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Sociodemographic Factors Affecting Non-Communicable Diseases in Saudi Arabia: A Cross-Sectional Analysis

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Abstract **Objectives:** Non-communicable diseases which include hypertension along with diabetes mellitus and hypercholesterolemia represent major and expanding health problems across Saudi Arabia. These healthcare conditions generate extensive mortality and morbidity together with high healthcare expenditure in the nation. Knowledge about age group distribution together with gender identity and nationality background helps develop purposive evidence-based treatment approaches and healthcare initiatives. **Methods:** 5,000 adult participants underwent a cross-sectional secondary data analysis based on National Health Research and Studies Portal (NHRSP) data gathered throughout an 11-month time period. Self-reported information about chronic disease diagnoses together with related risk factors appeared in the available dataset. A demographic breakdown together with the prevalence numbers of each NCD were presented through descriptive statistics. The connection between demographic factors and disease occurrences was evaluated through Chi-square methods but multivariate logistic models determined key NCD prediction variables. Different tests were used throughout this study at a significance level of $p<0.05$. **Results:** Statistics showed that hypertension affected 16.3% of male participants while 15.2% of female participants faced the same condition ($p = 0.021$). Results showed diabetes prevalence rates at 14.6% for males and 13.2% for females but this difference proved not statistically significant ($p = 0.169$). The occurrence of high cholesterol varied between 17.0% in males and 16.3% in females yet these numbers had equal statistical significance ($p = 0.569$). All groups demonstrated a significant increase in measured conditions at each age stage according to statistical analysis ($p<0.001$). The smoking prevalence rate showed highly significant differences between male (26.9%) and female patients (4.8%) ($p<0.001$). Hypertension prevalence rates among Saudi nationals exceeded non-Saudi residents by 5.6 percent points (17.8 percent and 12.2 percent respectively) and diabetes prevalence by 6.9 percentage points (16.5 percent and 9.6 percent) along with high cholesterol risk (19.0 percent and 12.5 percent) ($p<0.001$ for all conditions). Logistic regression statistics showed age, gender and nationality served as important predictors to define NCD risk throughout the population. **Conclusion:** Research findings demonstrate significant differences in NCD distribution that exist across sociodemographic groups of Saudi Arabian citizens. The disease burden involving hypertension and diabetes is greatest among elderly adults and high cholesterol rates are predominant in both genders but smoking occurs mainly among males. All studied Non-Communicable Diseases show higher risks among Saudi nationals when compared to the non-Saudi population. Public health initiatives need to become target-oriented through age-specific screening tools and gender-related smoking cessation programs and culturally appropriate health education approaches for Saudi nationals. The primary healthcare system should receive additional support because this enhanced approach will decrease the national NCD burden while improving long-term health results.

Key Words Non-communicable diseases, secondary data analysis, hypertension, diabetes, high cholesterol, smoking, Saudi Arabia, public health, epidemiology

INTRODUCTION

One of the biggest public health apprehensions globally at present is Non-communicable diseases (NCDs). It negatively impacts low or middle-income countries all over the globe particularly emerging economies of the world [1]. One of the other significant problems with NCDs as they can halt the economic progress of any nation by directly impacting people's quality of life and well-being. Notably, they cause the most mortality alone in very productive age groups that is between the thirties to sixties as compared with

any other diseases and/or problems. Which put NCDs as a main barrier to health disparities all over the world [2].

In the context of Saudi Arabia, NCDs are of great concern. The life expectancy in Saudi Arabia has been on the raised for the last 2 decades, and it has increased by approximately 4 years reaching almost 75 years [3]. According to data available through the Global Burden of Disease (GBD) by the Institute for Health Metrics and Evaluation, one of the key issues in Saudi Arabia's growing economy is the increasing burden of NCDs. According to their report, it accounts for approximately 68% of all disability-adjusted life years lost in Saudi Arabia [4]. The numbers are indeed threatening which requires proper measurements, and assessment of all NCDs in every region of Saudi Arabia. So that targeted health policies can be made and existing policies can be supplemented with evidence-based approaches to manage the burden of NCDs ideally by prevention in the Kingdom of Saudi Arabia (KSA).

The best management of any chronic disease is by prevention. In this regard, KSA has transformed the health system knowing the significantly high burden of NCDs in the country, several measures have been taken for its early diagnosis and prevention at the primary care level [5]. This transformation of the health system took place in 2017 with the main theme of improving overall health so that pain and suffering caused by NCDs can be reduced at a significantly lower cost. The new system operates by decentralizing the resources and provision of services in the form of "Health Clusters" at the regional level. Financing for health care services will be moved from the current Ministry of Health to the National Health Insurance Institute. It will greatly help to fulfill unmet population health needs and specifically the burden of NCDs in each region of KSA and ultimately the whole country [5].

To our knowledge, the existing literature on NCDS in KSA primarily examines the disparities and inequalities in the prevalence of non-communicable diseases (NCDs) in KSA rather than the disparities in the service provision of NCD services at the primary level. Various sociodemographic factors such as region of residence, educational level, gender, and income have been identified as contributors to the disparities in NCD burden [6-10].

To plan effective service provision for NCDs, the measurement of the burden of NCDs for above mentioned sociodemographic variables within the kingdom is of prime importance. So that effective management of NCDs could be successfully implemented and integrated into the new health transformation system of the country. Keeping that in mind the present study is planned to measure the burden of NCDs such as (Diabetes, Cardiovascular disease, Asthma, and Hypertension), and risk factors such as (Smoking, and high blood cholesterol) in the whole kingdom in general with a deep focus on every region of the country. The present study has employed a secondary data analysis approach by making use of already existing data collected by the National Health Research Council in Saudi Arabia (NHRSP) through the Absher platform.

Multiple national studies have examined NCD burden patterns yet there is still a need to analyze recent data through robust sampling stratification techniques using demographic factors including nationality due to underrepresentation of these variables. The research has neglected to thoroughly evaluate how gender along with age influences the smoking prevalence levels that continue into adult life stages. The research study completes these data missing points through NHRSP-based nationally representative data and implements advanced statistical modeling procedures.

This study examines the prevalence of major NCDs among adults in Saudi Arabia and explores their relationship with key sociodemographic factors, including gender, age, and nationality. The present study analyzed patterns and disparities in disease burden. The goal is to identify high-risk groups and provide insights that can guide health policies, preventive strategies, and public awareness efforts to reduce the impact of NCDs in the country.

METHODS

Study Design

The present study used a secondary data analysis approach, utilizing existing data already collected by the National Health Research Council in Saudi Arabia (NHRSP) through the Absher platform from 1st April 2019 till 1st February 2020 (11 months). The data collection method involved the distribution of a self-administered questionnaire via the Absher platform to gather information on demographic variables, chronic diseases, and associated risk factors among Saudi residents. The researchers selected a cross-sectional design because it utilized a nation-wide dataset to investigate prevalence relationships between variables despite lacking ability to determine cause-effect relationships. The available dataset prevented the use of analysis for longitudinal designs despite their recognized value.

Data Source

The dataset used for this study comprises responses obtained from the self-administered questionnaire administered through the Absher platform.

The dataset includes information on above mentioned Sociodemographic variables, NCDs such as (Diabetes, Cardiovascular disease, Asthma, and Hypertension), and risk factors such as (Smoking, high blood cholesterol, and Body mass index)

Sample Selection

The sampling frame of the data gathered by NHRSP was adults 18 years of age and above residing in Saudi Arabia. The Saudi population data utilized in this study were taken from the 2018 Statistical Yearbook published by the Saudi General Authority for Statistics (GASTAT). To establish a representative survey sample, sample weights were formulated based on the demographic distributions of region, gender, nationality, and age groups. These weights were then applied to a random sample from the survey data. A stratified systematic random sampling method was then employed,

with probabilities proportional to size, resulting in the creation of two strata: one for males and another for females. This systematic approach yielded a random subsample that closely mirrors the demographic composition of the Saudi population. Although a power analysis was not conducted prior to data collection, the final sample of 5,000 adults exceeds the minimum threshold required for national-level population health surveys and offers sufficient statistical power for subgroup analyses.

Data Collection Period

Data for this study were collected for 11 months.

The dataset covers responses obtained from participants during this period, providing comprehensive details of demographic characteristics, the prevalence of NCDs, and associated risk factors among the Saudi population during the abovementioned time frame.

Ethical Considerations

Ethical approval for the present study was applied and obtained from the Institutional Review Board (IRB) of the Scientific Research Committee at the University of Ha'il. IRB and the proposal were submitted to NHRSP to fulfil their requirements for obtaining the existing data. Once the request was approved, data was shared by the NHRSP team through a link to maintain the privacy of the dataset.

This secondary data analysis study adheres to ethical guidelines and regulations governing the use of existing data for research purposes.

Data Analysis

To assess the prevalence of non-communicable diseases (NCDs) and their relationship with key demographic factors, a comprehensive statistical analysis was conducted. Descriptive statistics, including frequencies and proportions, were used to summarize the demographic characteristics of the study population and the distribution of hypertension, diabetes, high cholesterol, and smoking. To explore associations between NCD prevalence and sociodemographic factors such as gender, age, and nationality, Chi-square tests were performed. Additionally, logistic regression analysis was used to identify significant predictors of NCDs, estimating the likelihood of developing these conditions based on demographic characteristics. A p-value of <0.05 was considered statistically significant. The findings from these analyses provide valuable insights into the patterns and risk factors of NCDs in Saudi Arabia, supporting evidence-based public health policies and targeted intervention strategies. Multivariate logistic regression models were adjusted for gender, age, and nationality to control for confounding. Adjusted odds ratios (AOR) with 95% confidence intervals were reported to quantify the strength of associations. Missing data represented less than 5% of the total responses and were excluded via listwise deletion.

RESULTS

The study analyzed the prevalence of non-communicable diseases (NCDs), including hypertension, diabetes, high cholesterol, and smoking, among a sample of 5,000 adults in Saudi Arabia. The demographic distribution showed a higher proportion of males (55.9%) and Saudi nationals (64.5%), with age groups ranging from 15 to 65+ years.

Statistical analyses revealed significant associations between age, gender, and nationality with the prevalence of various NCDs. Hypertension, diabetes, and high cholesterol showed a clear age-related increase, while smoking was more prevalent among males. Logistic regression further confirmed that nationality and age were strong predictors of disease risk, emphasizing the need for targeted health interventions. These findings provide important insights for public health policies and preventive strategies in Saudi Arabia.

Table 1 presents a detailed demographic and health profile of the study's participants, encompassing a total of 5,000 individuals. The table categorizes participants by gender, showing a majority of males (55.9%). Age distribution across the sample varies, with a notable concentration in the mid-life age range (30-39 years), indicating a focus on a potentially working-age population.

Nationality data reflect a significant majority of Saudi nationals (64.5%), which is pertinent to the study's regional focus. Health indicators demonstrate lower prevalence rates of hypertension (15.8%), diabetes (14.0%), and high

Table 1: Demographic and Health Characteristics of Study Participants

Demographic Characteristics	Number of Respondents (%)
Gender	
Male	2794 (55.9%)
Female	2206 (44.1%)
Age in Years	
15 - 19	272 (5.4%)
20 - 24	513 (10.3%)
25 - 29	659 (13.2%)
30 - 34	705 (14.1%)
35 - 39	751 (15.0%)
40 - 44	612 (12.2%)
45 - 49	488 (9.8%)
50 - 54	371 (7.4%)
55 - 59	252 (5.0%)
60 - 64	159 (3.2%)
65 and above	218 (4.4%)
Nationality	
Saudi	3224 (64.5%)
Non-Saudi	1776 (35.5%)
Hypertension	
Yes	791 (15.8%)
No	4209 (84.2%)
Diabetes	
Yes	701 (14.0%)
No	4299 (86.0%)
High Cholesterol	
Yes	834 (16.7%)
No	4166 (83.3%)
Smoking	
Yes	857 (17.1%)
No	4143 (82.9%)

Table 2: Hypertension Prevalence and Its Association with Sociodemographic Factors

Category	Hypertension		Chi-square Statistic	p-value
	Yes (%)	No (%)		
Gender			5.34	0.021
Male	456 (16.3)	2338 (83.7)		
Female	335 (15.2)	1871 (84.8)		
Age			22.47	0.013
15 - 19	13 (4.8)	259 (95.2)		
20 - 24	30 (5.8)	483 (94.2)		
25 - 29	56 (8.5)	603 (91.5)		
30 - 34	51 (7.2)	654 (92.8)		
35 - 39	80 (10.7)	671 (89.3)		
40 - 44	88 (14.4)	524 (85.6)		
45 - 49	94 (19.3)	394 (80.7)		
50 - 54	94 (25.3)	277 (74.7)		
55 - 59	84 (33.3)	168 (66.7)		
60 - 64	77 (48.4)	82 (51.6)		
65 and above	130 (59.6)	88 (40.4)		
Nationality			4.88	0.027
Saudi	574 (17.8)	2650 (82.2)		
Non-Saudi	217 (12.2)	1559 (87.8)		

Table 3: Diabetes Prevalence and Its Association with Sociodemographic Factors

Category	Diabetes Yes (N, %)	Diabetes No (N, %)	Chi-square Statistic	p-value
Gender			1.90	0.169
Male	409 (14.6)	2385 (85.4)		
Female	292 (13.2)	1914 (86.8)		
Age			645.86	0.000
15 - 19	17 (6.2)	255 (93.8)		
20 - 24	33 (6.4)	480 (93.6)		
25 - 29	47 (7.1)	612 (92.9)		
30 - 34	42 (6.0)	663 (94.0)		
35 - 39	60 (8.0)	691 (92.0)		
40 - 44	67 (10.9)	545 (89.1)		
45 - 49	78 (16.0)	410 (84.0)		
50 - 54	87 (23.5)	284 (76.5)		
55 - 59	78 (31.0)	174 (69.0)		
60 - 64	77 (48.4)	82 (51.6)		
65 and above	115 (52.8)	103 (47.2)		
Nationality			44.63	0.000
Saudi	531 (16.5)	2693 (83.5)		
Non-Saudi	170 (9.6)	1606 (90.4)		

cholesterol (16.7%), with a modest proportion of smokers (17.1%). This health data is crucial for assessing risk factors and designing targeted interventions within the cohort.

Table 2 illustrates the prevalence of hypertension across various sociodemographic categories. The analysis reveals a higher prevalence of hypertension among males (16.3%) compared to females (15.2%), with a statistically significant association ($\chi^2 = 5.34$, $p = 0.021$). Age-related differences are evident, with hypertension prevalence increasing progressively with age. The youngest age group (15–19 years) exhibits a prevalence of 4.8%, while the oldest group (65 and above) shows the highest prevalence at 59.6%. This association between age and hypertension is statistically significant ($\chi^2 = 22.47$, $p = 0.013$).

Regarding nationality, Saudi respondents demonstrate a higher prevalence of hypertension (17.8%) compared to non-Saudis (12.2%). This difference is statistically significant ($\chi^2 = 4.88$, $p = 0.027$).

Table 4: High Cholesterol Prevalence and Its Association with Sociodemographic Factors

Category	High Cholesterol		Chi-square Statistic	p-value
	Yes (N, %)	No (N, %)		
Gender			0.32	0.569
Male	474 (17.0)	2320 (83.0)		
Female	360 (16.3)	1846 (83.7)		
Age			560.51	0.000
15 - 19	10 (3.7)	262 (96.3)		
20 - 24	26 (5.1)	487 (94.9)		
25 - 29	48 (7.3)	611 (92.7)		
30 - 34	60 (8.5)	645 (91.5)		
35 - 39	95 (12.6)	656 (87.4)		
40 - 44	95 (15.5)	517 (84.5)		
45 - 49	121 (24.8)	367 (75.2)		
50 - 54	112 (30.2)	259 (69.8)		
55 - 59	87 (34.5)	165 (65.5)		
60 - 64	72 (45.3)	87 (54.7)		
65 and above	108 (49.5)	110 (50.5)		
Nationality			34.16	0.000
Saudi	612 (19.0)	2612 (81.0)		
Non-Saudi	222 (12.5)	1554 (87.5)		

These findings underscore the impact of sociodemographic determinants on hypertension prevalence, emphasizing the need for targeted interventions focused on high-risk groups, such as older adults, males, and Saudi nationals.

The prevalence of diabetes was higher among males (14.6%) than females (13.2%), but this difference was not statistically significant ($\chi^2 = 1.90$, $p = 0.169$). Age demonstrated a significant association with diabetes prevalence ($\chi^2 = 645.86$, $p<0.001$). The youngest age group (15–19 years) reported the lowest prevalence at 6.2%, while the oldest group (65 and above) exhibited the highest prevalence at 52.8%, indicating a clear trend of increasing diabetes prevalence with age. (Table 3)

Nationality also showed significant differences ($\chi^2 = 44.63$, $p<0.001$). Saudi nationals had a higher prevalence of diabetes (16.5%) compared to Non-Saudis (9.6%).

These findings highlight the need for age- and nationality-specific interventions to address the rising burden of diabetes, particularly among older populations and Saudi nationals.

Table 4 summarizes the prevalence of high cholesterol across various sociodemographic categories, including gender, age, and nationality. The prevalence of high cholesterol was similar between males (17.0%) and females (16.3%), with no statistically significant difference ($\chi^2 = 0.32$, $p = 0.569$). However, age demonstrated a significant association with high cholesterol ($\chi^2 = 560.51$, $p<0.001$), with prevalence increasing markedly in older age groups. The youngest group (15–19 years) reported a prevalence of only 3.7%, compared to 49.5% in the oldest group (65 and above).

Nationality also showed significant differences ($\chi^2 = 34.16$, $p<0.001$). Saudis had a higher prevalence of high cholesterol (19.0%) compared to non-Saudis (12.5%).

The prevalence of smoking was significantly higher among males (26.9%) compared to females (4.8%), with a highly significant association ($\chi^2 = 424.48$, $p<0.001$). Age did not

demonstrate a statistically significant association with smoking prevalence (χ^2 = 14.99, p = 0.133). Smoking prevalence was relatively consistent across all age groups, with the highest rate observed among individuals aged 20–24 years (19.1%). Nationality showed a significant difference ($\chi^2 = 6.66$, $p = 0.010$). Smoking prevalence was higher among Saudi nationals (18.2%) compared to Non-Saudis (15.3%) (Table 5).

In Table 6, a detailed summary of NCD's relationship with various sociodemographic factors has been showed for the Saudi population.

The logistic regression analysis provides a detailed examination of how gender, age, and nationality influence the likelihood of non-communicable diseases (NCDs), including hypertension, diabetes, high cholesterol, and smoking. For hypertension, men were found to be 22% more likely to have the condition than women ($\beta = 0.22$, $p = 0.014$). Additionally, Saudi nationality significantly increased the odds of hypertension by 67% compared to Non-Saudis (β = 0.67, p = 0.000). The likelihood of hypertension also increased significantly with age, particularly in individuals aged 25–29, highlighting the strong role of age as a determinant.

In the case of diabetes, nationality again played a prominent role, with Saudis being 54% more likely to develop diabetes compared to Non-Saudis (β = 0.54, p = 0.001). While men were slightly more likely to have diabetes (β = 0.16, p = 0.072), the association was not statistically significant. Age was also a critical factor, with individuals aged 25–29 showing significantly higher odds of diabetes compared to younger groups.

Table 5: Smoking Prevalence and its association with Sociodemographic factors

Category	Smoking Yes (N, %)	Smoking No (N, %)	Chi-square Statistic	p-value
Gender			424.48	0.000
Male	752 (26.9)	2042 (73.1)		
Female	105 (4.8)	2101 (95.2)		
Age			14.99	0.133
15 - 19	40 (14.7)	232 (85.3)		
20 - 24	98 (19.1)	415 (80.9)		
25 - 29	129 (19.6)	530 (80.4)		
30 - 34	111 (15.7)	594 (84.3)		
35 - 39	142 (18.9)	609 (81.1)		
40 - 44	115 (18.8)	497 (81.2)		
45 - 49	76 (15.6)	412 (84.4)		
50 - 54	54 (14.6)	317 (85.4)		
55 - 59	40 (15.9)	212 (84.1)		
60 - 64	21 (13.2)	138 (86.8)		
65 and above	31 (14.2)	187 (85.8)		
Nationality			6.66	0.010
Saudi	586 (18.2%)	2638 (81.8)		
Non-Saudi	271 (15.3%)	1505 (84.7)		

Table 6: Summary of NCD Analyses

NCD	Prevalence	Significant Associations	Key Insights
Hypertension	Males: 16.3%, Females: 15.2%; increases with age (4.8% in 15-19 to 59.6% in 65+); Saudis: 17.8%, Non-Saudis: 12.2%	Gender (p=0.021), Age (p=0.013), Nationality (p=0.027)	Higher prevalence in males, older adults, and Saudis; targeted interventions needed.
Diabetes	Males: 14.6%, Females: 13.2%; increases with age (6.2% in 15-19 to 52.8% in 65+); Saudis: 16.5%, Non-Saudis: 9.6%	Age (p<0.001), Nationality (p<0.001); Gender not significant	Strong link to age and nationality; Saudis and older adults at greater risk.
High Cholesterol	Males: 17.0%, Females: 16.3%; increases with age (3.7% in 15-19 to 49.5% in 65+); Saudis: 19.0%, Non-Saudis: 12.5%	Age (p<0.001), Nationality (p<0.001); Gender not significant	Age and nationality are major determinants; older adults and Saudis at higher risk.
Smoking	Males: 26.9%, Females: 4.8%; consistent across age groups (14.7%-19.6%); Saudis: 18.2%, Non-Saudis: 15.3%	Gender (p<0.001), Nationality (p=0.010); Age not significant	Substantial gender disparity; males and Saudis exhibit higher smoking rates.

Table 7: Logistic Regression Analysis of Sociodemographic Determinants for Non-Communicable Diseases (NCDs)

NCD	Variable	Coefficient (β)	p-value
Hypertension	Constant	-3.81	0.000
	Gender (Male)	0.22	0.014
	Nationality (Saudi)	0.67	0.000
	Age: 20–24	0.31	0.364
	Age: 25–29	0.80	0.012
Diabetes	Constant	-3.45	0.000
	Gender (Male)	0.16	0.072
	Nationality (Saudi)	0.54	0.001
	Age: 20–24	0.27	0.292
	Age: 25–29	0.75	0.015
High Cholesterol	Constant	-2.97	0.000
	Gender (Male)	0.18	0.065
	Nationality (Saudi)	0.62	0.002
	Age: 20–24	0.25	0.340
	Age: 25–29	0.68	0.020
Smoking	Constant	-1.91	0.000
	Gender (Male)	1.42	0.000
	Nationality (Saudi)	0.27	0.045
	Age: 20–24	0.12	0.501
	Age: 25–29	0.37	0.123

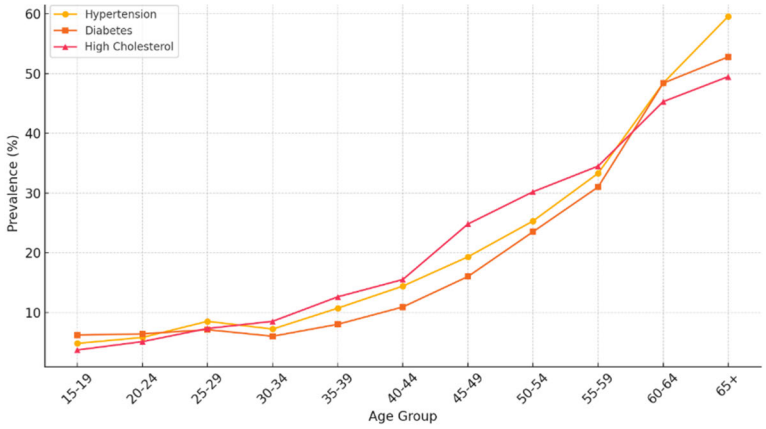

Figure 1: Prevalence of hypertension, diabetes, and high cholesterol with age

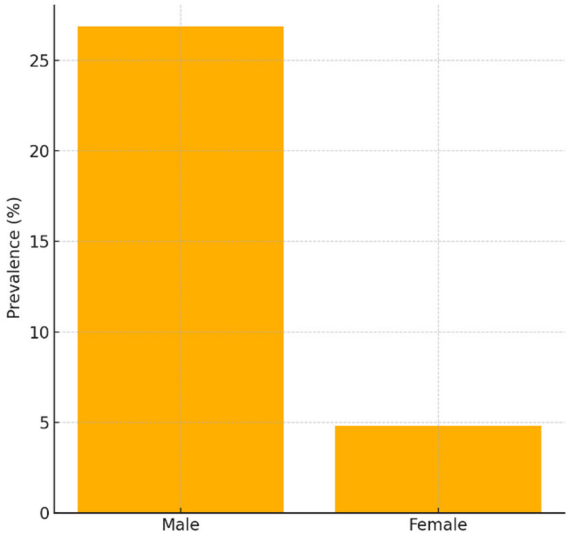

Figure 2: Gender disparity in smoking prevalence

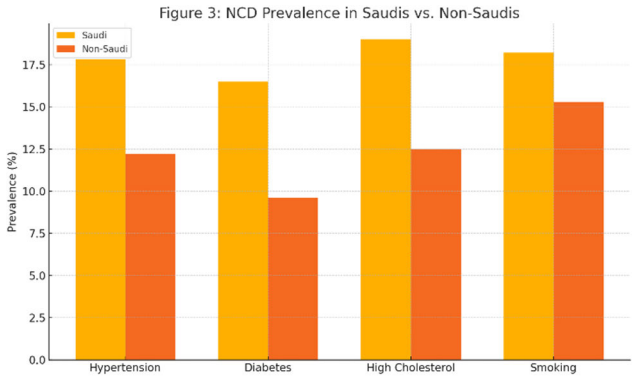

Figure 3: Prevalence of NCDs between Saudi and non-Saudi populations

For high cholesterol, Saudi nationality was significantly associated with a 62% higher likelihood of the condition compared to Non-Saudis ($\beta = 0.62$, $p = 0.002$). Gender showed a borderline association, with men showing slightly higher odds ($\beta = 0.18$, $p = 0.065$). Age was again a significant determinant, with individuals aged 25–29 showing notably higher odds of high cholesterol compared to younger age groups.

Smoking exhibited the strongest gender disparity among all NCDs, with men being over four times as likely to smoke as women ($\beta = 1.42$, $p = 0.000$). Saudi nationality was also significantly associated with higher odds of smoking ($\beta = 0.27$, $p = 0.045$). Unlike the other NCDs, age did not show a statistically significant association with smoking prevalence.

In summary, the findings indicate that gender, age, and nationality play varying roles in determining the risk of different NCDs. Men and Saudi nationals consistently exhibit higher risks for most conditions, while age emerges as a critical factor for hypertension, diabetes, and high cholesterol. These results underscore the need for tailored public health interventions targeting these specific demographic groups to effectively manage and reduce the burden of NCDs (Figure 1-3).

DISCUSSION

This study provides important insights into the burden of non-communicable diseases (NCDs) in Saudi Arabia and how they vary across different sociodemographic groups. The results show that hypertension, diabetes, and high cholesterol become more prevalent with age, particularly affecting older adults. In contrast, smoking was significantly more common among males, highlighting a strong gender disparity. Additionally, Saudi nationals had higher rates of hypertension, diabetes, and high cholesterol compared to non-Saudis, suggesting that nationality may play a role in NCD risk. Logistic regression confirmed that age and nationality were key predictors of disease risk, while gender was a major factor in smoking behavior. Reliability between disease burden statistics of Saudi nationals and non-Saudis relate to cultural eating habits and lifestyle patterns. Due to traditional diet consumption and inactive patterns Saudis show elevated high-calorie food use according to local nutritional research findings. The situation requires culturally adapted interventions to advocate healthier lifestyles among Saudi citizens.

Consistent with both global and regional trends, the present study found that age is one of the strongest predictors of NCD risk, particularly for hypertension, diabetes, and high cholesterol. The results showed a progressive increase in disease prevalence with age, with hypertension rates rising from 4.8% in those aged 15-19 years to 59.6% in those aged 65 and above ($p = 0.013$). Similarly, diabetes prevalence increased from 6.2% in younger individuals to 52.8% in the elderly ($p<0.001$). This aligns with data where hypertension prevalence was 23.4% and diabetes 13.8% among individuals with elementary education. The higher NCD burden in older age groups is likely due to age-related metabolic changes, cumulative exposure to risk factors, and reduced physical activity.

The findings of the current study revealed significant gender disparities, particularly in hypertension and smoking prevalence. While hypertension was slightly more common among males (16.3%) than females (15.2%) ($p = 0.021$), other studies in Saudi Arabia, such as Al-Hanawi and Keetile [11], found that women were more likely to be hypertensive and obese. This discrepancy may be due to differences in physical activity levels, dietary habits, and healthcare-seeking behaviour between study populations. Furthermore, the association between gender and high cholesterol was not statistically significant ($p = 0.569$), suggesting that both men and women may have similar lipid profiles despite differing lifestyle behaviours.

In terms of smoking prevalence, this study found a strong gender disparity, with males being over four times more likely to smoke than females (26.9% vs. 4.8%, $p<0.001$). This aligns with regional patterns, such as findings from Iran, where smoking prevalence was 20.8% in men compared to only 1.7% in women Kazemi *et al.* [12]. The cultural and social norms in the Middle East may often discourage smoking among women, contributing to this unembellished contrast. Interestingly, the lack of a significant age-based trend in smoking prevalence ($p = 0.133$) suggests that smoking initiation occurs at an early age and remains relatively stable throughout adulthood.

A prominent finding in this study was the higher prevalence of NCDs among Saudi nationals compared to non-Saudis. Hypertension prevalence was significantly higher among Saudis (17.8%) than non-Saudis (12.2%) ($p = 0.027$), and similar trends were observed for diabetes (16.5% vs. 9.6%, $p<0.001$) and high cholesterol (19.0% vs. 12.5%, $p<0.001$). This is consistent with previous research by Salam & Siddiqui (2013), [13]. Which also identified nationality as a major determinant of NCD burden in Saudi Arabia.

Several factors could explain these disparities. Saudi nationals may have different dietary habits, and lower physical activity levels. However, identifying, and measuring these factors is an absolute must to reduce the burden of NCD among the Saudi cohort. This highlights the need for tailored public health initiatives addressing lifestyle modifications among Saudi populations while ensuring equitable healthcare access for all residents.

When implementing health promotion programs leaders need to deal with operational barriers together with cultural roadblocks. To achieve effective anti-smoking campaigns they should incorporate gender-specific strategies and exist within unique local communities. The implementation of mobile NCD screening applications on Absher platforms combined with rural area screening service expansion can reduce healthcare disparities. Evaluation of intervention programs through pilots will determine their potential for growth within Health Clusters across different regions.

Given the significant burden of hypertension, diabetes, high cholesterol, and smoking in Saudi Arabia, several public health measures should be prioritized:

- **Preventive Screening Programs:** Since NCD risk increases with age, regular screenings for blood pressure, blood glucose, and cholesterol should be integrated into primary healthcare services, particularly for adults aged 40 and above
- **Community-Based Interventions:** To combat the high smoking prevalence among males, culturally tailored anti-smoking campaigns, taxation policies, and workplace smoking cessation programs should be strengthened.
- **Nutritional Education and Physical Activity Promotion:** Since dietary habits and sedentary lifestyles play a critical role in Saudi NCD disparities, school-based nutrition programs, sugar tax policies, and urban planning initiatives should encourage healthier lifestyles

Study Limitations and Future Research Directions

The analysis depends on clients providing accurate self-reported data which might produce errors when measuring smoking practices and medical conditions. The research has restricted our capacity to examine wider socioeconomic and urban-rural disparities since it lacks vital variables such as education, income, occupation and geographic location data. The statistical analysis included controlling confounders through logistic regression but did not eliminate the possibility of uncontrolled residual confounding. The study's design as cross-sectional data stops scientists from establishing cause-effect relationships.

CONCLUSIONS

The findings of this study reinforce the significant burden of NCDs in Saudi Arabia, with age, gender, and nationality emerging as key determinants. The results largely align with regional studies from Lebanon, UAE, Iran, Bahrain, and Cyprus, though some gender-related discrepancies in hypertension prevalence highlight the need for further investigation. Given the increasing rates of hypertension, diabetes, and high cholesterol, especially among older adults, males, and Saudi nationals, urgent policy interventions and health promotion strategies are required. Future research should explore socioeconomic disparities, healthcare accessibility, and behavioral risk factors to develop a comprehensive national strategy for reducing NCD burden in Saudi Arabia.

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Conflicts of Interest

The author declares that no external funding was received for this study. The data were obtained through official request and approval by the National Health Research and Studies Portal. The author has no conflicts of interest to declare.

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