Research Article

Utilization of Preventive Care Services at a University Hospital in Saudi Arabia

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Abstract

Background: Chronic diseases have significant impacts on health systems worldwide and are a leading cause of death. Early diagnosis and treatment of chronic diseases are the best ways to reduce mortality and morbidity.

Objectives: The aim of this study was to evaluate public access to preventive services for chronic diseases in Jeddah, Saudi Arabia.

Methods: A survey of university hospital visitors was conducted in 2019. Participants were randomly selected and asked to fill a 16-question survey, including demographics, health care utilization, and type of preventive services. The chi-square test (SPSS) was used to identify any significant association between age and gender using the variable of preventive screening or counseling.

Results: The majority of individuals who completed the survey (250 participants) were young, married, and male bachelor's degree holders. About 71% of the participants received counseling services for either smoking, physical activity, weight, diet, or sleeping. More than half (58%) had undergone screening services, including breast cancer, colon cancer, diabetes, hypertension, or weight management. Chi-square analysis showed that females had a significant (P < 0.01) positive statistical relationship with the utilization of diabetes and breast cancer screening services, while males were more associated (P < 0.01) with smoking and weight-related counseling than females.

Conclusions: The study demonstrated an insufficient use of preventive services and that sociodemographic differences (such as age and gender) could influence the utilization of various preventive services. Females were significantly positively associated with breast cancer and diabetes-related preventive services as these diseases are highly prevalent among females. Public education and awareness campaigns are needed to broadcast the importance of preventive services and promote better understanding and management of chronic diseases.

Keywords: Preventive Services, Chronic Diseases, Primary Care Unit, Saudi Arabia

1. Background

Globally, chronic diseases are a leading cause of death and the most common problem faced by health care systems (1). Chronic conditions (including respiratory and cardiovascular diseases, diabetes, and arthritis) will lead to an even greater burden on public health in the near future (2). The prevalence of chronic diseases is particularly high in Middle Eastern countries compared to other regions. According to the World Health Organization (WHO), Saudi Arabia was ranked second in the Middle East and 17th worldwide in terms of the prevalence of diabetes (3). Furthermore, Saudi Arabia was among the top 15 countries regarding the prevalence of obesity and hypertension, which are common in adults (4). Individuals with hypertension

were found to have a higher mortality rate than those without hypertension (5). The economic impact of hypertension in the United States has been estimated at $76.6 billion (6). Interestingly, a previous study estimated that the ministry of health in Saudi Arabia spent approximately 17 billion riyals ($4.53 billion) to control diabetes, which is equal to 17% of the ministry budget (7).

The management of patients with chronic diseases is often complex and challenging, though chronic disease management and prevention programs have been developed to improve patient care, reduce associated risk, and minimize disease spread (8). These preventative strategies have been shown to reduce costs, hospital admissions, mortality, and use of health services while improv-

ing quality of life and adherence to medication ([8]). Providing health education to individuals, for example, has been shown to be a successful approach for controlling illnesses and improving societal quality of life ([9]). Primary care is crucial because it brings forth most of the evidence-based medicine on chronic disease screenings as well as prevention services in a health care plan ([10]). The best way to reduce the number of chronic diseases is through primary prevention and screening, as the prevention of disease implies avoiding and forsaking bad habits by individuals who are well-educated on their health ([11]). Chronic disease prevention strategies have been developed to improve peoples' knowledge and habits regarding heart disease ([12]), diabetes ([13]), depression ([14]), asthma ([15]), obesity ([16]), and hypertension ([17]); these strategies have all been shown to be effective in achieving the targeted outcomes.

Many countries have made efforts to emphasize the importance of primary care and preventive services. In the United States, preventive care has become a significant part of clinical guidelines and medical education ([18]). The current evidence-based clinical guidelines recommend maintaining a healthy lifestyle ([18]). Saudi Ministry of Health has established preventive clinics to enhance public awareness of smoking, obesity, diabetes, and breast cancer; their success would reduce the consequences of chronic diseases ([19]).

A recent study showed that the majority of the Saudi population, especially the elderly, had at least 1 chronic disease. The number of chronic diseases positively correlated with increased age, weight, and smoking ([20]). These alarming findings require quick and effective actions. Continued evaluation of the public's access to primary care units is crucial to ensure the effective implementation of chronic disease preventive strategies ([10]). However, there is insufficient information regarding public utilization of preventive services for diseases such as diabetes, hypertension, and smoking.

2. Objectives

The purpose of this study was to assess the population's utilization of preventive services and its association with age and gender in Saudi Arabia.

3. Methods

This cross-sectional study was conducted for 2 weeks, from July 7th to 19th, 2019, at King Abdulaziz University Hospital, Jeddah, Saudi Arabia. Individuals aged 18 years and above who visited the hospital during the study period

were included in the study. However, those below 18 years were excluded. Participants were randomly selected using simple random sampling; each individual who visited the hospital was given a number, and those with odd numbers were invited to fill out a short questionnaire.

3.1. Survey Instrument

To create the final survey, a questionnaire was first developed based on the literature on the topic in question. The first version of the questionnaire was validated by 2 reviewers (family medicine and epidemiology specialists) to select the best in terms of clarity of the questions, accuracy of the knowledge measured, and interpretability. The final versions of those questions were then piloted to ensure that the questionnaire was both clear and met the goals of the study. After 2 weeks, this pilot group was asked to fill the same questionnaire to assess test-retest reliability.

The questionnaire consisted of 3 sections. The first section explored demographic characteristics such as age, marital status, occupation, income, and education level. The second section was about health care utilization over the last 6 months, including the number of times the individual visited the hospital, primary health care center, private doctor, and emergency room, as well as how many times they were admitted to the hospital for an overnight stay. Individuals were also asked to rate their health conditions on a scale (poor, good, very good, excellent). The third section discussed preventive services, including consultations (regarding smoking, physical activity, weight, sleep, etc) and screenings (for breast cancer, colon cancer, diabetes, hypertension, and body mass index [BMI]) over the last year. Additional questions were asked about family and personal history of breast cancer, colon cancer, diabetes, hypertension, and chronic vascular disease.

3.2. Statistical Analysis

The data were manually entered into SPSS version 25 (SPSS Inc, Chicago, Ill, USA). Descriptive data were used to calculate the number of participants, frequencies, and percentages. The chi-square test was used to identify significant associations between age and gender and any type of preventive screening (smoking, physical activities, weight, diet, and sleep) or preventive counseling (breast cancer, colon cancer, diabetes, hypertension, and BMI). The result was considered significant when P value < 0.05.

3.3. Ethical Approval

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval for the study protocol, questions, and consent statement was granted by the

Ethics Committee at King Abdulaziz University under ethical approval number 452-19. Participants willing to voluntarily enroll in the study were asked to sign the informed consent form.

4. Results

4.1. Sociodemographic Characteristics of the Study Participants

A total of 250 individuals took part in the study; they had a mean age of 39.64 years (SD = 15.57; age range 20 - 65 years). The majority (57.2%) of the respondents were between 20 to 30 years old. There were more males (61.2%), and almost two-thirds of the participants were married (62.4%). The majority of the participants hold a bachelor's degree (Table 1).

Of the 250 participants, 74.4% had visited the hospital, and 54.4% had visited the primary health care center in the last 6 months. Only 46.0% had not visited the emergency room during that time. Over half of the participants (54%) had visited a private doctor, and 40.8% had stayed overnight in the hospital over the same period. In general, 44% described their health as excellent, 44.4% as very good, 10% as good, and 1.6% as poor (Table 2).

4.2. Total Population Utilized Preventive Services

Of the 250 participants, 28.4% did not receive any counseling services for one or more than one of the following: smoking, physical activity, weight, diet, and sleeping. The percentages of participants who received counseling were 19.2%, 38.4%, 37.2%, 47.6%, and 23.2% for smoking, physical activity, weight, diet, and sleeping, respectively. Moreover, 41.2% of the participants had not undergone a preventive screening for any of the following: breast cancer, colon cancer, diabetes, hypertension, and BMI. Further, 14 (5.6%) participants said that they had had a breast cancer screening, 5 (2.0%) a colon cancer screening, 87 (34.8%) a diabetes screening, 85 (34.0%) a hypertension screening, and 59 (23.6%) a BMI screening (Table 3).

4.3. Distribution of Preventive Services and Association Between Age and Sex

A chi-square analysis was conducted, and the results showed that gender and age had a significant positive statistical relationship with the utilization of diabetes screening services, with P values of 0.048 and 0.003 for female and those aged 46 - 65 years old, respectively. Moreover, gender had a significant positive statistical (P < 0.01) relationship with the utilization of breast cancer screening

Table 1. Demographics of the Participants

Variables	No. (%)
Age (y)	
20 - 30	143 (57.2)
31 - 45	56 (22.4)
46 - 65	51 (20.4)
Gender	
Male	153 (61.2)
Female	97 (38.8)
Marital status	
Married	156 (62.4)
Never married	89 (35.6)
Divorced	4 (1.6)
Widowed	1 (0.4)
Occupation	
Teacher	29 (11.6)
Student	58 (23.2)
Military personnel	11 (4.4)
Retired	25 (10.0)
Housewife	26 (10.4)
Other jobs	72 (28.8)
Unemployed	29 (11.6)
Monthly income [a]	
Less than 3000 Saudi riyals	92 (36.8)
3000 riyals to less than 5000 riyals	34 (13.6)
5000 riyals to less than 10 000 riyals	74 (29.6)
10 000 riyals to less than 20 000 riyals	38 (15.2)
20 000 riyals or more	12 (4.8)
Education level	
Postgraduate	35 (14.0)
Bachelor's	141 (56.4)
Secondary	64 (25.6)
Less than middle	10 (4.0)

[a] One Saudi riyal approximately equals $0.26.

services with females (14.40%), showing a higher percentage than males (0%). The chi-square analysis also indicated a significant statistical relationship between gender and smoking counseling (P < 0.01) and gender and weight counseling (P = 0.007). Males were more likely to have had smoking-related counseling (28.10%) than females (5.20%); the same was true for weight loss counseling (male, 43.80%; female, 26.80%; Tables 4 and 5).

Table 2. Number of Visits to Health Care Facilities in the Last 6 Months

Question	Category	Count (%)
1. How many times did you visit the hospital in the last 6 months?	0	64 (25.6)
	1 - 2	99 (39.6)
	3 - 4	52 (20.8)
	More than 5	35 (14.0)
2. How many times did you visit the primary health care center in the last 6 months?	0	114 (45.6)
	1 - 2	96 (38.4)
	3 - 4	24 (9.6)
	More than 5	16 (6.4)
3. How many times did you visit your private doctor in the last 6 months?	0	115 (46.0)
	1 - 2	78 (31.2)
	3 - 4	26 (10.4)
	More than 5	31 (12.4)
4. How many times did you visit an emergency room in the last 6 months?	0	115 (46.0)
	1 - 2	91 (36.4)
	3 - 4	27 (10.8)
	More than 5	17 (6.8)
5. How many times did you have to stay overnight in the hospital in the last 6 months?	0	148 (59.2)
	1 - 2	78 (31.2)
	3 - 4	18 (7.2)
	More than 5	6 (2.4)
6. In general, how would you describe your own health during the last 6 months?	Excellent	110 (44.0)
	Very good	111 (44.4)
	Good	25 (10.0)
	Poor	4 (1.6)

5. Discussion

Primary care is an essential part of health care that relies on evidence-based medicine to prevent chronic diseases. Screenings and other preventative strategies are effective in reducing the prevalence of chronic diseases within a given population [11]. Therefore, this study aimed to assess the population's access to preventive services for various chronic diseases in Saudi Arabia.

More than half of the recruited population was young (20 - 30 years old) males, suggesting that most university hospital visitors were young. Interestingly, a third of participants had low-income (< 3000 riyals), reflecting the fact that the university hospital is a general hospital. This is in line with a previous report that found socioeconomic status to be a major factor affecting health care utilization in Iran [21]. Treatment and consultation are free of charge in general hospitals; accordingly, the majority of Saudis prefer to visit general hospitals, especially for chronic diseases, where consecutive visits are required [22]. Most of the participants in the current study had visited the hospital over the last 6 months (74%), and just about half had stayed overnight.

These results suggested that most participants were suffering from at least 1 health issue, despite the fact that almost all of them (88%) rated their health condition to be either very good or excellent. Beliefs in disease and health differ between groups such that some people tend to believe they are healthy even if they are not [23]. Previous studies have shown that most of the Saudi population with very good health was taking prescribed medication [24]. Thus, preventive clinical services are crucial because members of the public may have health complications without being aware of them. Additionally, the high number of visitors to the university hospital may be due to the availability of specialists and advanced procedures. It has been

Table 3. Preventive Screening and Counseling Services Used by the Study Population

Counseling Services		Screening Services	
Variable	**Count out of 250 (%)**	**Variable**	**Count out of 250 (%)**
Smoking		**Breast cancer**	
No	202 (80.8)	No	236 (94.4)
Yes	48 (19.2)	Yes	14 (5.6)
Physical activities		**Colon cancer**	
No	154 (61.6)	No	245 (98.0)
Yes	96 (38.4)	Yes	5 (2.0)
Weight		**Diabetes**	
No	157 (62.8)	No	163 (65.2)
Yes	93 (37.2)	Yes	87 (34.8)
Diet		**Hypertension**	
No	131 (52.4)	No	165 (66.0)
Yes	119 (47.6)	Yes	85 (34.0)
Sleep		**BMI**	
No	192 (76.8)	No	191 (76.4)
Yes	58 (23.2)	Yes	59 (23.6)
Non		**Non**	
No	179 (71.6)	No	147 (58.8)
Yes	71 (28.4)	Yes	103 (41.2)

Table 4. Use of Preventive Screening Services and Associations Between Age and Sex [a]

Variable	Gender			Age			
	Male	**Female**	**P Value**	**20 - 30**	**31 - 45**	**46 - 65**	**P Value**
Breast cancer			< 0.01				0.751
No	153 (100.00)	83 (85.60)		134 (93.70)	54 (96.40)	48 (94.10)	
Yes	0 (0.00)	14 (14.40)		9 (6.30)	2 (3.60)	3 (5.90)	
Colon cancer			0.326				0.104
No	151 (98.70)	94 (96.90)		141 (98.60)	53 (94.60)	51 (100.00)	
Yes	2 (1.30)	3 (3.10)		2 (1.40)	3 (5.40)	0 (0.00)	
Diabetes			0.048				0.003
No	107 (69.90)	56 (57.70)		101 (70.60)	39 (69.60)	23 (45.10)	
Yes	46 (30.10)	41 (42.30)		42 (29.40)	17 (30.40)	28 (54.90)	
Hypertension			0.408				0.073
No	104 (68.00)	61 (62.90)		101 (70.60)	37 (66.10)	27 (52.90)	
Yes	49 (32.00)	36 (37.10)		42 (29.40)	19 (33.90)	24 (47.10)	
BMI			0.735				0.938
No	118 (77.10)	73 (75.30)		110 (76.90)	43 (76.80)	38 (74.50)	
Yes	35 (22.90)	24 (24.70)		33 (23.10)	13 (23.20)	13 (25.50)	

[a] Values are expressed as No. (%)

Table 5. Use of Preventive Counseling Services and Association Between Age and Sex [a]

Variable	Gender			Age			
	Male	**Female**	**P Value**	**20 - 30**	**31 - 45**	**46 - 65**	**P Value**
Smoking			< 0.01				0.468
No	110 (71.90)	92 (94.80)		112 (78.30)	48 (85.70)	42 (82.40)	
Yes	43 (28.10)	5 (5.20)		31 (21.70)	8 (14.30)	9 (17.60)	
Physical activity			0.095				0.126
No	88 (57.50)	66 (68.00)		87 (60.80)	30 (53.60)	37 (72.50)	
Yes	65 (42.50(	31 (32.00(		56 (39.20)	26 (46.40)	14 (27.50)	
Weight			0.007				0.777
No	86 (56.20)	71 (73.20)		92 (64.30)	33 (58.90)	32 (62.70)	
Yes	67 (43.80)	26 (26.80)		51 (35.70)	23 (41.10)	19 (37.30)	
Diet			0.635				0.771
No	82 (53.60)	49 (50.50)		73 (51.00)	29 (51.80)	29 (56.90)	
Yes	71 (46.40)	48 (49.50)		70 (49.00)	27 (48.20)	22 (43.10)	
Sleep			0.166				0.067
No	113 (73.90)	79 (81.40)		112 (78.30)	37 (66.10)	43 (84.30)	
Yes	40 (26.10)	18 (18.60)		31 (21.70)	19 (33.90)	8 (15.70)	

[a] Values are expressed as No. (%).

shown that the increased number of patients negatively influences the quality of preventive health services provided by physicians in Turkey (25).

Almost one-third of the participants did not receive any consultation, and the numbers of visitors to counseling clinics differed across smoking, physical activity, weight, diet, and sleeping services. Possible explanations include that some of this population did not require such services or that doctors did not explain all preventive service options while examining these patients. Although doctors in primary care units tend to listen to patients carefully, they do not have enough information to advise patients about tests or recommended procedures (26). In order to establish a high level of health awareness and reduce illnesses in society, doctors should pay attention to all available preventive screenings and counseling sessions. The main goal of health centers, especially primary care units, is to identify diseases early and educate patients on disease management. Moreover, this may help the doctors and health centers to know their strengths and weaknesses.

Diet and weight counseling services were the most frequently provided, followed by physical activity-related services. This is unsurprising as the majority of the participants were young and can be assumed to care about their looks and body shapes. In line with previous studies, most of the primary care unit visitors inquired about weight and healthy diet (24). Diet counseling often recommends increasing one's fiber intake and reducing one's fat intake while improving one's level of physical activity, all of which indirectly improve quality of life (27).

Interestingly, only 58.8% of the participants used screening services for chronic diseases. The prevalence of chronic diseases, including diabetes, is high among Saudis and positively correlated with BMI. Diagnosis and management of diabetes are highly dependent on a given patient's primary health care clinic at which they were educated about disease and treatment options (24). Although about a third of the population was referred to diabetic clinics, over 40% reported that a member of their families had diabetes (Appendix 1). This may support previous findings, showing that general primary care physicians do not examine the patients properly and fail to adhere to diabetes management guidelines (18), though the availability of random glucose tests at primary care units may assist in a more rapid diagnosis of diabetes. Our results are consistent with (28) where a third of the population used health care applications for diabetes management. However, a recent study found that 47% of the Saudi population used the SEHA application to schedule appointments at chronic disease clinics (29). The COVID-19 pandemic has increased public awareness of diseases and encouraged them to use

technology for health care services, scheduling appointments, virtual consultation, and medication ordering (30).

The chi-square analysis revealed that females and the elderly (aged 46 - 65 years old) had a significant positive relationship with the utilization of diabetes screening services. The prevalence of diabetes is higher in females and the elderly in Saudi Arabia, attributed to increases in BMI (> 25) (31). In fact, diabetes is strongly associated with obesity; over 80% of those diagnosed with type 2 diabetes were overweight (32). The prevalence of obesity worldwide has recently increased, linked to many factors, including reduced physical activity, especially among the elderly (31). Thus, an effective method for reducing diabetes and obesity is health education through doctors and nurses in preventive clinics.

Breast cancer is the most common cancer among Saudi women, reaching more than 21%, and the number of cases is expected to increase in the coming decade (33). This could explain this study's results, showing that females were positively associated with breast cancer screening services' visits. Increased public awareness, especially in women, about breast cancer screening has been linked with early diagnosis of malignancy, which can improve the treatment outcome. Providing information about breast cancer focusing on the female population is highly recommended to reduce the prevalence of the disease in Saudi Arabia (34).

Smoking prevalence is higher in Saudi males (38%) than in Saudi females (13%) (35). Internationally, smokers, including cigarette and shisha users, are usually young (36) and account for half of the smokers in Saudi Arabia (37). This may explain the current findings, indicating a higher proportion of male smokers than female smokers. Although smoking is prohibited in many government-owned buildings and public places, its prevalence remains high in Saudi Arabia, and more education is required 36. Primary care units and preventive clinics are important in this effort and can provide support and information to smokers in order to assist them in quitting.

Although the current study measured different preventive clinical utilizations, there were some limitations. As the data were collected over a short period and had a small sample size, the findings may not represent the Saudi population as a whole. Additionally, the method of collection was a self-reported questionnaire, which is subject to biases. Despite these limitations, the study still emphasizes the importance of preventative services in maintaining good public health.

5.1. Conclusions

In general, each individual's use of preventive services, either consultations or screenings, appeared to be insufficient. Moreover, this study demonstrated that sociodemographic differences (such as age and gender) influenced the utilization of preventive services. Although visitors were in generally good health, they used diet, weight, and physical activity services more frequently, which can be attributed to their young age. The prevalence of diabetes and breast cancer in Saudi Arabia is higher in females than in males, and therefore females had a significant positive association with accessing these screening services. Additional public education and awareness campaigns are required to highlight the importance of preventive services and promote an enhanced understanding of chronic diseases overall.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Informed Consent: Participants were enrolled in the study after signing an informed consent form.

References

1. WHO. *Global status report on noncommunicable diseases.* Geneva, Switzerland: World Health Organization; 2010.

2. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med.* 2006;**3**(11). e442. doi: 10.1371/journal.pmed.0030442. [PubMed: 17132052]. [PubMed Central: PMC1664601].

3. Al Dawish MA, Robert AA, Braham R, Al Hayek AA, Al Saeed A, Ahmed RA, et al. Diabetes Mellitus in Saudi Arabia: A Review of the Recent Literature. *Curr Diabetes Rev.* 2016;**12**(4):359–68. doi: 10.2174/1573399811666150724095130. [PubMed: 26206092].

4. M Alqarni SS. A Review of Prevalence of Obesity in Saudi Arabia. *Int J Eat Disord.* 2016;**2**(2). doi: 10.21767/2471-8203.100025.

5. Oparil S, Acelajado MC, Bakris GL, Berlowitz DR, Cifkova R, Dominiczak AF, et al. Hypertension. *Nat Rev Dis Primers.* 2018;**4**:18014. doi: 10.1038/nrdp.2018.14. [PubMed: 29565029]. [PubMed Central: PMC6477925].

6. Lloyd-Jones D, Adams RJ, Brown TM, Carnethon M, Dai S, De Simone G, et al. Executive summary: heart disease and stroke statistics–2010 update: a report from the American Heart Association. *Circulation.* 2010;**121**(7):948–54. doi: 10.1161/CIRCULATIONAHA.109.192666. [PubMed: 20177011].

7. Marwa Tuffaha AH. Cost of Diabetes in the Kingdom of Saudi Arabia, 2014. *J Diabetes Metab.* 2015;**6**(8). doi: 10.4172/2155-6156.1000575.

8. Fortin M, Chouinard MC, Dubois MF, Belanger M, Almirall J, Bouhali T, et al. Integration of chronic disease prevention and management services into primary care: a pragmatic randomized controlled trial (PR1MaC). *CMAJ Open.* 2016;**4**(4):E588–98. doi: 10.9778/cmajo.20160031. [PubMed: 28018871]. [PubMed Central: PMC5173473].

9. Ford ES. Trends in mortality from all causes and cardiovascular disease among hypertensive and nonhypertensive adults in the United States. *Circulation.* 2011;**123**(16):1737–44. doi: 10.1161/CIRCULATIONAHA.110.005645. [PubMed: 21518989].

10. Reynolds R, Dennis S, Hasan I, Slewa J, Chen W, Tian D, et al. A systematic review of chronic disease management interventions in primary care. *BMC Fam Pract.* 2018;**19**(1):11. doi: 10.1186/s12875-017-0692-3. [PubMed: 29316889]. [PubMed Central: PMC5759778].

11. Barrett DH, Ortmann LW, Dawson A, Saenz C, Reis A, Bolan G. *Public Health Ethics: Cases Spanning the Globe.* Springer; 2016.

12. Hamar GB, Rula EY, Coberley C, Pope JE, Larkin S. Long-term impact of a chronic disease management program on hospital utilization and cost in an Australian population with heart disease or diabetes. *BMC Health Serv Res.* 2015;**15**:174. doi: 10.1186/s12913-015-0834-z. [PubMed: 25895499]. [PubMed Central: PMC4422132].

13. Tan WS, Ding YY, Xia WC, Heng BH. Effects of a population-based diabetes management program in Singapore. *Am J Manag Care.* 2014;**20**(9):e388–98.

14. Ryan JG, Buford U, Arias E, Alfonsin-Vittoria I, Fedders M, Jennings T, et al. Participation in and impact of a depression care management program targeting low-income minority patients in an urban community-based clinic. *Clin Ther.* 2014;**36**(5):778–90. doi: 10.1016/j.clinthera.2014.03.007. [PubMed: 24746989].

15. Jain VV, Allison R, Beck SJ, Jain R, Mills PK, McCurley JW, et al. Impact of an integrated disease management program in reducing exacerbations in patients with severe asthma and COPD. *Respir Med.* 2014;**108**(12):1794–800. doi: 10.1016/j.rmed.2014.09.010. [PubMed: 25294691].

16. Kruschitz R, Wallner-Liebmann SJ, Lothaller H, Luger M, Schindler K, Hoppichler F, et al. Evaluation of a meal replacement-based weight management program in primary care settings according to the actual European Clinical Practice Guidelines for the Management of Obesity in Adults. *Wien Klin Wochenschr.* 2014;**126**(19-20):598–603. doi: 10.1007/s00508-014-0585-6. [PubMed: 25193476]. [PubMed Central: PMC4226923].

17. Bex SD, Boldt AS, Needham SB, Bolf SM, Walston CM, Ramsey DC, et al. Effectiveness of a hypertension care management program provided by clinical pharmacists for veterans. *Pharmacotherapy.* 2011;**31**(1):31–8. doi: 10.1592/phco.31.1.31. [PubMed: 21182356].

18. Doubeni CA, Simon M, Krist AH. Addressing Systemic Racism Through Clinical Preventive Service Recommendations From the US Preventive Services Task Force. *JAMA.* 2021;**325**(7):627–8. doi: 10.1001/jama.2020.26188. [PubMed: 33492333].

19. Ministry of Health. *Media Center, News.* 2019. Available from: https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/default.aspx.

20. Saquib N, Saquib J, Alhadlag A, Albakour MA, Aljumah B, Sughayyir M, et al. Chronic disease prevalence among elderly Saudi men. *Int J Health Sci (Qassim).* 2017;**11**(5):11–6. [PubMed: 29114188]. [PubMed Central: PMC5669504].

21. Zakeri M, Bagheri Lankarani K, Kavosi Z, Ravangard R. Health Care Utilization Inequality in a Mixed Public-Private Health Care System: An Insight from the National Survey in Iran. *Health Scope.* 2019;**9**(1). doi: 10.5812/jhealthscope.88589.

22. Al-Rubeaan KA, Al-Manaa HA, Khoja TA, Al-Sharqawi AH, Aburisheh KH, Youssef AM, et al. Health care services provided to type 1 and type 2 diabetic patients in Saudi Arabia. *Saudi Med J.* 2015;**36**(10):1216–25. doi: 10.15537/smj.2015.10.12596. [PubMed: 26446334]. [PubMed Central: PMC4621729].

23. Kahissay MH, Fenta TG, Boon H. Beliefs and perception of ill-health causation: a socio-cultural qualitative study in rural North-Eastern Ethiopia. *BMC Public Health.* 2017;**17**(1):124. doi: 10.1186/s12889-017-4052-y. [PubMed: 28122606]. [PubMed Central: PMC5267452].

24. Khan AR, Al-Abdul Lateef ZN, Al Aithan MA, Bu-Khamseen MA, Al Ibrahim I, Khan SA. Factors contributing to non-compliance among diabetics attending primary health centers in the Al Hasa district of Saudi Arabia. *J Family Community Med.* 2012;**19**(1):26–32. doi: 10.4103/2230-8229.94008. [PubMed: 22518355]. [PubMed Central: PMC3326767].

25. Alfaqeeh G, Cook EJ, Randhawa G, Ali N. Access and utilisation of primary health care services comparing urban and rural areas of Riyadh Providence, Kingdom of Saudi Arabia. *BMC Health Serv Res.* 2017;**17**(1):106. doi: 10.1186/s12913-017-1983-z. [PubMed: 28153002]. [PubMed Central: PMC5288856].

26. Akbulut Y, Goktas B, Kutlu G. Public Hospital Utilization among Syrian Refugees in Turkey. *Health Scope.* 2018;**7**(4). doi: 10.5812/jhealthscope.13405.

27. Maderuelo-Fernandez JA, Recio-Rodriguez JI, Patino-Alonso MC, Perez-Arechaederra D, Rodriguez-Sanchez E, Gomez-Marcos MA, et al. Effectiveness of interventions applicable to primary health care settings to promote Mediterranean diet or healthy eating adherence in adults: A systematic review. *Prev Med.* 2015;**76 Suppl**:S39–55. doi: 10.1016/j.ypmed.2014.12.011. [PubMed: 25524613].

28. Alharbi R, Qadri A, Mahnashi M, Hakami A, Darraj B, Shnaimer J, et al. Utilization of Health Applications Among Patients Diagnosed with Chronic Diseases in Jazan, Saudi Arabia During the COVID-19 Pandemic. *Patient Prefer Adherence.* 2021;**15**:2063–70. doi: 10.2147/PPA.S329891. [PubMed: 34556976]. [PubMed Central: PMC8453435].

29. Alharbi A, Alzuwaed J, Qasem H. Evaluation of e-health (Seha) application: a cross-sectional study in Saudi Arabia. *BMC Med Inform Decis Mak.* 2021;**21**(1):103. doi: 10.1186/s12911-021-01437-6. [PubMed: 33736622]. [PubMed Central: PMC7977258].

30. Bazaid AS, Aldarhami A, Binsaleh NK, Sherwani S, Althomali OW. Knowledge and practice of personal protective measures during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia. *PLoS One*. 2020;**15**(12). e0243695. doi: 10.1371/journal.pone.0243695. [PubMed: 33306718]. [PubMed Central: PMC7732079].

31. Alqurashi KA, Aljabri KS, Bokhari SA. Prevalence of diabetes mellitus in a Saudi community. *Ann Saudi Med*. 2011;**31**(1):19–23. doi: 10.4103/0256-4947.75773. [PubMed: 21245594]. [PubMed Central: PMC3101719].

32. Leitner DR, Fruhbeck G, Yumuk V, Schindler K, Micic D, Woodward E, et al. Obesity and Type 2 Diabetes: Two Diseases with a Need for Combined Treatment Strategies - EASO Can Lead the Way. *Obes Facts*. 2017;**10**(5):483–92. doi: 10.1159/000480525. [PubMed: 29020674]. [PubMed Central: PMC5741209].

33. Ibrahim EM, Zeeneldin AM, Bin Sadiq B. The present and the future of breast cancer burden in the Kingdom of Saudi Arabia. *J Clin Oncol*. 2008;**26**(15_suppl):22089. doi: 10.1200/jco.2008.26.15_suppl.22089.

34. Alotaibi RM, Rezk HR, Juliana CI, Guure C. Breast cancer mortality in Saudi Arabia: Modelling observed and unobserved factors. *PLoS One*. 2018;**13**(10). e0206148. doi: 10.1371/journal.pone.0206148. [PubMed: 30347002]. [PubMed Central: PMC6197663].

35. Bassiony MM. Smoking in Saudi Arabia. *Saudi Med J*. 2009;**30**(7):876–81. [PubMed: 19617999].

36. Moradi-Lakeh M, El Bcheraoui C, Tuffaha M, Daoud F, Al Saeedi M, Basulaiman M, et al. Tobacco consumption in the Kingdom of Saudi Arabia, 2013: findings from a national survey. *BMC Public Health*. 2015;**15**:611. doi: 10.1186/s12889-015-1902-3. [PubMed: 26141062]. [PubMed Central: PMC4491232].

37. Al-Haddad NS, Al-Habeeb TA, Abdelgadir MH, Al-Ghamdy YS, Qureshi NA. Smoking patterns among primary health care attendees, Al-Qassim region, Saudi Arabia. *East Mediterr Health J*. 2003;**9**(5-6):911–22. [PubMed: 16450521].