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Hypertension clinical pathway: Experience of Aseer region, Saudi Arabia

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Abstract:

BACKGROUND: Hypertension (HTN) is a common chronic health problem with many complications and high morbidity rates. This study aimed to describe the HTN pathway, to assess the performance of screening and registration programs, to explore the challenges and suggest solutions for those challenges.

MATERIALS AND METHODS: This study was conducted in primary care centers in the Aseer region, Saudi Arabia, at the end of 2022. The study consisted of three parts namely: Screening for HTN, registration of known hypertensive patients and opinions of representatives of Primary Healthcare Centers (PHCs) on challenges to the implementation of HTN pathway and suggestions for overcoming these challenges. Three Google forms were developed by the investigators to achieve the objectives of this study. The first two forms were completed by doctors and nurses at each PHC and reviewed by the leader of HTN pathway, and the third form completed by a representative of each PHC. SPSS version 26 was used for data management and analysis. Chi-square test was used to determine association between categorical variables; binary logistic regression analysis was performed to determine the correlates of being hypertensive and having good control of HTN.

RESULTS: A total of 159,243 individuals were screened for HTN, 55% of whom were females and 94% were Saudis. The prevalence of HTN was 13%; 70% were overweight or obese and 14% had diabetes. The total registered number of patients was 55,628; 50% had good HTN control. Major challenges were inadequate health coaches, care coordinators, laboratory and radiology facilities, lack of coordination with hospitals, and ineffective appointment system.

CONCLUSION: This study revealed that the current HTN pathway was successful with regard to screening and registration of patients with HTN. Many challenges need an executive plan with SMART objectives to optimize the care for HTN patients in the region.

Keywords:

Aseer region, hypertension, pathway, primary care, screening

Introduction

Hypertension (HTN) is global health problem and a major risk factor for coronary heart diseases, cerebral vascular diseases, and renal failure.^[1,2]

Worldwide, it is estimated that HTN affects about one-third of adults in the community.^[3] Many national and regional studies from Saudi Arabia have reported a varied prevalence of HTN ranging from

9% to 34%.^[4] In order to detect HTN early, most health organizations and societies have agreed and recommended regular screening of individuals above 18 years.^[5]

In Saudi Arabia, screening for HTN was recommended and started in primary healthcare centers (PHCs) in early 1992 when a quality assurance program was launched to cover all the elements of the primary healthcare services.^[6] However, many reports from Saudi Arabia on HTN care are not optimistic since there are still many obstacles in daily practice.^[7-13]

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Since 2016, there has been a Saudi national program to transform the health sector to achieve the goal of the national vision 2030.^[14-16] The Saudi Health transformation includes many aspects that aim to increase life expectancy to 80 years and reduce the rate of premature death from the ten leading causes by 40%–50%.^[14-16] In order to reach these goals, the Ministry of Health and Health Company approved the new model of healthcare comprising six health systems and six levels of healthcare.^[14,15] One of the most important health systems is the chronic care system which deals with the screening, diagnosis, and management of chronic health problems such as high blood pressure.^[14,15] There are many clinical pathways in chronic care models for HTN, diabetes, obesity, lipid disorders, bronchial asthma, and others.^[14,15] The HTN pathway was designed and implemented in 2019 based on the national and international guidelines.^[5]

This study aims to describe the HTN pathway, to assess the performance of screening and registration program, to explore the challenges and suggest solutions to these challenges.

Materials and Methods

This study was conducted at PHCs in Aseer region in November and December 2022. Aseer region is one of the 13 administrative regions in the south-west part of Saudi Arabia. According to the recent national report, its total population is about 2.3 million.^[17] There are 19 general hospitals, one central hospital, two maternal-child hospitals, and one psychiatric hospital with more than 2000 beds in addition to a diabetic center, a rehabilitation center, two main artificial kidney centers, and 210 PHCs. Ethical approval was obtained from the Institutional Review Board vide letter no. REC-8-10-2022 dated 31/10/2022 and informed written consent was taken from all participants in the study.

This survey was conducted to describe the new High Blood Pressure Pathway (HTNP) started in the Aseer region in 2019. The new HTNP was implemented after several meetings and workshops of the regional HTNP committee and representatives from the Health Holding Company at the General Directorate of Health Affairs–Aseer, Ministry of Health, Saudi Arabia, to discuss the new approach to managing HTN. The Saudi Guidelines of HTN were reviewed by the concerned committee and the clinical pathway developed.^[5] The pathway includes the following elements: screening, diagnosis, and plan of care with specific indications for referral from PHC to secondary care [Table 1]. After a complete development of HTNP which took 2 months, five PHCs were selected to pilot the implementation. Piloting consisted of the selection of a few PHCs and the training of frontline staff (doctors and nurses, care coordinators,

Table 1: Elements of hypertension pathway, Aseer region, Saudi Arabia

Community awareness program on HTN
Screening all individuals +18 years at least once per year or when to visit PHCs
Confirm hypertension diagnosis as per the SHMS guidelines
Conducting relevant history and clinical examination
Ask for relevant investigations
Conduct risk assessment
Risk factors for chronic heart disease
Associated morbidities (DM, obesity, smoking, and dyslipidemia)
Classify the patients
Primary or secondary HTN
High-urgent - emergency
Formulate plan of care
Health education
Investigations
Target of blood pressure control
Options of management (lifestyles and drugs)
Referral
Red flags
Appointment and follow up

HTN=Hypertension, PHCs=Primary healthcare centers, DM=Diabetes mellitus, SHMS=Saudi Hypertension Management Society

and health coach). The training consisted of lectures and workshops on patients' journey from PHCs to hospitals, the role of each member in the team, and the relevant key performance indicators (KPIs). In February 2020, the implementation of HTNP was extended to cover 60 PHCs, and in March 2020, the implementation was scaled up to cover the remaining 150 PHCs.

In order to measure the impact of HTNP, two Google forms eliciting the relevant data of age, sex, nationality, comorbidities, complications, and referral to secondary care were developed by the investigators. The first form was for HTN screening while the second was for registration of known HTN patients at PHCs. Both forms were completed by doctors and nurses at each PHC and reviewed by the leader of the pathway. Several KPIs were assessed during the period of implementation and a WhatsApp group headed by an HTNP leader was formed to discuss any challenges and give frontline staff and coordinators the relevant advice.

Screening for HTN was done as per the Saudi HTN guidelines by automated HTN machines, and patients were classified into the following categories after three consecutive readings: normal blood pressure (<120/70 mmHg), pre-HTN (120–139/80–89), HTN Grade I (140–159/90–99), HTN Grade II (160–179/100–109), and HTN Grade III (\geq 180/110). Patients who were established as hypertensives were registered in the HTN registry and were considered to have good controlled HTN if their last blood pressure reading was <140/90 mmHg.

In order to identify the barriers in the HTN pathway, a Google form was constructed by the investigators and sent by an electronic link to all PHCs, and the doctors in charge requested to complete in 2 days. The Google form had the name of center, total number of HTN patients, number of staff (doctors, nurses, health coaches, and care coordinators), available resources (laboratory, radiology, electrocardiogram, Wasfaty system, and electronic medical records), and a set of challenges they expected to face during the implementation and their suggestions for overcoming these challenges.

Data entry and analysis was carried out using the Google forms, Excel program. Statistical Package for the Social sciences (SPSS) program version 26.(IBM Corporation, Armonk, NY, USA) was used to carry out statistical analysis and find out the associations between HTN and demographic characteristics of the participants. The Chi-square test was used to test the association between categorical variables while binary logistic regression analysis was done to study the association between HTN as a dependent variable and demographics as independent variables. *P* values were considered significant if their values were <5%.

Results

Table 2 depicts the profile of screened individuals from 2020 to 2022. More than 159,000 individuals were screened for HTN, 50% of whom were between 26 and 45 years old, females and Saudis represented 55% and 94%, respectively. Less than 3% were smokers, 14% were diabetics, while 26% had a family history of HTN. More than 70% were overweight (37%) or obese (31%). The total incidence rate of HTN over 3 years was 13% while the pre-HTN rate was 43.7%.

Statistical analysis to find out the association between being HTN and sociodemographic variables using the Chi-square test revealed that HTN was higher in males than females (15.9% vs. 10.5%) and higher in non-Saudi compared to Saudi (17.4% vs. 12.7%), higher in those above 40 years compared to those younger than 40 years (20.2% vs. 7.1%), in the diabetics than the nondiabetics (24.9% vs. 11%), and in individuals with a positive family history of HTN (15.9% vs. 12%) and the obese compared with the nonobese (18.1% vs. 10.8%). However, the analysis of correlate of such factors as independent variables and HTN as an dependent variable using binary logistic regression revealed that males had 1.5 fold risk of developing HTN compared to females [adjusted odd ratio (AOR) =1.507, confidence interval (CI): 1.460–1.555, *P* = 0.00, Table 3].

Table 4 shows the profile of known patients with HTN who registered at the PHC registry. The total number

of registered patients was 55,628 individuals, 50.3% of whom were males, the majority were Saudis (95%), about 3% were smokers, 47% were diabetics, 44% were obese, 7% had lipid disorders, <1% had renal diseases, 2.5% had heart disease, <0.5% had had a stroke, and more than half had good control of HTN.

Table 5 summarizes the process of HTN care in PHCs during the study period. The total number of registered patients increased from 17,188 in 2020 to 36,692 in 2022 while the total number of visits to PHCs jumped from 25,812 visits in 2020 to 67,378 visits in 2022. Referral rates to hospital for different medical specialties were as follows: ophthalmology (4.6%–5.1%), cardiology (2%–2.6%), neurology (1.3%–2.2%, nephrology (1.6%–2.3%), while the rate of referral to emergency departments was around (0.3%) for all the 3 years. The rates of complications were 0.6% for stroke, 6% for ischemic heart disease, 1% for renal diseases, and 3%–4% for retinopathy. The control of HTN was good for about 50% during that period.

Statistical analysis to discover the association between good control of HTN and sociodemographic variables revealed that being female, Saudi, <50 years old, nondiabetic, nonobese, and nonsmoker had good HTN control compared with their counterparts (*P* <5%). However, binary logistic regression analysis revealed that being <50 years old (AOR = 1.37), Saudi (AOR = 1.3), nonobese (AOR = 1.3), and nonsmoker (AOR = 1.12) were the significant predictors of good blood pressure control [Table 6].

Table 7 illustrates the availability of different workforce and the essential infrastructure for HTN care at PHCs. The total number of physicians, nurses, health coach, and case coordinators were (459, 819, 148, and 212), respectively. Electrocardiogram, radiology, and laboratory were available in 60%, 20%, and 38% of PHCs, respectively. Electronic medical records and electronic prescribing system (Wasfaty) were available at 87% and 34% of PHCs, respectively.

Table 8 shows the common impediments to implementing the HTN pathway in the Aseer region as reported by the representatives of PHCs. Uncooperative hypertensive patients (50%), inadequately trained health coaches and care coordinators (30%–46%), unavailability of laboratory and radiology (30%–55%), weakness in the coordination between PHCs and hospitals (40%), and lack of effective appointment system (25%) were the common challenges.

Discussion

In this study, a total of 159,243 individuals were screened for HTN and the incidence rate for HTN was 13%. This figure is lower than that reported by Abolfotouh *et al.*, (21.6%) in 1996, Al-Nozha *et al.*, (26.1%) in 2007,

Table 2: Frequency distribution for screening of adults for hypertension by personal characteristics and year, Aseer region, Saudi Arabia, 2020–2022

Variables	Year		
	2020 N (%)	2021 N (%)	2022 N (%)
Age group			
18–25	5214 (16.7)	10,006 (18.5)	13,997 (18.9)
26–35	7504 (24.1)	13,727 (25.4)	18,315 (24.7)
36–45	6659 (21.4)	12,000 (22.2)	16,927 (22.8)
46–55	5122 (16.4)	8017 (14.9)	10,688 (14.4)
56–65	3694 (11.9)	5559 (10.3)	7497 (10.1)
66–80	2356 (7.6)	3685 (6.8)	5551 (7.5)
80+	616 (2.0)	952 (1.8)	1157 (1.6)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)
Sex			
Male	13,110 (42.1)	24,332 (45.1)	34,399 (46.4)
Female	18,055 (57.9)	29,614 (54.9)	39,733 (53.6)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)
Nationality			
Saudi	29,743 (95.4)	51,495 (95.5)	69,115 (93.2)
Non-Saudi	1422 (4.6)	2451 (4.5)	5017 (6.8)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)
Smoking status			
Not smoker	30,148 (96.7)	52,810 (97.9)	72,189 (97.4)
Smoker cigarette	930 (3.0)	1042 (1.9)	1688 (2.3)
Smoking cigarette and shisha	46 (0.1)	49 (0.1)	118 (0.2)
Smoking shisha only	41 (0.1)	45 (0.1)	137 (0.2)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)
History of DM			
Diabetic	5505 (17.7)	7067 (13.1)	9179 (12.4)
Not diabetic	25,660 (82.3)	46,879 (86.9)	64,953 (87.6)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)
Family history of HTN			
Yes	9491 (30.5)	13,082 (24.3)	16,529 (22.3)
No	21,674 (69.5)	40,864 (75.7)	57,603 (77.7)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)
Body weight			
Underweight	785 (2.5)	1416 (2.6)	2523 (3.4)
Normal weight	9166 (29.4)	17,413 (32.3)	24,613 (33.2)
Overweight	10,641 (34.1)	19,311 (35.8)	25,993 (35.1)
Obesity-1	6754 (21.7)	10,344 (19.2)	13,700 (18.5)
Obesity-2	2657 (8.5)	3791 (7.0)	5014 (6.8)
Obesity-3	1162 (3.7)	1671 (3.1)	2289 (3.1)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)
Blood pressure classification			
<120/80	14,519 (46.6)	24,622 (45.6)	29,980 (40.4)
120–139/80–89	12,628 (40.5)	22,888 (42.4)	33,993 (45.9)
140–159/90–99	2966 (9.5)	4868 (9.0)	7398 (10.0)
160–179/100–109	563 (1.8)	1104 (2.0)	1523 (2.1)
≥ 180/110	489 (1.6)	464 (0.9)	1238 (1.7)
Total	31,165 (100.0)	53,946 (100.0)	74,132 (100.0)

HTN=Hypertension, DM=Diabetes mellitus

Saeed *et al.*, (25.5%) in 2011, and Khoja *et al.*, (29.7%) in 2018.^[18-21] In a recent national study conducted by Alenazi and Alqahtani on 24,012 individuals, the prevalence of HTN in males and females was 8.5% and 10%, respectively.^[22] In a systematic review by Alshammari

et al., on 278,873 individuals in 29 studies from different regions of Saudi Arabia, the prevalence of HTN ranged from 15.2% to 32.6% with a total cumulative prevalence of 22.7%.^[4] Globally, the prevalence of HTN was 26.4% in Asia and 39% in Eastern Europe and Central Asia,

Table 3: Correlates of hypertension in screened individuals attending primary care centers, Aseer region, Saudi Arabia, 2020–2022

Predictor variables	AOR	95% CI for AOR	P-value
Age group (years)			
<40	0.367	0.355–0.380	<0.001
>40 (RC)	-		
Sex			
Male	1.507	1.460–1.555	<0.001
Female (RC)	-		
Nationality			
Non-Saudi	0.685	0.645–0.728	<0.001
Saudi (RC)	-		
Smoking			
Smoker	0.718	0.660–0.781	<0.001
Nonsmoker (RC)	-		
Family history HTN			
Positive	0.839	0.811–0.869	<0.001
Negative (RC)	-		
DM			
Yes	0.606	0.583–0.629	<0.001
No (RC)	-		
Obesity (BMI >29.9)			
Obese	0.640	0.620–0.661	<0.001
Not obese (RC)	-		
Constant			<0.001

RC=Reference category, AOR=Adjusted odd ratio, CI=Confidence interval, BMI=Body mass index, HTN=Hypertension, DM=Diabetes mellitus

while the prevalence rate in the Middle East region was 24.4% as reported by Okati-Aliabad *et al.*^[23,24] A study from Iran of 8296 adults older than 35 years reported a higher rate (36.5%) and another study from UAE, Dubai with 2530 individuals reported a prevalence of 32.5%.^[25,26]

Out of the screened individuals, 43.7% had pre-HTN. This figure is lower than what was reported from AlKharij, Saudi Arabia (55%), from India (55%) but higher than the figures reported from Iran (12.2%), UAE (29.8%), and Middle-East region (28.6%).^[24,26-28] The differences in the prevalence rates in these studies could be due to the methods of measuring HTN, sample sizes of studies in addition to prevalence of risk factors such as obesity, smoking, diabetes, salt intake, and sedentary life. In this regard, it was mandatory to follow up individuals with pre-HTN, assess them for other risk factors and manage them accordingly.

In this study, the risk factors and morbidities evident in the screened individuals were obesity (34%), diabetes (15%), and smoking (3%). Statistical analysis of the association between HTN and sociodemographic variables revealed that there was a high prevalence of HTN in individuals of male gender, non-Saudi, age above 40 years, smokers, those with a positive family history of HTN, diabetic or obese compared to their counterparts. However, logistic regression analysis revealed that being male is the only variable with high prediction of having HTN. These risk factors are common

in hypertensive patients as reported in different studies from Saudi Arabia and should be given greater attention in the comprehensive management of HTN.^[8,29-31]

Patient registry is an essential step to providing good care to hypertensive patients. In the current study, 55,628 patients were registered at PHC, but the number of registered patients had jumped from 17,188 in 2020 to 36,692 in 2022 while the total number of visits had increased from 25,812 visits in 2020 to 67,378 visits in 2022. In a previous study by Al-Sharif and Al-Khalidi (2003), the total number of registered HTN patients was 13,087 while another study by Alsaleem *et al.*, reported 23,156 HTN patients.^[7,8] This big difference indicates the positive impact of the pathway on HTN care in the region. Another positive aspect of HTN pathway is its comprehensive approach to registration and the management of other risk factors such as diabetes (46%), obesity (44%), and dyslipidemia (7%) which were prevalent in hypertensive patients in this study.

One important element of HTN care is referral to hospitals when needed. In this study, <8% were referred and most were referred to ophthalmology departments. This figure is very low compared to the standard which states that every HTN patient should be referred annually for funduscopy. In this regard, it is suggested that big PHCs should have at least one well equipped EYE clinic to which the nearby PHCs can refer their hypertensive patients for funduscopy.

Good control of HTN (<140/90 mmHg) ranged between 47.2% and 51.7% during the study period; these figures are higher than those reported earlier by Alsaleem *et al.*, (40%), Abolfotouh *et al.*, (19%), Al-Nozha *et al.*, (25%), Saeed *et al.*, (37%), Al-Tuwijri and Al-Rukban (40.4%), El-Bcheraoui *et al.*, (17%), Al-Baghli *et al.*, (34%), and Alshammari *et al.*, (35%) but lower than those reported by Muntner *et al.*, (70%) from the USA.^[4,8,18-20,29-32] However, similar figures were reported by Ahmed and El-Awad from Asir (49%) and Al-Qahtani from Najran region (45% to 48%).^[33,34] Logistic regression analysis revealed that male gender, being Saudi, nonsmoker, nondiabetic, and nonobese were the predictors of good control of HTN. The many factors responsible for good or poor control of HTN include compliance with lifestyles, medications, and control of other risk factors such as stress, obesity, and diabetes.^[35-37] However, good compliance with the appointment system and a clear plan of care, which are the elements of the current HTN pathway, can contribute significantly to good HTN control.

The rates of complications were 6% for ischemic heart disease and 3%–4% for retinopathy. These figures are similar to those reported by Al-Nozha (8.2%) for IHD and Alsaleem *et al.*, (7%) and Al-Khalidi (3.6%) for retinopathy.^[8,19,38] The low figures could be the result of

Table 4: Profile of registered hypertension patients by year, Aseer Region, Saudi Arabia, 2020–2022

Variables	Year		
	2020 N (%)	2021 N (%)	2022 N (%)
Age group			
18–25	277 (1.6)	536 (2.1)	1232 (3.4)
26–35	758 (4.4)	1186 (4.8)	2394 (6.5)
36–45	1716 (10.0)	2853 (11.4)	4771 (13.0)
46–55	3533 (20.6)	5207 (20.9)	7497 (20.4)
56–65	4798 (27.9)	6788 (27.2)	9429 (25.7)
66–80	4683 (27.2)	6558 (26.3)	9099 (24.8)
80+	1423 (8.3)	1826 (7.3)	2270 (6.2)
Total	17,188 (100.0)	24,954 (100.0)	36,692 (100.0)
Sex			
Male	8253 (48.0)	12293 (49.3)	18670 (50.9)
Female	8935 (52.0)	12661 (50.7)	18022 (49.1)
Total	17,188 (100.0)	24,954 (100.0)	36,692 (100.0)
Nationality			
Saudi	16,601 (96.6)	23,926 (95.9)	34,601 (94.3)
Non-Saudi	587 (3.4)	1028 (4.1)	2091 (5.7)
Total	17,188 (100.0)	24,954 (100.0)	36,692 (100.0)
Smoking status			
Not smoker	16,575 (96.4)	24,140 (96.7)	35,388 (96.4)
Smoker cigarette	504 (2.9)	666 (2.7)	1033 (2.8)
Smoking cigarette and shisha	43 (0.3)	75 (0.3)	120 (0.3)
Smoking shisha only	66 (0.4)	73 (0.3)	151 (0.4)
Total	17,188 (100.0)	24,954 (100.0)	36,692 (100.0)
Associated morbidities			
Diabetes	8117 (47.2)	11,506 (46.1)	16,838 (45.9)
Obesity	8549 (49.7)	11,667 (46.8)	15,509 (42.3)
Dyslipidemia	1251 (7.3)	1680 (6.7)	1976 (5.4)
Renal diseases	131 (0.8)	174 (0.7)	221 (0.6)
Heart diseases	403 (2.3)	438 (1.8)	801 (2.2)
Stroke	88 (0.5)	103 (0.4)	127 (0.3)

Table 5: Hypertension care provided at primary healthcare centers by year, Aseer region, Saudi Arabia, 2020–2022

Variables	Year		
	2020 N (%)	2021 N (%)	2022 N (%)
Total number of registered patients	17,188	24,954	36,692
Total number of visits to primary healthcare centers	25,812	46,208	67,378
Referral to hospitals			
Eye clinic	834 (4.6)	1505 (6.0)	1861 (5.1)
Cardiology clinic	348 (2.0)	767 (3.1)	948 (2.6)
Neurology clinic	220 (1.3)	544 (2.2)	818 (2.2)
Nephrology clinic	276 (1.6)	572 (2.3)	837 (2.3)
Emergency department	64 (0.4)	110 (0.4)	126 (0.3)
Control of HTN			
Controlled	8884 (51.7)	12,607 (50.5)	17,372 (47.2)
Uncontrolled	8304 (48.3)	12,347 (49.5)	19,320 (52.7)
Rate of complications			
Stroke	130 (0.8)	155 (0.6)	197 (0.5)
IHD	1100 (6.4)	1492 (6.0)	2075 (5.7)
Renal diseases	205 (1.2)	230 (0.9)	279 (0.7)
Retinopathy	680 (4.0)	693 (2.8)	1079 (2.9)

HTN=Hypertension, IHD=Ischemic heart disease

Table 6: Correlates of good control of hypertension in registered patients at primary healthcare centers, Aseer region, Saudi Arabia, 2020–2022

Predicting variables	AOR	95% CI for AOR	P-value
Age group (years)			
<50	1.371	1.335–1.408	<0.001
>50 (RC)	-		
Sex			
Female	0.911	0.891-0.931	<0.001
Male (RC)	-		
Nationality			
Saudi	1.312	1.244–1.395	<0.001
Non-Saudi (RC)	-		
Smoking status			
Nonsmoker	1.125	1.067–1.188	<0.001
Smoker (RC)	-		
DM			
No	1.106	1.082–1.130	<0.001
Yes (RC)	-		
Obesity			
Nonobese	1.301	1.273–1.330	<0.001
Obese (RC)	-		
Constant	0.785		<0.001

RC=Reference category, AOR=Adjusted odd ratio, CI=Confidence interval, DM=Diabetes mellitus

Table 7: Infrastructure for hypertension care at primary healthcare centers, Aseer region, Saudi Arabia, 2022

Human and nonhuman resources	N (%)
Number of PHCs who have implemented hypertension pathway	210 (95.5)
Number of doctors	459 (100)
Number of nurses	819 (100)
Number of health coaches	148 (70.5)
Number of care coordinators	210 (100)
Availability of electrocardiogram	126 (60.0)
Availability of laboratory	80 (38.1)
Accessibility to electronic records	182 (86.7)
Availability of X-rays	42 (20.0)
Accessibility for electronic prescribing	71 (33.8)

PHCs=Primary healthcare centers

Table 8: Challenges in the hypertension pathway and suggested solutions at primary healthcare centers, Aseer region, Saudi Arabia, 2022

Challenges	N (%)	Solutions
Inadequate training	84 (40.0)	Training all doctors and nurses Provide incentives based on KPIs achievements
Inadequate number of health coach	97 (46.1)	Train more health coaches Provide incentives
Inadequate number of care coordinators	63 (30.0)	Training more coordinators Provide incentives
Unavailability of laboratory	105 (50.0)	Arrange with nearby laboratories
Inadequate laboratory reagents - kits	71 (33.8)	Provide adequate kits
Unavailability of X-ray	116 (55.2)	Arrange with nearby PHCs
Inadequate essential drugs	58 (27.6)	Expand electronic prescribing to all PHCs
Ineffective appointment system	53 (25.2)	Activate appointment system with daily reminders
Weakness of coordination with hospitals	84 (40.0)	Activate electronic referral and audit referral process
Uncooperative patients	105 (50.0)	Patient education and community awareness about HTN Activate virtual clinic Assign one clinic weekly to HTN patients at each PHC

HTN=Hypertension, PHCs=Primary healthcare centers, KPIs=Key performance indicators

under recording and so PHC staff should make every effort to detect these morbidities as early as possible to be able to introduce optimal HTN care.

One aspect of the new HTN pathway is meeting regularly and discussing the barriers against the implementation and suggested solutions by the healthcare providers at PHCs to provide the best quality of care for patients. Several challenges were reported namely: inadequate number of health coaches (30%), unavailability of electrocardiogram machines (40%), lack of laboratories and X-rays (62%, 80%), and no electronic prescribing system in 66%. Similar barriers were reported by Al-Sharif and Al-Khalidi in previous studies from the Aseer region.^[7,9,38] In order to remove these barriers, it is suggested that all PHCs should have a short-term plan as suggested in Table 4 and an executive plan with SMART objectives to obliterate all these barriers in the next 5 years.

Conclusion

This study revealed that the current HTN pathway was successful and able to detect new cases of HTN and manage known cases as well. The rate of HTN control needs further effort for improvement. Many different challenges, including inadequate human resources, lack of essential infrastructure, inadequate professional training, inadequate drug supply, weak coordination among the healthcare levels, inactive community participation need extra work, and executive plan with SMART objectives to optimize the care for HTN patient in the region.

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Conflicts of interest

There are no conflicts of interest.

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