

National rates of emergency department visits associated with diabetes in Saudi Arabia, 2011-2015

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Citation: Almalki Z, Albassam A, Alnakhli MA, Alnusyan MF, Alanazi FN, Alqurashi S. National rates of emergency department visits associated with diabetes in Saudi Arabia, 2011-2015. *Ann Saudi Med* 2019; 39(2): 71-76 DOI: 10.5144/0256-4947.2019.71

Received: September 5, 2018

Accepted: February 23, 2019

Published: April 4, 2019

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Funding: None.

BACKGROUND: Despite the fact that diabetes is an important component of the burden of disease on the individual and on the national healthcare systems in Saudi Arabia, knowledge of the volume of emergency department (ED) visits for diabetes is unclear.

OBJECTIVE: Examine changes in ED visit rates associated with diabetes.

DESIGN: Retrospective.

SETTINGS: Governmental hospitals.

METHODS: Publicly available records of health statistics published by the Saudi Ministry of Health from 2011 through 2015 were used to extract data on ED visits related to diabetes. ED visits associated with diabetes were compared over time and by gender. We calculated diabetes-specific rates per 10000 persons for each sex category by dividing the total number of diabetes-associated ED visits in that category by the sex-specific population. We calculated the rate difference (RD) with 95% CI between 2011 and 2015.

MAIN OUTCOME MEASURES: Diabetes-specific rates per 10000 persons for each sex category.

RESULTS: Total annual visits to the ED for management of diabetes increased from 617 683 cases in 2011 to 748 605 in 2015. The annual number of ED visits associated with diabetes increased by 21% over the study period (20% for males and 23% for females). Compared to males, females had a larger increase in visit rates from 240.5 to 249.8 visits per 10000 women over the study years (RD, 9.6 per 10000 persons, 95% CI -16.4 to 26.6 versus 5.7 per 10000 persons, 95% CI-13.6 to 18.3 ; $P=.01$).

CONCLUSION: Although diabetes-associated ED visit rates dramatically increased in 2012, they remained relatively stable after 2012 to the end of the study period. More effective preventive diabetes programs that prevent the use of ED visits and other expensive healthcare resources among people with diabetes are needed.

LIMITATIONS: We had no information on the specific indications for the reported ED visits. These estimates may represent a lower bound on ED visits associated with diabetes since the private sector was not included.

CONFLICT OF INTEREST: None.

Diabetes mellitus has become a serious and common chronic disease that adversely affects all populations in both developed and developing countries.¹ In 2015, the disease affected approximately 415 million people worldwide, and numbers are expected to increase to over 552 million by 2030.² Saudi Arabia is one of the top countries in terms of prevalence of diabetes.³⁻⁵ The prevalence increased from 0.9 million in 1992 to 2.5 million in 2010,⁶ and this number could be 7.5 million in 2035.⁷ This increase has been linked to rapidly changing socio-economic trends, an increased rate of urbanization, unhealthy diets and lifestyles during the past few decades, and the aging of the population.⁸

Diabetes is also having a major economic impact on the Saudi healthcare system. In 2014, the Saudi Arabian Ministry of Health (MOH) spent an estimated \$4.4 billion on direct management of diabetes for Saudi citizens alone, which accounts for 17.5% of the MOH budget.⁹ The spending is expected to be even higher when the prevalence rate of diabetes increases.¹⁰ These cost estimates do not account for indirect costs such as a decrease in productivity of the patient, caregivers, and families. In addition, these costs do not reflect the impact of a lower quality of life.

With the prevalence of diabetes in Saudi Arabia being so high and with substantial individual and government costs of the disease, it is essential to identify how healthcare is utilized by patients with established diabetes. Because diabetes-related events that require ED visits are associated with increased use of healthcare resources and higher medical costs,¹¹ the ED setting is considered an important research setting in studying the effectiveness of preventive interventions and policies in controlling a chronic disease such as diabetes. Furthermore, rates of ED visits may be a more accurate reflection of trends in critical diabetes cases than studies of rates of hospitalizations because the decision to admit a patient to a hospital is multifactorial.^{12,13}

Unfortunately, there is a paucity of available data on the rate of diabetic events requiring ED care, which makes it difficult to understand the situation. For example, a few studies have described the frequency and characteristics of ED visits by diabetic patients in Saudi Arabia; however, extrapolation of findings to individual countries is problematic due to potential selection bias.^{14,15} Thus, this study aimed to examine the changes in diabetes-associated ED visit rates that occurred from 2011 through 2015 in Saudi Arabia. Information on ED visit patterns is essential for planning interventions that may safely ease the costs of this disease and lead to improved outcomes.

METHODS

We performed a retrospective analysis using data from the Health Statistics Yearly Books published by the MOH from 2011 through the most recently published report of the year 2015.¹⁶ The MOH primarily manages the healthcare sector in Saudi Arabia and provides the majority of healthcare. The MOH provides free healthcare at the point of use to 31 million legal Saudi residents across 14 different provinces.¹⁷ The Health Statistics Yearly Books provide information on demographic, economic, and health indicators, reported disease, health resources, activities, and Hajj services for each year. They also provide information on all health services provided to Saudi and non-Saudi patients including visits to the ED for each specific disease.

In this data, the total number of ED visits for a specific disease is reported by number of ED visits made by men and women for each year. For the purpose of this study, only visits associated with diabetes documented in the MOH data (2011-2015) were extracted into a single dataset. We used this dataset to calculate annual ED diabetes visit rates. Although diabetes causes acute and chronic complications,^{18,19} such as cardiovascular disease²⁰ and infectious diseases,²¹ which are significant sources of ED utilization, visits attributed to these complications were not examined due to the lack of this information in Health Statistics Yearly Books.

Statistical analysis

The primary analysis was a descriptive summary of ED visits for management of diabetes. ED visits associated with diabetes were described as counts and as population rates. Visit and rates were stratified by sex categories, male and female. For clarity, estimated visit rates were computed using an algorithm to standardize national rates for both genders. Specifically, we calculated the annual diabetes-specific rates per 10000 persons for each sex category by dividing the total number of diabetes-associated ED visits in that category by the sex-specific population. We used ED visit rates for the years 2011 and 2015 of the study years and calculated the rate difference (RD) between the two years with 95% CIs for the RD. To assess the statistical significance of trends in the proportions of ED visits between 2011 and 2015, we used the Wilcoxon Rank Sum Test. Analyses included 95% CIs. All analyses were performed using SAS 9.4, with $P < .05$ considered statistically significant.

RESULTS

Between 2011 and 2015, an estimated 102.2 million visits were made to EDs across Saudi Arabia. Of these visits, 3.5 percent were due to diabetes-related condi-

tions, most of them made by males (Table 1). As shown in Figure 1, the annual number of diabetes-related ED visits increased from 617 683 cases in 2011 to 748 605 in 2015. This was a 21 percent increase over the study period (20 and 23 percent for males and females, respectively). A substantial portion of this increase occurred from 2011 to 2012 ($\approx 18\%$ average annual percentage increase). ED visit rates fluctuated slightly from 2013 until the end of the study period. Between 2011 and 2015, ED visit rates for management of diabetes increased from 231.3 to 238.5 per 10 000 persons (RD, 7.4 per 10000 persons; 95% CI, -14.8 to 21.9; $P=.02$). Compared to males, females had a larger increase in visit rates from 240.5 to 249.8 visits per 10000 women over the study years (rate difference, 9.6 per 10000 persons, 95% CI -16.4 to 26.6 versus 5.7 per 10000 persons, 95% CI -13.6 to 18.3 ; $P=.01$) (Table 2).

DISCUSSION

Despite the wealth of data on the economic burden of diabetes in developed countries, the extent of this burden as an ongoing public health problem in some developing countries, such as Saudi Arabia, is relatively unknown. In this study, we used national data from MOH to estimate the annual rate of diabetic events requiring ED care. National projections showed the burden of diabetes care in terms of healthcare resource use and costs. The data indicates that the treatment of the disease and its complications is having a catastrophic impact on healthcare budgets and will soon force a tremendous increase in those budgets.

Almost 1 in 11 people in Saudi Arabia had diabetes in 2010, and it is projected that this ratio will increase to almost 1 in 5 people having the disease in 2020.¹⁰ In our study, this condition accounted for a high proportion of the total ED visits (i.e., 3.5% of the total of all-cause ED visits over a period of five years). This finding is within the range of previous multinational reports, which varied from 1.5% to as high as 5.9% for diabetic patients.^{14,15} This rate is the highest in the Middle East and Africa.¹⁵ However, since most mild-to-moderate glycemic events can be treated at home without the assistance of emer-

gency medical services,²² it is important to stress that this number may represent only the “tip of the iceberg” of a serious clinical health problem that requires a higher level of care.²³ Therefore, it is plausible to assume that our results may largely underestimate the total number of diabetes-associated events. However, the results have important resource implications from the viewpoint of ED use, and, for a small number of patients, hospital admission.²⁴

Despite the rapid growth in numbers of patients with diabetes, ED visit trends for diabetes have been stable since 2013. These findings are most likely due to unprec-

Table 1. Overall emergency department visits related to diabetes (2011–2015).

Variable	Total ED visits, no. in millions	Total ED visits associated with diabetes, no. in millions	Percentage of total ED visits (95% CI)
Overall	102.2	3.6	3.5 (3.4 - 3.6)
Sex (%)			
Male	55.5	2.0	3.6 (3.4 - 3.7)
Female	46.7	1.6	3.4 (3.3 - 3.5)

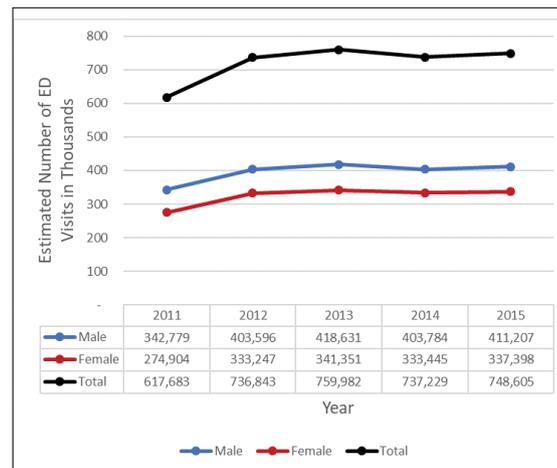


Figure 1. The annual number of diabetes-related emergency department visits.

Table 2. National changes in emergency department visits related to diabetes (2011 to 2015).

	Rate of diabetes-related ED visits, rate per 10 000 persons (95% CI)		Rate difference	P value for trend (2011 to 2015)
	2011	2015		
Total ED visits	231.3 (225.2 - 237.4)	238.5 (238.2 - 238.8)	7.4 (-14.8 to 21.9)	.02
Male	224.3 (218.9 - 229.7)	229.9 (229.7 - 230.1)	5.7 (-13.6 to 18.3)	.04
Female	240.5 (233.5 - 247.6)	249.9 (249.3 - 250.3)	9.6 (-16.4 to 26.6)	.01

edented and ongoing MOH efforts in raising awareness about diabetes and its complications and encouraging screening, prevention and early intervention within the Saudi government plan, a ten-year National Executive Plan (2010 to 2020) to tackle diabetes.²⁵ Pursuant to this plan, MOH established 22 specialized diabetes centers, which have added a great deal to the total capacity. Furthermore, the MOH has instituted a referral process for patients with diabetes, integrating care pathways across the 2281 primary healthcare centers (PHCs), specialized diabetes centers, and 270 diabetes centers and departments in tertiary-care MOH hospitals.²⁶ Although we cannot prove that these efforts actually caused an improvement in the trend of ED utilization to treat diabetes, continuing these efforts may be a promising way to further reduce diabetes complications. Thus, research is needed to examine the impact of these efforts not only on total ED visits, but also on all medical resources impacted by diabetes over time. This would result in more focused interventions or policy changes to improve diabetes management.

Males made more visits to the ED in general and for diabetes-related reasons due to the higher prevalence of diabetes in males compared to females.^{4,5,27-29} On the other hand, our results show that the use of ED per 10000 women was higher than the use per 10000 men and showed an increasing trend between 2011 and 2015. Differences in help-seeking behavior may explain our findings as indicated in other studies.³⁰⁻³² Women suffering from pregnancy-related diabetes mellitus may explain the discrepancy. Despite massive MOH efforts in reducing the national burden of this disease, these efforts might not be enough in the long run as the prevalence of diabetes is projected to increase in the future. Among the non-communicable disease control methods that have been adopted by MOH is moving the healthcare services for these diseases from secondary and tertiary levels to the primary level. This approach might be successful if PHC physicians receive sufficient and proper training for health professionals specifically in diabetes management.³³ In addition, diabetic patients require more specialized medical care,³⁴ thereby warranting a well-administered referral system. In addition, a considerable proportion of people in the country seek emergency care mostly due to convenience or to avoid making an appointment with a PHC or other non-ED care provider.³⁵ MOH can fill this gap by improving access to PHCs, such as implementing online scheduling services and extending clinic open hours (e.g., evenings and weekends) to offer patients greater choice of appointment times.³⁶

With the considerable volume of ED visits associ-

ated with diabetes, the ED should be a key place for delivery of patient education. The volume of visits is an indication of poor diabetes care, which requires diabetes education programs, especially for those who are newly diagnosed.^{37,38} These programs should focus on diabetes self-management,³⁹ since several reviews have found diabetes self-management interventions linked to improvements in clinical, behavioral, and psychosocial parameters,⁴⁰⁻⁴⁶ and thus fewer ED visits.⁴⁷⁻⁵⁰

The main strength of the study lies in the large dataset that covers the majority of the population of diagnosed with diabetes in recent years. However, the study has some limitations. First, the data used in this study did not provide information on patient demographics such as age, and clinical information such as type of diabetes and type of treatment. Second, since the data is administrative data, information on the specific reasons for the reported ED visits and the outcome of these visits were not available. Future research will use the International Classification of Diseases (ICD) when MOH implements the Australian 10th Revision of the Classification (ICD-10-AM ACHI/ACS) at all MOH hospitals in the very near future.⁵¹ The improved understanding of the clinical characteristics and causes of visits to the ED may help physicians in diabetes management, including the need for continuous follow-up. Third, these estimates represent a lower bound on ED visits associated with diabetes because information on the ED visits made in private hospitals is not available.

In conclusion, Saudi Arabia grapples with high rates of diabetes resulting in huge costs in managing this condition and its complications. This study of recent trends of ED visits associated with diabetes in the Saudi population revealed that the rate of ED visits for diabetic patients remained relatively stable after 2012 to the end of the study period. However, because of the compelling evidence that the prevalence of diabetes among the Saudi population will continue to rise in the future,⁵ development and implementation of new and more effective preventive national programs are crucial. For example, there are substantial opportunities within ED settings to intervene by implementing more effective diabetes programs to improve health outcomes among individuals with diabetes and consequently prevent ED use and the use of other expensive healthcare resources.

Acknowledgments

The authors would like to thank the Saudi Association for Scientific Research (SASR) for providing their intellectual, technical and logistical support throughout the duration of the project.

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