1049 (4.1)	989 (3.8)	1199 (4.7)	1206 (4.7)
Total	5565 (21.9)**	5250 (20.4)	5228 (20.6)	5308 (20.6)

Footnotes are in Table 1..

Table 3: Trends in the distribution of fatal cases and CMR among Korean adults with DM (ICD) by age adjusted groups between 2011 and 2015.

Diabetes mellitus Code (E10-E14)	Under 49-year-old Fatal cases (MR)		Over 50-year-old Fatal cases (MR)	
	2011	2015	2011	2015
.0: coma	14 (0.08)	16 (0.10)	266 (1.35)	276 (1.53)
.1: Ketoacidosis	39 (0.23)	45 (0.27)	124 (0.63)	157 (0.87)**
.2: Renal complication	70 (0.41)	55 (0.33)	1487 (7.52)	1732 (9.63)**
.3: Ophthalmic comp.	-	-	14 (0.07)	19 (0.11)
.4: Neurological comp.	8 (0.05)	3 (0.02)	209 (1.06)	157 (0.87)
.5: Peripheral comp.	47 (0.27)	40 (0.24)	2559 (12.95)	2596 (14.44)**
.6: Other specified comp.	5 (0.03)	2 (0.01)	109 (0.55)	134 (0.74)*
.7: Multiple comp.	143 (0.84)**	85 (0.51)	2578 (13.04)**	2150 (11.96)
.8: Unspecified comp.	50 (0.29)	39 (0.23)	817 (4.13)	857 (4.77)**
.9: Without comp.	57 (0.33)	56 (0.34)	2197 (11.11)	2139 (11.90)*
Total	433 (2.53)**	341 (2.06)	10360 (52.41)	10217 (56.82)**

Footnotes are in Table 1.

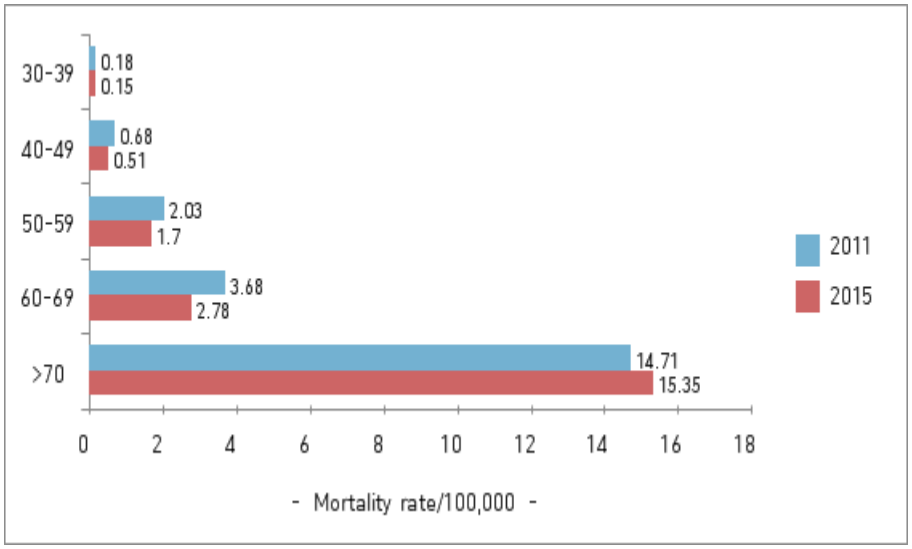

Fig 1: Crude morality rate trends in Korean adults with diabetes mellitus by age-adjusted between 2011 and 2015.

DICUSSION

Over the past three decades in Korea, a trend in the leading causes of death was declined.[5] However, diabetes is still increasing up to now [2-4], while increased crude morbidity and mortality is likely attributable to rapid economic development, improved living standards, aging, urbanization, and increasing prevalence of obesity and physical inactivity.[1,2] Especially, the morbidity of DM is increasing globally and the International Diabetes Federation has predicted that the number of people with diabetes will increase from 366 million to 552 million by 2030.[1,6]

In the case of Korea, the total FCs and CMR of DM in 2015 slightly decreased compared to those in 2011 are shown in Table 1 (p<0.01). In addition, the FCs, CMR and MFMR with DM among men were slightly higher or not than that of women; the latter are statistically not at a significant level. The remarkable, difference of FCs, CMR and MFMR of DM in gender is believed to be due to differences between men and women in terms of lifestyle between the sexes. For example, DM showed a pronounced female excess in the first half of the century but is now equally prevalent among men and women in most populations, with some evidence of male preponderance in early middle age.[8] Recently data have also shown that men develop diabetes at a lower degree of obesity than women a finding which adds support to the view that the pathogenesis of DM differs between men and women. Observation of sex differences in body fat distribution, insulin resistance, sex hormones, and blood glucose levels further support this notion.[1,5,9,10] Moreover, in this study, the distribution of the CFs, CMR and MFMR of DM in the over 70-year-age group was the highest in all age groups between 2011 and 2015 (Fig.1). The remarkable differences of CFs and CMR in older aged people are believed to be due to differences that seem to blur almost imperceptibly into the large mass of elderly patients with non-immune diabetes.[8] For example, in the United States in 2011, 63% of the adults (aged 10-79) with incident cases of diabetes were diagnosed between the ages of 40 and 64 years. About 16% were diagnosed at 18-39 years, and about 21% were diagnosed at 65-79 years.[11]

On the other hand, comparative observation of trends in the distribution of CFs and CMR among Korean adults with DM by gender with respect to the ten key classification of ICD (the following fourth-character subdivisions are for use with category E10-E14: .0-.9) were analyzed and changes among men are shown in Table 2 as follows; DM with ketoacidosis, and renal complications increased in 2015 since 2011, while DM with neurological, multiple, and unspecific complications decreased (p<0.01). During the same period among women, DM with coma, and renal complications were decreased in 2015 since 2011, while DM with neurological, and multiple complications decreased, respectively (p<0.01). The remarkable changes in the CFs and CMR of DM in gender are believed to be due to difference between the sexes.[1,2,8-13] For example, a report stated that men seem more susceptible than women to the consequences of indolence and obesity, possibly due to differences in insulin sensitivity and regional fat deposition. Women are, however, more likely to transmit DM to their offspring.[8] The comparative observation of trends in distribution of CFs and CMR among Korean adults with DM by age adjusted groups between 2011 and 2015 was analyzed and changes among men are shown in Table 3. The changes in the CFs and CMR of DM in the under 49 age adjusted group between 2011 and 2015 were as follows; DM with multiple complication and total CMR of DM were lower in 2015 than that in 2011 (p<0.01), and these of over-50-year-old group; DM with ketoacidosis, renal, peripheral, other specified, unspecified, without complications, and total CMR of DM tended to increase in 2015 since 2011, respectively (p<0.05~p<0.01). However, DM with multiple complications was lower in 2015 than that in 2011 (p<0.01). The remarkable changes in the CFs and

CMR of DM in age adjusted groups are believed to be due to differences between age-specific groups. The most important demographic change to prevalent diabetes appears to be the increased proportion of people who are old-aged.[1-4,13] In the present study, it was obvious that DM decreased significantly in 2015 (10,558 CFs and 20.5 CMR) compared to in 2011 (10,793 CFs and 21.3 CMR). Therefore, control measures should focus on the growing prevalence of DM. Despite much evidence that diabetes can be prevented or delayed with lifestyle changes and weight loss or certain physical and health activities to combat the increasing obesity, and improved longevity, diabetes and prediabetes are expected to dramatically increase more than previously projected.[1,2,12,13]

In conclusion, DM is one of the most severe and relatively common chronic diseases worldwide including Korea. A number of elderly fatal-cases with DM are overwhelmingly increasing in Korea as well as in westernized countries. It is necessary for us to care for the elderly who have DM in order to maintain their function and quality of life.

In this study, we provided a useful quantitative cross-section analysis of recent epidemiological trends in the mortality among Korean adults with DM between 2011 and 2015. It is our hope that this information would be a useful reference for the further studies of diabetes in the field of the public health science.

ACKNOWLEDGEMENTS: All data used in this study were collected by the Korea Statistics Promotion Institute (KSPI) (2011-2015).

Conflicts of Interest: The authors have no conflicts of interest to disclose.

REFERENCES

1. Wild S, Roglic G, Green A, Sicree R, King H. (2004): Global Prevalence of Diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care, 27: 1047-1053.
2. Kim DJ. (2011): Review. The Epidemiology of Diabetes in Korea. Diabetes Metab. J, 35: 303-308.
3. Korea Center for Disease Control and Prevention (KCDC)(2015): Korea Health Statistics: Korea National Health and Nutritional Examination Survey (KNHAN VI-3) 2015. Available at http://www.cdc.go.kr/ (in Korean).
4. Korea Statistics Promotion Institute (KSPI) (2011-2015): Diabetes. Annual Report on the Cause of Death Statistics, Statistic Korea, 2011 and 2015. (in Korea). Available at http://www.stat.or.kr/
5. Lim D, Ha M, Song I. (2014): Trends in the leading causes of death in Korea, 1983-2012. J. Korean Med. Sci, 29: 1597-1603.
6. American Diabetes Association (ADA): Statistics About Diabetes. ADA, Arington, VA. 22202, USA. Available at http://www.diabetes.org/diabetes-basics/statistics/?referrer=https://www.google.co.kr/
7. World Health Organization (WHO): International Classification of Diseases, Reversion (ICD-10)-WHO, 2016. Available at. http://apps.who.int/classifications/cd10/browese/2016/en#/E10-E14/
8. Gale EAM, Gillespie KM. (2001): Diabetes and gender. Diabetologia, 44: 3-15.
9. Kristine F. (2014): Gender and T2DM [internet]. Diapedia, rev. no, 10. Available from: http://dx.doi.org/10.14496/dia.3104972816.10.
10. Green EB, Shen W. (2009) Gender differences in insulin resistance, body composition, energy balance. Gend Med, 6: 60-75.
11. Center for Disease Control and Prevention (CDC) (2015): Distribution of Age at Diagnosis of Diabetes among Adults Incidence Cases Aged 18-79 Years, United State, 2011. CDC 24/7: Saving Lives. Protecting People. http://www.cdc.gov/diabetes/statistics/age/fig1.htm
12. Cho MH. (2010): The Epidemiology of Diabetes in Korea: From the Economics to Genetics. Korean Diabetes J, 34: 10-15.
13. World Health Organization (WHO) (2015): Diabetes, Media Centre, Fact Sheet No 312. Geneva, WHO, 2015.Available at http://www.who.int/mediacentre/factsheets/fs312/en/