

Demographic, Clinical, and Biomedical Profile of Diabetic Patients Receiving Home Healthcare in Saudi Arabia

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Abstract

Background: Identifying characteristics of diabetic patients receiving home healthcare will help in designing services that respond to their conditions and improve their health status and quality of life. The aim of this study was to describe the demographic, clinical, and biomedical characteristics of diabetic patients receiving home healthcare (HHC).

Methods and Results: We used a descriptive cross-sectional design, and data were collected from 251 medical records of diabetic patients in two home healthcare centers in Saudi Arabia. The collected data included demographic, clinical, and biomedical profile variables. The average age was 74.7 ± 11.6 years, with most patients (93.2%) aged 60 or older. The most common treatment modality was multiple daily insulin injections with or without oral medication (38.6%), followed by oral medication with sulfonylurea (19.9%). Pressure injury was the most reported complication/comorbidity, affecting 33.1% of patients. Cerebrovascular disease came next, affecting 20.7% of patients, followed by cardiovascular disease, ischemic heart disease, and nephropathy, affecting 12.3%, 10%, and 6.4% of patients, respectively. Only 4.2% of patients experienced hypoglycemia, and only 5.6% of patients were hospitalized due to diabetes mellitus complications. The mean HbA1c was $7.6 \pm 1.7\%$, with approximately 71.7% of the diabetic patients having $HbA1c \leq 8\%$, and 28.2% with $HbA1c > 8\%$ ($P < 0.0001$). The median (range) low-density lipoprotein was 2.93 (1-317) mmol/L. The median (range) eGFR was 76.6 (9-389) mL/min/1.73m². Around 48% of the population had an eGFR < 60 mL/min/1.73m².

Conclusion: Our findings show satisfactory glycemic control, acceptable LDL levels, low incidence of hypoglycemia, and minimal hospital admissions. (**International Journal of Biomedicine. 2023;13(4):323-328.**)

Keywords: diabetes mellitus • home healthcare • Saudi Arabia • glycemic control

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Abbreviations

CKD, chronic kidney disease; **DM**, diabetes mellitus; **eGFR**, estimated glomerular filtration rate; **HHC**, home healthcare; **HbA1c**, glycated hemoglobin; **LDL**, low-density lipoprotein; **SNDC**, Saudi National Diabetes Center; **SMBG**, self-monitoring of blood glucose; **T2D**, type 2 diabetes.

Introduction

Diabetes mellitus (DM) is a chronic disease that affects approximately 194 million individuals, equivalent to 5.1% of the adult population globally.⁽¹⁾ In Saudi Arabia, the age-

adjusted prevalence of diabetes is currently estimated to be 18.7%, according to the International Diabetes Federation. This high prevalence places the country among the top five in the Middle East and North Africa region⁽²⁾ and the top ten globally.⁽³⁾

DM can cause acute medical crises, such as diabetic ketoacidosis,⁽⁴⁾ as well as long-term complications, including blindness, renal failure, and lower limb amputations.⁽¹⁾ These complications can cause significant suffering for individuals and have a considerable impact on their quality of life and overall health outcomes.^(1,4)

To effectively prevent medical crises and long-term complications associated with diabetes, access to ongoing and timely care is crucial, and flexible follow-up schedules must also be in place to ensure comprehensive management of the disease.^(4,5) However, the access and scheduling limitations associated with traditional clinic-based medical care might hinder the provision of such care.⁽⁵⁾ Consequently, home-based care has emerged as a convenient alternative for the provision of diabetes management, particularly for elderly individuals and patients who are housebound or bed-dependent.

Home healthcare (HHC) is a recognized model of healthcare provision that encompasses a broad range of medical and health services delivered by skilled practitioners in the patient's home.^(6,7) DM is currently listed behind congestive heart failure as the primary diagnosis for admission to HHC.^(7,8) In Saudi Arabia, patients with DM are among the 17 categories that qualify for HHC services provided by the Ministry of Health (MoH).⁽⁹⁾

Numerous studies have evaluated the characteristics of diabetic patients in Saudi Arabia, including their glycaemic control levels.^(3,10,11) However, there is a lack of data regarding diabetic patients who receive HHC. These patients may differ from the general diabetic population, as they may be older and experience mobility restrictions due to underlying conditions. Consequently, there is a pressing need to identify the profile of these patients to determine their current situation and to inform the development of tailored HHC services that enhance their health outcomes and overall quality of life. Therefore, the aim of this study was to describe the demographic, clinical, and biomedical characteristics of diabetic patients receiving HHC.

Materials and Methods

This was a descriptive cross-sectional study conducted in the King Salman Hospital and Medina Home Healthcare Center. In 2005, King Salman Hospital became the first hospital to start providing homecare services in the Riyadh region. Currently, the hospital has 390 patients receiving home healthcare; around 50% of them have DM. The Medina Home Healthcare Center was also established in 2005 and currently provides care to 581 patients, with approximately 86% of them diagnosed with DM. The scope of the services provided under the home healthcare in both centers covers diagnosis, management, and follow-up of patients. Both HHC centers belong to the Saudi MoH and provide HHC services according to the regulations of the General Directorate of HHC in the MoH.

We used anonymized data from the medical records of patients with a diagnosis of DM who were receiving HHC from King Salman Hospital and Medina HHC Center. The

sample included records of all age groups and both sexes. We calculated the sample size assuming a confidence level of 95%, a 50% hypothesized frequency of outcome factor in the population, and a non-response rate of 5%. The resulting sample size of 251 was divided proportionally between the two HHC centers. From each center, the medical records of diabetic patients were selected using the simple random sampling technique.

We collected data using a structured, pre-tested data collection sheet. The demographic variables included patient's age and sex. The clinical profile variables included type of DM, anti-diabetic medications, DM complications/comorbidities, hospital admissions, self-monitoring of blood glucose (SMBG), and retinal examination. The biomedical profile variables included the most recent results of the following laboratory tests: glycated hemoglobin (HbA1c), low-density lipoprotein (LDL), and creatinine level.

Using the HbA1c values, the study population was divided into two categories (HbA1c<8% and HbA1c≥8%) according to the SNDC guidelines for elderly diabetic patients with co-morbidities.⁽¹²⁾ The eGFR was calculated using age, sex, ethnicity, and creatinine level, and the population was grouped based on SNDC guidelines as eGFR <60 or ≥60 mL/min/1.73m².⁽¹²⁾

Statistical analysis was performed using the statistical software package SPSS version 21.0 (SPSS Inc, Armonk, NY: IBM Corp). Baseline characteristics were summarized as frequencies and percentages for categorical variables. For the descriptive analysis, results are presented as mean (M) ± standard deviation (SD) or as median and range (Min-Max). Group comparisons with respect to categorical variables were performed using chi-square test. A probability value of $P < 0.05$ was considered statistically significant.

Ethical considerations

The research was considered exempt from review by the Institutional Review Board (IRB) of Prince Nourah bint Abdulrahman University (IRB registration number 22-1051). This study fully complies with the STROCSS 2021 criteria.⁽¹³⁾

Results

Demographic and Medical Information

We collected data from 252 medical records of eligible diabetic patients with a response rate of 99.6%.

Table 1 presents the demographic information of the study population. The average age was 74.7±11.6 years, with most patients (93.2%) aged 60 or older. Females accounted for 65.3%. Most patients had T2D (Table 2). About half (50.2%) and three-quarters (75.7%) of the patients were bedridden or homebound, respectively. The most common treatment modality was multiple daily insulin injections with or without oral medication (38.6%), followed by oral medication with sulfonylurea (19.9%). About 16% of the patients were managed with a combination of oral anti-diabetic therapy

and basal insulin, and 11.6% were managed with metformin alone. Approximately 7% of patients were not taking any anti-diabetic medication. Most patients (95.2%) performed SMBG (Table 2).

Table 1.

The background characteristics of diabetic patients receiving home healthcare (n = 251)

	Mean (SD)	Median (Min-Max)
Age, years	74.7 (11.6)	75(31-107)
	Frequency	Percent
Age groups		
<60	17	6.8
60 - 74	103	41.0
75 - 89	112	44.6
≥90	19	7.6
Sex		
Male	87	34.7
Female	164	65.3

Table 3.

Diabetes complications/comorbidities among diabetic patients receiving home healthcare (n = 251)

	Frequency	Percent
Complications/comorbidities		
Pressure injuries	83	33.1
Cerebrovascular disease	52	20.7
Cardiovascular disease	31	12.4
Ischemic heart disease	25	10
Nephropathy	16	6.4
Hypoglycemia	12	4.8
Peripheral neuropathy	5	2
Retinopathy proliferative and non-proliferative	4	2.4
Hearing impairment	3	1.2
Other	2	2.8
Readmission for complications		
Yes	14	5.6
No	237	94.4

Diabetes Complications/Co-morbidities

Pressure injury was the most reported complication/comorbidity, affecting 33.1% of patients. Cerebrovascular disease came next, affecting 20.7% of patients, followed by

Table 2.

The medical profile of diabetic patients receiving home healthcare (n = 251)

	Frequency	Percent
Type of Diabetes Mellitus		
Type 1	7	2.8
Type 2	244	97.2
Bedbound		
Yes	126	50.2
No	125	49.8
Housebound		
Yes	190	75.7
No	61	24.3
Treatment		
Oral and basal	41	16.3
Metformin alone	29	11.6
Oral non-sulfonylureas	16	6.4
Multiple daily injection with/without oral medications	97	38.6
Oral medication with sulfonylureas	50	19.9
No medication	18	7.2
Self-monitoring of blood glucose		
Yes	239	95.2
No	12	4.8
Retinal eye examination (last year)		
Yes	7	2.8
No	244	97.2

cardiovascular disease, ischemic heart disease, and nephropathy, affecting 12.3%, 10%, and 6.4% of patients, respectively (Table 3). Only 4.2% of patients experienced hypoglycemia, and only 5.6% of patients were hospitalized due to DM complications.

Biomedical Profile

The mean HbA1c was $7.6 \pm 1.7\%$, with approximately 71.7% of the diabetic patients having $HbA1c \leq 8\%$, and 28.2% with $HbA1c > 8\%$ ($P < 0.0001$). The median (range) LDL was 2.93 (1-317) mmol/L. The median (range) eGFR was 76.6 (9-389) mL/min/1.73m². Around 48% of the population had an eGFR < 60 mL/min/1.73m² (Table 4).

Discussion

The demand for HHC services is increasing rapidly to cater to the needs of the growing elderly population and those suffering from chronic disorders.⁽⁶⁾ This paper presents the population of patients with DM receiving HHC in Saudi Arabia.

Table 4.**The biomedical profile of diabetic patients receiving home healthcare.**

	Frequency	Percent	P-value
HbA1c			
≤ 8%	180	71.7	<0.0001
> 8%	71	28.3	
eGFR			
<60 mL/min/1.73m ²	122	48.6	0.6586
≥ 60 mL/min/1.73m ²	129	51.4	
	Mean (SD)	Median (Min-Max)	
HbA1c	7.6(1.7)	7.3(5-14)	
LDL	11.28 (24.0)	2.93 (1-317)	
eGFR	84.2 (44.9)	76.6 (9-389)	

Background and Medical Information

Our results revealed that most of the study population were elderly, which is expected as the majority of HHC patients are 65 years of age and older.⁽¹⁴⁾ On the other hand, while global patterns suggest that DM affects males more than females,⁽¹⁵⁾ our study found a higher proportion of female patients. However, it is important to note that this gender disparity may be due to the higher demand for HHC services among females rather than a higher susceptibility to DM. As such, it is crucial to ensure the inclusion of female health workers as part of the HHC team.

Our study also revealed that a significant proportion of the study population were bedbound or housebound. These findings underscore the importance of home-based care for diabetic patients with disabilities who need ongoing and timely care to effectively manage their DM.⁽⁵⁾

Diabetes Management and SMBG

Our study revealed a high utilization of insulin alone or in combination with oral medications among the study population; this finding differs from previous studies conducted in Saudi Arabia, which reported a lower use of insulin and a higher use of oral hypoglycemic agents.⁽¹⁶⁾ However, it is important to note that the selection of pharmacological agents for diabetes management is patient-centered, based on their medical condition (life expectancy and risk of hypoglycemia), the risk for side effects, and preferences. The global guidelines for T2D⁽¹⁷⁾ and the SNDC recommend this individualized approach.⁽¹²⁾

For individuals with T2D treated with insulin, clinical guidelines suggest regularly monitoring their BG levels to titrate insulin dosage and avoid hypoglycemia.⁽¹⁷⁾ This practice of SMBG was observed to be high among our study population. This finding contrasts with a previous study in Saudi Arabia that reported lower rates of SMBG among T2D patients treated with oral glucose-lowering drugs alone or in combination with insulin, who receive clinic-based

care.⁽¹⁶⁾ As reported by several studies, HHC can improve BG monitoring and diabetes self-care techniques, leading to fewer hospitalizations and emergency department visits.^(5,18,19) HHC presents a unique opportunity to encourage homebound patients to take charge of their diabetes management.⁽⁸⁾

Diabetes Complications/Comorbidities and Biomedical Profile

Diabetes is associated with multiple complications/comorbidities that can impact its management and influence patient outcomes. Our study revealed pressure ulcers as the most prevalent complication/comorbidity among the study population. Due to their bedridden status, advanced age, and DM, our patients are particularly susceptible to pressure ulcers.^(20,21) These findings underscore the significance of incorporating pressure ulcer prevention and management into diabetes care, with a focus on addressing the contributing factors that predispose patients to this condition.⁽²⁰⁾

Our study also identified cerebrovascular disease, cardiovascular disease, and ischemic heart disease as complications/comorbidities among our patient population. However, the prevalence of cardiovascular and ischemic heart diseases in our study lies toward the lower limit of the range reported from other countries for coronary heart disease in diabetic patients (ranging from 1.8% to 43.4% in population-based studies).⁽¹⁾ The median LDL revealed by our study (2.9 (1-317) mmol/L) was slightly higher than the target of less than 2.6 mmol/L recommended by the Saudi National Dyslipidemia Committee.⁽¹²⁾ Our finding is also consistent with another study conducted in Saudi Arabia, which reported a mean LDL level of 2.7±1.2 mmol/L among diabetic patients receiving clinic-based diabetes care.⁽³⁾ This finding suggests that home-based care could be as effective as facility-based care for dyslipidemia management. However, there may still be room for improvement to reach the target set by the SNDC for LDL.

Additionally, our study identified nephropathy as one of the complications/comorbidities of DM in our patient population's medical records. However, upon calculating the eGFR in this study, we found a significant decline in this marker, indicating a higher prevalence of CKD than what was reported in the medical records. This finding is consistent with previous reports in Saudi Arabia, which suggest that DM is the leading cause of CKD.⁽¹²⁾ In a previous study conducted in Saudi Arabia, more than half of the newly diagnosed patients in dialysis centers had T2D.⁽⁸⁾ Our results underscore the importance of monitoring diabetic patients in the home setting for the early detection of CKD. It is crucial to increase efforts to identify and manage CKD among diabetic patients to prevent disease progression and improve their long-term outcomes.

Only a small proportion of our patients experienced hypoglycemia. This is in contrast to the results of other studies conducted in Saudi Arabia, which reported a prevalence of hypoglycemia as high as 12.5%⁽²²⁾ and 61.9%⁽²³⁾ among patients with T2D. The low prevalence of hypoglycemia in our population could be explained by the old age group and the high practice of SMBG.

The biomedical profile of our patients indicates a mean HbA1c of $7.6 \pm 1.7\%$, with the majority having an HbA1c level of $\leq 8\%$. This is a positive finding considering the population's functional dependency and multiple coexisting chronic illnesses. For a population with such characteristics, the SNDC recommends glycemic goals of HbA1c ranging from 8.0% to 8.5%.⁽¹²⁾

The average HbA1c level revealed by our study was lower than that reported in other studies targeting populations receiving facility-based diabetic care in Saudi Arabia. For example, Alshareef et al.⁽³⁾ reported a mean HbA1c of $8.7 \pm 2.4\%$, while Alramadan et al.⁽¹⁰⁾ reported a mean HbA1c of $8.5 \pm 1.9\%$. This suggests that home-based care may be an effective approach for diabetes management. Studies in many countries have shown that HHC provided to diabetic patients is effective in improving glycemic control.^(5,19) In this context, our study revealed that a relatively small percentage of patients required hospital admission, suggesting that effective home healthcare services were provided to manage their conditions and prevent complications and exacerbations of the disease. This finding is consistent with the primary objective of home healthcare, which is to discharge patients to self or family care while minimizing the need for subsequent hospitalizations, particularly unplanned ones.⁽¹⁸⁾

Limitations of the Study

One of the limitations of this study was the use of secondary data, which may have limited the accuracy and completeness of the data collected. Another limitation is that the study was conducted in only two home healthcare centers in Saudi Arabia and may not be generalizable to other regions.

Conclusion

Our findings show satisfactory glycemic control, acceptable LDL levels, low incidence of hypoglycemia, and minimal hospital admissions. The biomedical profile of diabetic patients receiving HHC reveals a positive finding, with the majority having an HbA1c level of $\leq 8\%$ and LDL median of 2.9 (1-317) mmol/L. However, eGFR level had declined, necessitating early detection and management of CKD. Pressure ulcers, cerebrovascular disease, cardiovascular disease, and ischemic heart disease were the most common complications/comorbidities among diabetic patients, requiring the inclusion of services targeting these conditions. The most common treatment modality was insulin with or without oral medication, and there is a high level of SMBG and a low hospital admission rate. Further studies are needed to assess the quality of care provided to diabetic patients in the home setting.

Competing Interests

The authors declare that they have no competing interests.

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