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Quick Response Code:

Website: www.jfcmonline.com

DOI: 10.4103/jfcm.jfcm_139_23

The prevalence and predictors of diabetes in a private health insurance scheme: An analysis of three million beneficiaries in Saudi Arabia

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Received: 30-05-2023
Revised: 30-10-2023
Accepted: 13-11-2023
Published: 08-01-2024

Abstract:

BACKGROUND: Noncommunicable diseases (NCDs) are a leading threat to population health in Saudi Arabia. Addressing NCDs is a priority for health-care transformation, and understanding the current disease prevalence is crucial. The prevalence in other settings is unknown because studies have relied on data from households or public health-care institutions. This study aims to investigate the prevalence and predictors of diabetes in the privately insured population.

MATERIALS AND METHODS: This retrospective study explored the prevalence and predictors of diabetes in beneficiaries aged 15 years or older who sought medical care in 2022. Data were sourced from the National Platform for Health and Insurance Exchange Services, a unified health insurance claim platform. We used the International Classification of Disease-10 to capture the condition. To identify predictors of diabetes, we employed a backward selection approach for logistic regression.

RESULTS: Over 3.3 million beneficiaries sought medical care during the study. The population was relatively young aged 26–39 years, (47.5%) and two-thirds of males. The prevalence of diabetes was 11.0% and varied across regions, with the highest in Bahah (18.4%) and the lowest in Jizan (9.5%). Age, gender, nationality, insurance company size, body mass index, region, hypertension, and coronary heart disease were significant predictors of diabetes. Hypertensive patients were over five times more likely to have diabetes than those without hypertension (odds ratio OR = 5.08; 95% confidence interval CI = 5.02–5.24). Saudis were 30% more likely to have diabetes than other nationalities (OR = 1.3; 95% CI = 1.28–1.31).

CONCLUSION: We found a higher prevalence of diabetes in privately insured beneficiaries than the recent national estimate. This necessitates population health management strategies at all levels (primary, secondary, and tertiary) to mitigate the burden of diabetes in privately insured individuals. This study provides valuable baseline data for the prevalence of diabetes in this population and emphasizes the urgent need for targeted interventions, especially in regions with a higher prevalence.

Keywords:

Diabetes, epidemiology, prevalence, private health insurance, risk factors, Saudi Arabia

Introduction

Noncommunicable diseases (NCDs) threaten population health in many countries, Saudi Arabia not excepted.[1] Of the many NCDs, diabetes mellitus (DM) is of growing concern because of its prevalence and association with adverse health outcomes, such as cardiovascular disease, renal disease, eye and nerve damage, and mortality.[2,3] Various risk factors of DM,

How to cite this article: Aljehani N, Alghnam S, Alqunaibet A, Alwahabi S, Reka H, Almohammed R, *et al*. The prevalence and predictors of diabetes in a private health insurance scheme: An analysis of three million beneficiaries in Saudi Arabia. J Fam Community Med 2024;31:36-41.

such as sedentary lifestyle have increased. As a result, the disease has increased in prevalence in the past several decades.[4-9] Nevertheless, there are no consistent estimates for its prevalence in Saudi Arabia, as the latest published estimate from the Ministry of Health hovers around 8.0%. In contrast, early national estimates suggest that as many as 13.2% of adults have DM.[4,9]

The Saudi Vision 2030 has prioritized NCDs to improve population health, life expectancy, and quality of life.[10] As a part of the Vision, the Saudi Council of Health Insurance (CHI), the regulatory body tasked with regulating health insurance in Saudi Arabia, has devised a Population Health Management strategy focusing on five conditions over the next 5 years.[10] The targeted conditions include DM, hypertension, obesity, coronary heart disease (CHD), and smoking.

Several lines of evidence suggest that understanding the underlying burden of DM in various population segments is vital for the provision of adequate health-care resources.[11,12] Privately insured individuals in Saudi Arabia may differ from the overall population in terms of age, gender, or other factors owing to being on employer-based compulsory health insurance. This population represents 32% of the overall population, with more than 11 million beneficiaries, with prospects of this population increasing to 22 million beneficiaries by 2030.[13] Therefore, understanding the disease burden of this population is crucial to moving a reactive curative health-care model to a proactive one that focuses on population health. Thus, epidemiological data are needed to set the underlying burden of various population segments and monitor the trend over time. National surveys by the Ministry of Health provide insights into the overall burden.[4] However, they are resource-intensive, time-consuming, and capture only a broad snapshot without segmenting the population.[14] Thus, utilizing secondary data sources to examine disease burden has gained interest in recent years.[15] With its large target population, CHI represents the most significant source of administrative data on disease prevalence in the country without national surveys.

Despite the importance of understanding the underlying burden of DM in various population segments in Saudi Arabia, all studies have examined the prevalence of DM using data from governmental hospitals. In particular, the prevalence in private healthcare settings has not been examined;[16,17] although there have been several studies using data from governmental hospitals. Considering the rise in the prevalence of DM and the associated adverse health outcomes, the magnitude of the difference between the insured and the total population, the lack of consistent estimates of the prevalence of DM, particularly in the private sector context, the examination of the prevalence, and burden of DM in the private sector is urgent.

Therefore, the aim of the present study was to describe the prevalence and risk factors for DM of privately insured beneficiaries in Saudi Arabia. Of particular importance is the understanding of disease prevalence in different segments of the population, including non-Saudi workers. This group represents the majority of beneficiaries covered under CHI. Findings from this study can inform policymakers, clinicians, and researchers about the underlying burden to guide prevention programs that can improve health outcomes and reduce health-care expenditures.

Materials and Methods

This retrospective study examined individuals with private health insurance coverage from January 1 to December 31, 2022. The investigation focused on those who sought medical care and for whom hospitals submitted health insurance claims for services provided during that year. In 2022, there were 24 health insurance companies varying in size from small firms insuring a few thousand beneficiaries to major corporations covering millions. We classified insurers as large (more than 500,000 beneficiaries) and small or medium (<500,000 beneficiaries). In fact, the two largest companies insured over half of the covered population in 2022. Ethical approval was obtained from the Institutional Review Board vide letter No. IRB/0589/22 dated 17/03/2022 with a waiver of informed consent since there was no direct contact with human subjects in this study.

Data for the study were sourced from the National Platform for Health and Insurance Exchange Services (NPHIES), a unified health insurance claim platform.[18] NPHIES is a standardized platform that processes all health insurance claims based on a mandatory Minimum Data Set (MDS). The MDS includes patient-level information on diagnosis, procedures, medications, and claim values.

A diabetic patient was identified as having an International Classification of Disease 10 diagnosis of DM (ICD = E10-E14, excluding gestational diabetes). All types of DM except for gestational diabetes were included in the study and further stratified during the analysis.

Data were extracted from the electronic database of the CHI. Microsoft® Structured Query Language was employed to determine cases based on predefined ICD-10 codes for diagnosis. Demographic variables such as age, gender, nationality, insurance provider, and region were also extracted. Furthermore, clinical parameters such as weight, height, hypertension (ICD-10: I10-I15), and CHD

were obtained. Cardiac patients are those diagnosed with ischemic heart diseases using the ICD-10 codes: I20-I25. We calculated body mass index (BMI) based on weight and height variables extracted from the NPHIES database. The equation is the weight (in kg) divided by height (in meters squared). The latest measurement was used because it was possible that the database included all the weight and height measurements for every visit to a health-care facility. Subjects were categorized using the Centers for Disease Prevention and Control as underweight (BMI <18.5), normal (BMI = 18.5–24.9), overweight (BMI = 25–29.9), or obese (≥30).[19]

STATA 17 (StataCorp LLC, College Station, TX) was utilized as the Statistical Package for all Statistical Analyses. Descriptive statistics and frequency tables were generated to characterize the demographics and disease prevalence in the population. Chi-square tests and Cramer V estimates were calculated by diabetes status and presented. Region-specific prevalence rates were calculated for each region and compared with the national estimates from the latest Ministry of Health World Survey.[4]

A logistic regression model with a backward selection approach was constructed to identify DM predictors. This method includes all potential predictors, retaining those below the statistical threshold. Insurance category was not considered in the regression model as it could reflect the underlying population served rather than being a predictor of DM. The cutoff for maintaining variables in the model was a $P < 0.1$. Age, gender, BMI, CHD, hypertension, insurance provider, and region were all treated as categorical variables in the model. A $P < 0.05$ was established as the cutoff for statistical significance.

Results

Over 3.3 million beneficiaries sought medical care during the study period. The population was relatively young (26–39 years, 47.5%), and around two-thirds were males [Table 1]. Of those with complete weight and height data, 38.2% were overweight and 36.4% were obese patients. Over 400 thousand (11.0%) were seen by a physician for diabetes-related conditions. Those with DM were more likely to be older males, and a little over half were non-Saudis. In addition, over a third of the diabetic population was obese, whereas the prevalence of obesity among nondiabetics was 17.9% ($P < 0.01$). Around 45.7% of the patients had missing weight or height information. Diabetic individuals were also more likely than nondiabetics to suffer from other conditions such as hypertension (44.5% vs. 6.1%, $P < 0.01$) and CHD (8.6% vs. 1.2%, $P < 0.01$). Cramer's effect size ranged between 0.0 in nationality to 0.4 in hypertension [Table 1].

There was a variation in the prevalence of DM in the regions in Saudi Arabia [Figure 1]. The highest prevalence of DM was in the Bahah region (18.4%), whereas the lowest was in Jizan (9.5%). Whereas the high estimate in Bahah was consistent with the national average, the lowest prevalence was not. The prevalence of DM in the Western regions was similar (Makkah = 13.5% and Madinah = 14.2%) but slightly lower in the Eastern Region (12.8%).

In the regression analysis, all variables included in the initial model remained significant and were retained in the final model [Table 2]. Patients aged 40–64 years were over six times more likely to suffer from DM than those between 15 and 18 (odds ratio [OR] =6.2; 95% confidence interval [CI]: 5.9–6.5). On the other hand, a much smaller effect was found when males were 10% more likely to suffer from DM than females. Higher BMI was significantly associated with increased odds of DM. Obese patients were three times more likely to suffer from DM than those underweight (OR = 3.0; 95% CI: 2.8–3.1). Moreover, hypertension was associated with five-fold increased odds of DM compared with those without hypertension (OR = 5.1; 95% CI: 5.0–5.2).

Discussion

We found a higher prevalence of DM than the recent national estimate reported in Saudi Arabia. This is concerning because it is expected that since the younger and working population constitutes most of the insured population, their health should be better than the overall population. Nevertheless, reports before 2019 in Saudi Arabia suggested a higher DM prevalence than 8.0%.[9] Nonetheless, population health management approaches are needed to facilitate prevention at all levels of the privately insured population (primary, secondary, and tertiary).[20]

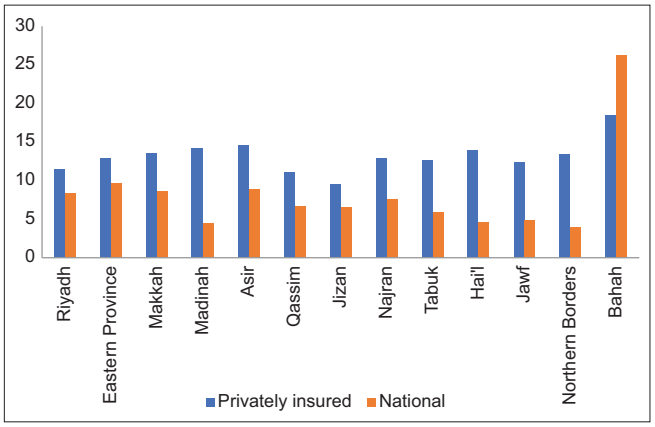

Figure 1: The prevalence of diabetes mellitus in the 13 regions of Saudi Arabia compared to the estimates reported in the Ministry of Health in 2019

Table 1: Descriptive characteristics of the study population by diabetes status

Characteristics	Non-DM (*n*=2,952,429) *N* (%)	Diabetic (*n*=401,750) *N* (%)	Total (*n*=3,354,179) *N* (%)	Cramer V	*P-value*
Age					
15–18	112,305 (4.0)	2397 (0.6)	114,702 (3.6)	0.33	<0.01
19–25	348,506 (12.6)	8264 (2.1)	356,770 (11.3)		
26–39	1,424,887 (51.3)	79,229 (20.3)	1,504,116 (47.5)		
40–64	816,538 (29.4)	238,184 (61.1)	1,054,722 (33.3)		
≥65	74,170 (2.7)	61,682 (15.8)	135,852 (4.3)		
Gender					
Female	1,115,615 (37.8)	133,339 (33.2)	1,248,954 (37.2)	0.03	<0.01
Male	1,836,814 (62.2)	268,411 (66.8)	2,105,225 (62.8)		
Nationality					
Non-Saudi	1,528,227 (51.8)	206,745 (51.5)	1,734,972 (51.7)	0.00	<0.01
Saudi	1,424,202 (48.2)	195,005 (48.5)	1,619,207 (48.3)		
Insurance size					
Large	2,068,031 (70.0)	290,280 (72.3)	2,358,311 (70.3)	0.01	<0.01
Small and medium	884,398 (30.0)	111,470 (27.7)	995,868 (29.7)		
BMI category					
Underweight	29,919 (1.0)	886 (0.2)	30,805 (0.9)	0.14	<0.01
Normal	398,081 (13.5)	33,006 (8.2)	431,087 (12.9)		
Overweight	602,692 (20.4)	93,480 (23.3)	696,172 (20.8)		
Obese	527,902 (17.9)	135,198 (33.7)	663,100 (19.8)		
Missing	1,393,835 (47.2)	139,180 (34.6)	1,533,015 (45.7)		
Hypertension					
Nonhypertensive	2,773,153 (93.9)	222,822 (55.5)	2,995,975 (89.3)	0.40	<0.01
Hypertensive	179,276 (6.1)	178,928 (44.5)	358,204 (10.7)		
CHD					
Non-CHD	2,918,218 (98.8)	367,013 (91.4)	3,285,231 (97.9)	0.17	<0.01
CHD	34,211 (1.2)	34,737 (8.6)	68,948 (2.1)		

CHD=Coronary heart disease, BMI=Body mass index, DM=Diabetes mellitus

This is the first analysis of the privately insured population of Saudi Arabia. Because prior literature suggests that the prevalence of DM has increased in the past few decades, continuous monitoring of the prevalence and its associated predictors is vital to addressing the disease.[4-9] While this is the first attempt to capture those with private insurance, our findings may underestimate the actual burden of DM because it is likely that some of these patients receive care in governmental health-care facilities. However, as a part of the health-care transformation in Saudi Arabia, this double eligibility is expected to disappear with the implementation of Article 11 in CHI, which states that any health benefits provided by government facilities are to be covered by the insurance provider.[21] Differences from previous reports may be due to differences in the underlying population or a change in the underlying disease burden. A study by Alghnam *et al*., suggests that the prevalence of DM is around 18% among beneficiaries in a public health-care system.[3] Unfortunately, DM is expected to increase in Saudi Arabia if there are no significant interventions to reduce its risk factors such as obesity.[22]

In our study, obesity was found to be higher than the national findings. Previous local literature has found it associated with many conditions, such as DM and cardiovascular diseases. A study of those aged 35–70 years suggested that one-half of this age group was obese, and over a third was overweight.[23] There is a pressing need to address obesity in the privately insured population to reduce its impact on the incidence of NCDs. Equally important is improving data quality and completeness, as over 40% of the study population had missing values.

This study has several implications. First, health insurance regulators may use this finding to further enhance current prevention and disease management strategies to reduce the impact on population health. Second, other agencies, such as Public Health Authority, can complement these efforts by working with providers to introduce various effective interventions and measure their effects to reduce the risk of DM and other chronic conditions. One of the primary goals of the transformation is to reduce the prevalence of diabetes and obesity between 2016 and 2030.[13] Therefore, the already devised population health management approaches should be part of the qualification requirements to facilitate prevention in the privately insured population at all levels (primary, secondary, and tertiary).[20]

Table 2: Logistic regression analysis: factors associated with diabetes in the privately insured population in Saudi Arabia

Variable	OR (95% CI)
Age	
≤18	Reference
19–25	1.04 (0.98–1.09)
26–39	1.9 (1.80–1.99)
40–64	6.2 (5.90–6.54)
≥65	12.3 (11.66–12.90)
Gender	
Female	Reference
Male	1.10 (1.09–1.10)
Nationality	
Non-Saudi	Reference
Saudi	1.30 (1.28–1.31)
Regions	
Riyadh	Reference
Asir	1.32 (1.25–1.40)
Bahah	1.34 (1.18–1.52)
Eastern province	1.06 (1.05–1.08)
Ha'il	1.20 (1.1–1.3)
Najran	1.13 (1.04–1.24)
Makkah	1.15 (1.09–1.17)
Madinah	1.20 (1.16–1.24)
Jazan	0.92 (0.83–1.02)
Northern borders	0.98 (0.84–1.14)
Alqasim	1.00 (0.98–1.09)
Tabuk	0.89 (0.80–0.99)
Jawf	0.94 (0.80–1.11)
BMI category	
Underweight	Reference
Normal	1.6 (1.50–1.68)
Overweight	2.1 (1.9–2.25)
Obese	3.0 (2.8–3.18)
Hypertension	
Nonhypertensive	Reference
Hypertensive	5.08 (5.02–5.24)
CHD	
Non-CHD	Reference
CHD	1.83 (1.79–1.89)

CHD=Coronary heart disease, BMI=Body mass index, OR=Odds ratio, CI=Confidence interval

The observed regional variation in DM prevalence underscores the need for targeted interventions and public health programs to address the underlying risk factors that contribute to the growing prevalence of DM in Saudi Arabia. Further research is needed to understand the reasons behind the regional differences in DM prevalence and identify effective prevention strategies tailored to the specific needs of different regional and population groups. In addition, future studies should focus on evaluating the impact of prevention programs to reduce the burden of DM and improve population health in Saudi Arabia.

This is the largest epidemiological study investigating DM in Saudi Arabia. While many previous studies relied on self-report measures of DM, we utilized health insurance claims where services related to DM were rendered. Despite the strengths of this study, we must acknowledge some limitations. First, our analysis is based on those who visited a health-care facility and represented a portion of the population. Therefore, it is not unlikely that those seeking medical care might be sicker than those who did not seek healthcare. On the other hand, our study does not capture undiagnosed diabetics. According to previous reports, these patients represent a sizable section of the DM population.[9] The cross-sectional nature of the present analysis does not imply causality as some factors such as hypertension may have arisen after becoming diabetic. Finally, although the large sample size is a strength of the study, this might have revealed some small differences that are not truly meaningful. However, the inclusion of the logistic regression approach deals with the quantifying measures of association for the various variables, which were consistent with prior literature.

Conclusion

The study provides a baseline for the prevalence of DM in the privately insured population. Future studies should evaluate prevention strategies to reduce the burden of DM on population health in Saudi Arabia.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Alqunaibet A, Herbst CH, El-Saharty S, Algwizani A, editors. Noncommunicable Diseases in Saudi Arabia. Riaydh: World Bank; 2021. Available from: https://openknowledge.worldbank.org/bitstream/handle/10986/36546/9781464817175.pdf?sequence=2&isAllowed=y. [Last accessed on 2023 Jun 20].
2. Aggarwal A, Patel P, Lewison G, Ekzayez A, Coutts A, Fouad FM, *et al.* The profile of non-communicable disease (NCD) research in the Middle East and North Africa (MENA) region: Analyzing the NCD burden, research outputs and international research collaboration. PLoS One 2020;15:e0232077.
3. Alghnam S, Alessy SA, Bosaad M, Alzahrani S, Al Alwan II, Alqarni A, *et al.* The association between obesity and chronic conditions: Results from a large electronic health records system in Saudi Arabia. Int J Environ Res Public Health 2021;18:12361.
4. World Health Survey of Saudi Arabia. Riyadh, Saudi Arabia; 2019.
5. Bacchus RA, Bell JL, Madkour M, Kilshaw B. The prevalence of diabetes mellitus in male Saudi Arabs. Diabetologia 1982;23:330-2.
6. Fatani HH, Mira SA, el-Zubier AG. Prevalence of diabetes mellitus in rural Saudi Arabia. Diabetes Care 1987;10:180-3.
7. El-Hazmi MA, Al-Swailem A, Warsy AS, Al-Sudairy F, Sulaimani R, Al-Swailem A, *et al.* The prevalence of diabetes mellitus and impaired glucose tolerance in the population of Riyadh. Ann Saudi Med 1995;15:598-601.
8. Anokute CC. Epidemiologic studies of diabetes mellitus in Saudi

Arabia – Part I – Screening of 3158 males in King Saud University. J R Soc Health 1990;110:201-3.
9. El Bcheraoui C, Basulaiman M, Tuffaha M, Daoud F, Robinson M, Jaber S, *et al.* Status of the diabetes epidemic in the Kingdom of Saudi Arabia, 2013. Int J Public Health 2014;59:1011-21.
10. Hasbrouck L, Alghamdi S. With Contributions from the Medical Consulting Team. The Council for Cooperative Health Insurance. Riyadh, Saudi Arabia; 2021. Available from: https://chi.gov.sa/ResearchLibrary/CCHI Population Health WP.pdf. [Last accessed on 2023 Jun 20].
11. Almalki ZS, Albassam AA, Alnakhli MA, Alnusyan MF, Alanazi FN, Alqurashi MS. National rates of emergency department visits associated with diabetes in Saudi Arabia, 2011-2015. Ann Saudi Med 2019;39:71-6.
12. Al Slamah T, Nicholl BI, Alslail FY, Harris L, Kinnear D, Melville CA. Correlates of type 2 diabetes and glycaemic control in adults in Saudi Arabia a secondary data analysis of the Saudi health interview survey. BMC Public Health 2020;20:515.
13. Reka H, Almagrabi A, Alghamdi S. Value-Based Health Care in Saudi Health Insurance Market. Riyadh: Saudi Arabia; 2022. Available from: https://chi.gov.sa/ResearchLibrary/CCHI Population Health WP.pdf. [Last accessed on 2023 Jun 20].
14. Kennedy JM, Vargus B. Challenges in survey research and their implications for philanthropic studies research. Nonprofit Volunt Sect Q 2001;30:483-94.
15. Perlman SE, McVeigh KH, Thorpe LE, Jacobson L, Greene CM, Gwynn RC. Innovations in population health surveillance: Using electronic health records for chronic disease surveillance. Am J Public Health 2017;107:853-7.
16. McPherson K, Marsh T, Brown M, Soiza RL, Donaldson AI, Myint PK, *et al*. The Saudi abnormal glucose metabolism and diabetes impact study (SAUDI-DM). BMJ Open 2020;11:211-8.
17. Al-Rubeaan K, Youssef AM, Ibrahim HM, Al-Sharqawi AH, AlQumaidi H, AlNaqeb D, *et al.* All-cause mortality and its risk factors among type 1 and type 2 diabetes mellitus in a country facing diabetes epidemic. Diabetes Res Clin Pract 2016;118:130-9.
18. What is NPHIES? 2021. Available from: http://www.cchi.gov.sa/en/Uniplat/Pages/default.aspx. [Last accessed on 2021 Jan 03].
19. Defining Adult Overweight and Obesity. Overweight and Obesity. Available from: https://www.cdc.gov/obesity/basics/adult-defining.html. [Last accessed on 2023 Jun 20].
20. Hewitt AM, Mascari JL, Wagner SL. Population Health Management: Strategies, Tools, Applications, and Outcomes. USA, Springer Publishing Company, 2021. p. 300.
21. Rules and Regulations of Health Insurance in Saudi Arabia; 2019. Available from: https://chi.gov.sa/en/AboutCCHI/Rules/Pages/default.aspx. [Last accessed on 2023 Jun 20].
22. Coker T, Saxton J, Retat L, Alswat K, Alghnam S, Al-Raddadi RM, *et al.* The future health and economic burden of obesity-attributable type 2 diabetes and liver disease among the working-age population in Saudi Arabia. PLoS One 2022;17:e0271108.
23. Alhabib KF, Batais MA, Almigbal TH, Alshamiri MQ, Altaradi H, Rangarajan S, *et al.* Demographic, behavioral, and cardiovascular disease risk factors in the Saudi population: Results from the Prospective Urban Rural Epidemiology study (PURE-Saudi). BMC Public Health 2020;20:1213.