Contents lists available at ScienceDirect

Preventive Medicine Reports

A lifestyle intervention to prevent hypertension in primary healthcare settings: A Saudi Arabian feasibility study

Hayat Mushcab [a,*], Abdullah Al Mutairi [b], Ashwaq Al Matroud [b], Sheikha Dossary [b], Mohammed J. Ghamdi [b]

[a] Research Office, Johns Hopkins Aramco Healthcare, Dhahran, Eastern Province, Saudi Arabia
[b] Population Health Department, Johns Hopkins Aramco Healthcare, Dhahran, Eastern Province, Saudi Arabia

A B S T R A C T

Background: Hypertension is a leading cause of morbidity and mortality in Saudi Arabia, causing a significant public health challenge in the kingdom. In this study, we aimed to assess the feasibility of the Blood pressure LifeStyle Management (BLSM) program for preventing hypertension by making a significant changes in lifestyle interventions through controlling some risk factors such as behavior, diet, physical activities, and weight in Primary Care.
Aim: The aim of this study is to evaluate the effectiveness of the Blood pressure LifeStyle Management (BLSM) program in reducing blood pressure.
Methods: This is a cohort of three-month period feasibility study in a primary care setting in a before-and-after study design.
Results: A total of 100 individuals were recruited for the study, and 73 have completed the program. The overall systolic (SBP) and diastolic (DBP) blood pressure showed an increment of 0.75 and 1.67 mmHg, respectively. The subgroup analysis exhibited a decrease in SBP (−6.5 mmHg) for patients with hyperlipidemia, while a DBP average increased (+2 mmHg). Females showed a decrease in SBP (−1.04 mmHg) compared to males, who increased in their SBP (+1.69). Smokers showed a significant improvement in SBP and DBP with $p < 0.05$.
Conclusion: Lifestyle intervention can improve and control blood pressure in primary care settings. The program can be tailored to include more participants, the length of the program could be modified, and the frequency of follow-ups could be increased to enable participants to change their habits and incorporate better life choices in their daily routines.

1. Introduction

In recent years, nearly 1.3 billion adults have developed hypertension worldwide (WHO, 2021), causing or contributing to nearly 670,000 deaths in the United States and 7.5 million deaths worldwide (CDC, 2022; Xiao et al., 2020). Therefore, hypertension, the "silent killer," is considered a severe medical condition and a major cause of premature death worldwide (WHO, 2021). Globally, the most common non-communicable disorders is a sustained elevation of blood pressure to systolic >140 mmHg and diastolic BP > 90 mmHg (Mills et al., 2020). In Saudi Arabia, a national survey reported that the prevalence of hypertension and prehypertension is 15.2 % and 40.6 %, respectively, making it a leading cause of morbidity and mortality and causing a significant public health challenge in the kingdom (El Bcheraoui et al., 2014).

Hypertension – or high blood pressure- is a condition that affects the arteries that carry the blood from the heart to the rest of the body by forcefully pushing the blood against their walls, which will damage the blood vessels and low-density lipoprotein cholesterol (Saudi MoH, xxxx). This pressure will increase the workload on the circulatory system, causing a high risk for cardiac diseases such as stroke, aneurysm, congestive cardiac failure, and other diseases such as kidney problems, retinal hemorrhage, metabolic syndrome, and dementia (WHO, 2021; Clinic, 2022). Hypertension is classified as primary or secondary hypertension (Saudi MoH, xxxx). Primary hypertension, also called essential hypertension, has no identifiable cause. It is accountable for 90.0 % of all hypertension cases, whereas the remaining 10.0 % are classified under secondary hypertension because of another disease or health condition (Ibekwe, 2015).
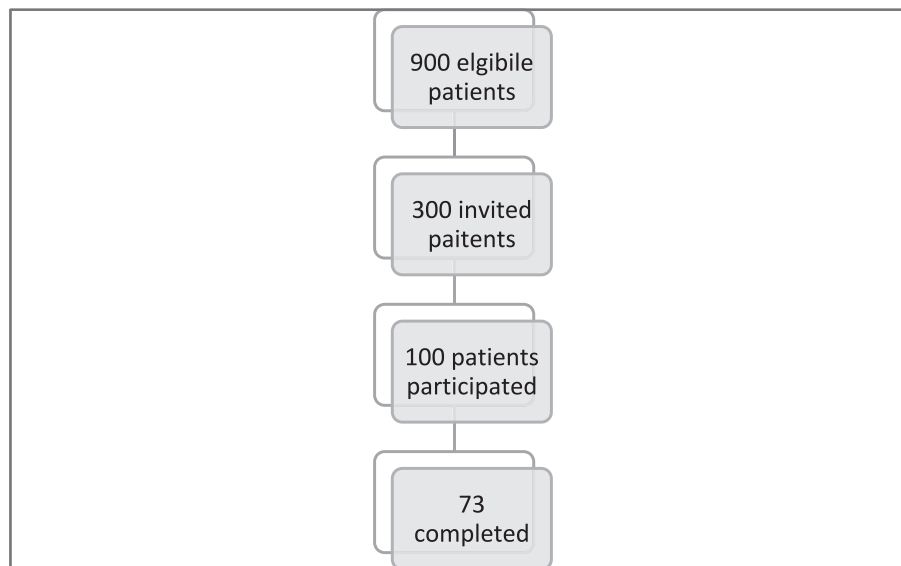

Fig. 1. Breakdown of participants completed the BLSM program at JHAH from October to December 2021.

There are modifiable and non-modifiable risk factors that can lead to hypertension. The non-modifiable risk factors are attributes and characteristics in the individual that cannot be changed or adjusted, thus, considered uncontrollable such as family history, genetic composition, aging, and gender (Saudi MoH, xxxx). In contrast, modifiable risk factors are attributes, characteristics, and exposures that can be modified or adjusted to prevent the development or progression of the condition (Ibekwe, 2015). These attributes include obesity, smoking, alcohol consumption, diet, a sedentary lifestyle, and other chronic illnesses such as diabetes (Saudi MoH, xxxx).

Screening the population for hypertension can help in the early detection and identification of high-risk individuals. Consequently, it can result in a timely intervention that will decrease morbidities and mortalities and significant savings in costs associated with hypertension (Unger et al., 2020; Gay et al., 2016). Lifestyle modification for at-risk individuals developing hypertension can be a great approach to tackling the condition and managing the associated factors (Schmidt et al., 2020).

Generally, a healthy diet and appropriate physical activity benefit everyone decreasing the risk of cardiovascular disease, morbidity, and mortality (USPSTF, 2020). Modifying the individual's lifestyle is considered the ultimate antihypertension treatment (Unger et al., 2020). These modifications include healthy dietary choices, salt reduction, weight reduction, smoking cessation, reduced alcohol consumption, and regular physical activity (Gay et al., 2016; Diaz and Shimbo, 2013; Unger et al., 2020). According to the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO), these factors can affect the blood pressure equally (WHO, 2021; Wang et al., 2022).

At Johns Hopkins Aramco Healthcare (JHAH), a hypertension prevention program has been recently introduced as one of the health promotion programs targeting the at-risk population. We called it BLSM (pronounced BALSAM), it is an Arabic word for "Remedy." BLSM, or the "Blood pressure LifeStyle Management" program, is a lifestyle intervention program targeting eligible pre-hypertensive patients. The program consists of six live virtual educational sessions over a three months, reinforced by educational videos developed by the institution post each session. In this feasibility study, we evaluate the effectiveness of BLSM in reducing the participants' blood pressure.

2. Methodology

2.1. Study design

This program was piloted over three months at a primary care setting in a tertiary hospital, a multi-centered healthcare institution serving the Saudi Aramco community in several districts. This is a prospective feasibility cohort study. Data were collected between October and December 2021 in a before-and-after study design to investigate the effectiveness of the BLSM intervention program. This study was conducted following the Declaration of Helsinki and has received JHAH's Institution Review Board's approval. The informed consent form was waivered as data were collected retrospectively and anonymously from patients' electronic medical records. The manuscript is written following the STROBE Statement checklist for observational cohort studies.

2.2. Study population

Using the hospital's Electronic Medical Record System (EPIC), the prehypertension registry pulled 3412 patients. The prehypertension registry's criteria and data dictionary was created in 2019 by experts from Johns Hopkins Medicine (JHM) and healthcare providers from JHAH, in collaboration with the EPIC team. Included patients were 15 years of age or older and had three elevated blood pressure measurements of ($\geq$130 to $\leq$ 139 systolic; $\geq$80 to $\leq$ 89 diastolic mmHg) within their visits to primary care in the past 6 months. Patients who are diagnosed with hypertension and take medical treatment for it and patients with comorbidities such as cardiovascular diseases, diabetes mellitus, chronic kidney disease, as well as pregnant women, were excluded from the study.

2.3. Study sample

A total of 900 patients met our inclusion criteria. A sample size of 10–30 % of the population was appropriate for the feasibility study. The study team randomly introduced the program to 300 patients. Only 100 patients accepted to join the lifestyle intervention, and 73 patients completed the program and their results were included in the outcome analysis (Fig. 1).

Table 1

Videos delivered to patients weekly, focused on strategies to adopt a healthy diet and lifestyle in order to lower blood pressure and prevent hypertension. B: Videos for staff training on blood pressure measurement.

A: Diet and Lifestyle videos - for patients	
Why is blood pressure important?	https://www.jhah.com/ar/health-wellbeing/health-programs/blood-pressure-lifestyle-management/why-is-blood-pressure-important
Reduce the amount of salt in your diet	https://www.jhah.com/ar/health-wellbeing/health-programs/blood-pressure-lifestyle-management/reducing-sodium-in-your-diet
Healthy diet	https://www.jhah.com/ar/health-wellbeing/health-programs/blood-pressure-lifestyle-management/healthy-diet
Physical activity	https://www.jhah.com/ar/health-wellbeing/health-programs/blood-pressure-lifestyle-management/physical-activity
Managing your weight	https://www.jhah.com/ar/health-wellbeing/health-programs/blood-pressure-lifestyle-management/managing-your-weight
B: Standardized BP measurement Training Videos – for training clinical staff	
Why is hypertension important?	Why hypertension is an important issue
Preparing for measurement	Preparing an individual for blood pressure measurement
How to diagnose hypertension	How to diagnose hypertension
What to do after diagnosis	What to do after a diagnosis of hypertension

2.4. Program description

BLSM is a lifestyle intervention program that promotes healthy choices and encourages patients to modify their lifestyles to prevent or delay the onset of hypertension. The program was adapted from the Centers of Disease Control and Prevention's (CDC) Hypertension Management Program (HMP) (Nicoll, 2010). HMP was developed for all patients suffering from hypertension and their methods were combined with medications. However, BLSM focused on the pre-hypertensive patients and were not on any hypertension medication. BLSM consists of six educational sessions carried out virtually to all participants biweekly. In addition, videos developed by health professionals at the hospital about each topic are shared with the participants post each session via text message to their phones and MyChart (patients' portal to their electronic medical records).

Participants are seen in-person at the clinic at the beginning, at six weeks, and at the end of the program for baseline, mid-point, and end-point measurements of their blood pressure, weight, and BMI. The sessions and videos cover the following educational topics: the importance of blood pressure and its complications, the components of a healthy diet, the importance of sodium intake reduction, the benefits of regular physical activity, the impact of weight loss, and smoke cessation [Table 1].

2.5. Outcome measures

The program's outcome was the reduction of systolic and diastolic measurements from baseline to program completion.

2.6. Data collection

Participants' initial data were extracted from their electronic medical records. Trained nurses were recruited for this project to standardize the measurement collection process. The nurses took blood pressure, weight, and BMI measurements and recorded them in the program's data database at each data point.

2.7. Risk of bias

The BLSM program coordinator approached all recruited

Table 2

Descriptive statistics of Socio-Demographic and baseline characteristics of 73 adult participants included in BLSM at JHAH between October and December 2021.

	Frequency	Percentages	*n*
Hyperlipidemia	8	38.1	21
Hypertension Family history	17	70.8	24
Smokers	5	10.87	46
Age (Mean ± SD)	43.6 ± 8.67		73
Gender			
Male		65.8	48
Female		34.2	25

participants, and any patient who met the criteria was asked to join the program without any selection bias.

2.8. Statistical analysis

Nominal variables were presented using frequencies and percentages, whereas continuous variables were presented as means ± SD. All variables were examined for outliers and non-normality. Mean change in SBP and DBP from baseline was reported using a paired *t*-test. Sub-group analyses were performed as part of the analysis to assess whether the intervention has effects across sex (male/female), hyperlipidemia (yes/no), age (<50, ≥50), family history (yes/no), smoking status (yes/no), obesity (BMI < 30 kg/m^2, ≥30 kg/m^2). An unadjusted linear regression model was used to determine the change in SBP and DBP from baseline and the last visit with 95 % CI. A p-value of <0.05 was considered to be significant. Analyses were performed using JMP®, Version 15. SAS Institute Inc., Cary, North Carolina, 1989–2021.

3. Results

One hundred participants were enrolled in the study, and only 73 completed the program. Most were males (65.8 %) with a mean ± SD age of 43.6 ± 8.67 years for all participants. Of the 73 participants, 70.8 % had reported a family history of hypertension, 38.1 % had reported hyperlipidemia, and 10.8 % were smokers [Table 2]. According to the chart [Fig. 2], 57.5 % of the educational sessions were completed.

Table 2 presents the baseline readings of the SBP and DBP levels of the 73 participants who completed the program and the change in these levels after the intervention. The SBP and DBP showed an increment of 0.75 and 1.67 mmHg, respectively, for all participants. Moreover, sub-group analysis was conducted when associated with hyperlipidemia, age, family history of hypertension, obesity, and smoking. During the three months, there was a slight mean increase in SBP from baseline + 0.75 and DBP + 1.67. Females had a decrease in SBP (-1.04 mmHg) compared to their male counterparts (1.69 mmHg). Patients with hyperlipidemia had a decrease in SBP (-6.5 mmHg), while the DBP average increased ($+2$ mmHg). However, smokers showed a statistically significant improvement in both SBP and DBP with p < 0.05, while no significant improvement was present amongst the other subgroups.

A linear regression analysis was performed to determine the change in blood pressure from the baseline data. There were 73 observations in the analysis. The test results showed that the regression model was significant for SBP $R^2 = 0.54$, RMSE = 9.51, p < 0.0001. DBP $R^2 = 0.53$, RMSE = 6.37, p < 0.0001. [Figs. 3 and 4].

4. Discussion

Hypertension is considered a modifiable cause of cardiovascular disease and increased mortality rate globally (NICE, 2019). The prevalence of events related to hypertension or elevated blood pressure is increasing significantly; thus, it is widely occurring primarily amongst pre-hypertensive patients (120–139 mmHg systolic; 80–89 mmHg diastolic), and the first stage of hypertension (140–159 mmHg systolic;
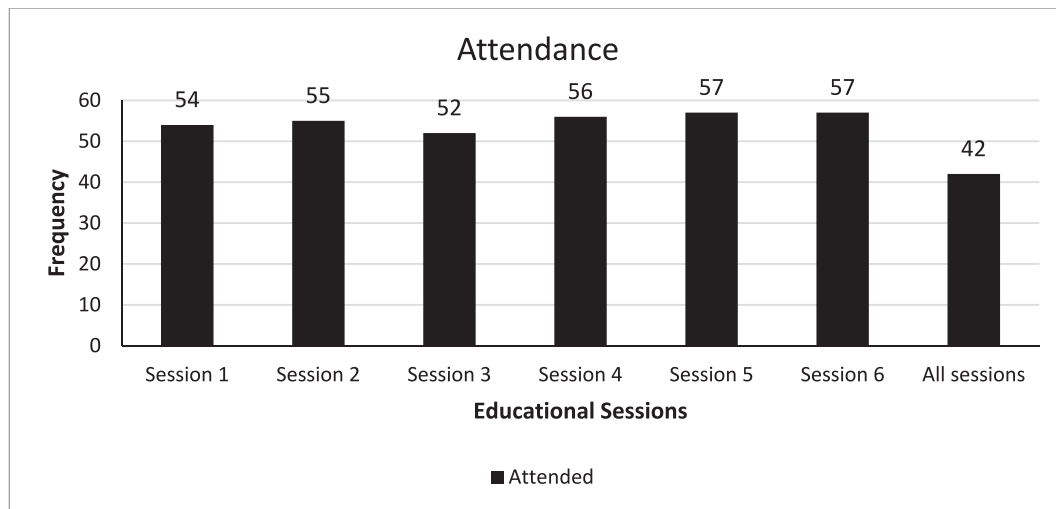
Fig. 2. Session attended by participants in the BLSM program at JHAH from October to December 2021.
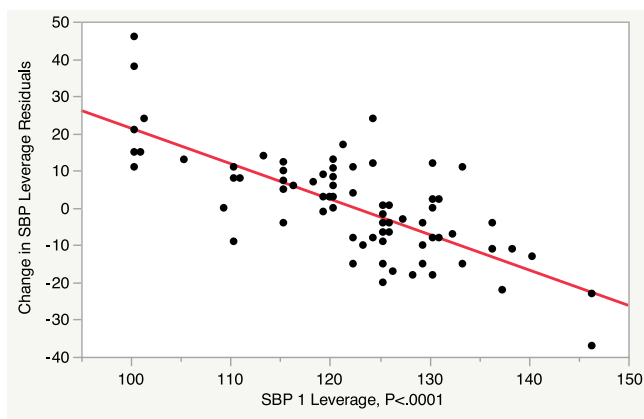

Fig. 3. Linear regression model of the change in SBP from baseline for 73 adult participants of BLSM program at JHAH from October to December 2021.
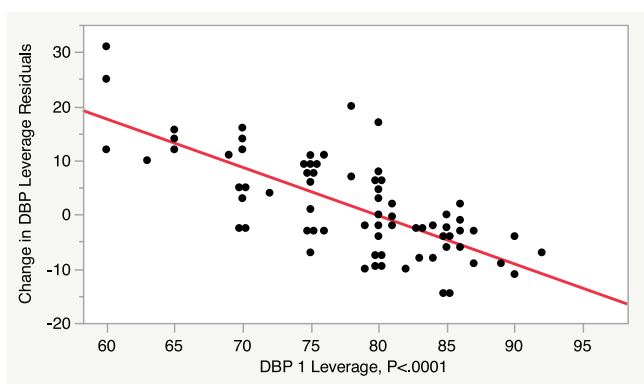

Fig. 4. Linear regression model of the change in DBP from baseline for 73 adult participants of BLSM program at JHAH from October to December 2021.

90–99 mmHg diastolic) (Abate et al., 2022).

The National Institute for Health and Care Excellence (NICE) has recommended lifestyle interventions to treat and manage hypertension. These recommendations include following a healthy diet, physical activity, and regular exercise to reduce blood pressure (Miller et al., 2021). NICE guidelines also recommended reducing alcohol and caffeine consumption, lowering sodium intake, and quitting smoking. In addition, a

report by the Task Force of the Hypertension Committee, the Guideline Committee of the Taiwan Society of Cardiology, and the Taiwan Hypertension Society was recently published guidelines for the management of hypertension recommending lifestyle modification-based therapy to reduce lifetime blood pressure burden (NICE, 2019). The recommended lifestyle modifications can be summarized mnemonically as S-ABCDE: Sodium restriction (2–4 g/day), Alcohol limitation (1 drink/day for men and half the amount for women), Bodyweight reduction (BMI 20–24.9 kg/m^2), Cigarette smoke cessation, Diet adaptation, and Exercise adoption (at least 30 min of moderate-intensity exercise 5–7/week) (NICE, 2019). They identified that poor persistence to change over time is this population's most significant limitation. Thus, committing to this kind of intervention can prevent pharmacological treatment and potentially delay the condition's progression (NICE, 2019).

A recent systematic review and meta-analysis published in 2022 amongst Ethiopian adults' adherence to a healthy lifestyle to manage their hypertension (Mushcab et al., 2021). The authors considered six domains to be healthy habits, including diet, sodium intake, physical activity, smoking, alcohol consumption, and weight management. Seventeen observational studies met the authors' criteria in this review. The review showed that patients had the least compliance rate of 48.7 % for adherence to physical activity, which entails a low adherence rate of 47.9 % for weight management (Mushcab et al., 2021). A slightly higher compliance rate of 50.9 % and 52.0 % was reported for dietary adherence and sodium intake, respectively. Finally, the highest adherence rate of 77.7 % and 86.4 % was reported for adherence to alcohol intake and quitting smoking, respectively. The review concluded that sedentary behaviors such as office work, inactivity, and traveling, could account mainly for the low adherence rate. However, the educational level among patients has increased the odds of adherence to a healthy lifestyle, similar to the results presented in the Ethiopian review (Mushcab et al., 2021).

A similar study was conducted in our institution and included patients with systolic blood pressure (SBP) above 140 mmHg using the videos only (Lally et al., 2010). A significant reduction in SBP was exhibited. However, this was not seen in our pilot. This could be because of the seriousness of hypertension when compared to prehypertension and the levels of risks associated with each condition. This could also be due to the level of knowledge of hypertension, level of education, and the duration of the condition, which resulted in lesser compliance with lifestyle modification (Lally et al., 2010).

Similarly, another lifestyle intervention program (TAWAZON) was conducted in our institution targeting pre-diabetic patients to prevent or

Table 3

Cub-analysis of changes in SBP and DBP in 73 adult participants in the BLSM program at JHAH according to sex, age, smoking, and medical history (family history of blood pressure, hyperlipidemia, and obesity) between October and December 2021.

	SBP				DBP			
	Baseline	N	Change from baseline	P-value*	Baseline	N	Change from baseline	P-value
All participants*	121.67	73	0.75	0.64	77.89	73	1.67	0.12
Gender*								
Male	121.25	48	1.69	0.38	77.69	48	1.94	0.72
Female	122.48	25	−1.04		78.28	25	1.16	
Hyperlipidemia*								
Yes	127.125	8	−6.5	0.25	77.5	8	2	0.52
No	122.77	13	1.46		79	13	−0.615	
Age*								
<50	120.7	53	1.28	0.64	77.66	53	1.85	0.82
≥50	124.1	19	−0.526		78.7	19	1.4	
Family History*								
Yes	124.82	17	−2.24	0.94	79.8	17	−1.294	0.44
No	125.86	7	−1.86		78	7	1.57	
Smoker*								
Yes	130.6	5	−13.4	0.00	82.6	5	−4.6	0.04
No	119.2	41	4.66		76.2	41	3.98	
Obese*								
Yes	121.1	27	2.7	0.33	77.76	27	2.81	0.42
No	122	46	−0.39		78.1	46	1	
Number of session, mean(SD)**	121.67	73	0.753(13.895)	0.30	77.89	73	1.67(9.2)	0.22

*Paired *t*-test.

**Linear regression.

delay the occurrence of Type 2 Diabetes Mellitus (T2DM) (Primatesta et al., 2001). TAWAZON consisted of educational material provided to the patients, activities, and continuous feedback regarding their diet and physical activity. Twelve sessions were provided over twelve months in stages to gradually optimize the behavioral change and make it permanent (Primatesta et al., 2001). Furthermore, according to an article published by the University College London (UCL) from the Department of Epidemiology and Public Health (Amir et al., 2022), it takes an average of 66 days to form a new habit. This could be another reason behind the slight improvement seen amongst our pilot patients, as the program duration was 90 days (Table 3).

A study published in the journal of Hypertension in 2001 based on the evidence from the Health Survey for England suggested that there are no consistent independent differences of clinical significance in BP levels between smokers and nonsmokers (Primatesta et al., 2001). The authors explained that this observation could be due to other associated confounders, such as alcohol consumption and BMI. In contradiction, our findings showed a significant reduction in BP amongst smokers who complied with the program and made lifestyle modifications.

Only 54.7 % of the participants attended all six sessions, which is the main limitation of our study. Consequently, healthcare providers, health educators, and the BLSM team's intention is to raise awareness of the importance of dietary and lifestyle modification in preventing, controlling, and treating hypertension.

5. Conclusion

In conclusion, lifestyle modification intervention can improve and control blood pressure in primary care settings. We plan to tailor the program and collaborate with neighboring institutions to include a wider range of participants diagnosed with pre-hypertension and uncomplicated hypertension to assess the effectiveness of the program on a broader population with the intention to increase awareness of the importance of lifestyle intervention on one's health in general and blood pressure in particular. Moreover, we plan to modify the length of the program and increase the frequency of follow-ups to enable participants to change their habits and incorporate better life choices in their daily routine, such as reducing sodium intake and being active physically more often.

Funding.

CRediT authorship contribution statement

Hayat Mushcab: Conceptualization, Validation, Writing – original draft. **Abdullah Al Mutairi:** Conceptualization, Methodology, Validation, Investigation, Writing – review & editing. **Ashwaq Al Matroud:** Conceptualization, Methodology, Validation, Investigation, Writing – review & editing. **Sheikha Dossary:** Investigation, Writing – review & editing, Supervision. **Mohammed J. Ghamdi:** Conceptualization, Writing – review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

References

Abate, T.W., Gedamu, H., Ayalew, E., Genanew, A., Ergetie, T., Tesfa, G., 2022. A systematic review and meta-analysis of the Ethiopian cohort of adult hypertensive people's adherence to healthy behaviors. Heliyon 8 (11), e11555.

Amir, M. Alasnag, R. Al-Raddadi, T. Al-Bassam, K. Saeed, M. Yazicioglu, A. Shabana, 2022. Patient Journey for Hypertension and Dyslipidemia in Saudi Arabia, *Research Square,* p. Preprint.

CDC, 2022. Facts About Hypertension, 14 10 2022. [Online]. Available: https://www.cdc.gov/bloodpressure/facts.htm#:~:text=Facts%20About%20Hypertension%20in%20the%20United%20States&text=Having%20hypertension%20puts%20you%20at,death%20in%20the%20United%20States.&text=In%202020%2C%20more%20than%20670%2C000,a%20primary%20or%c.

Mayo Clinic, 2022. High blood pressure (hypertension), 15 09 2022. [Online]. Available: https://www.mayoclinic.org/diseases-conditions/high-blood-pressure/symptoms-causes/syc-20373410.

Diaz, K.M., Shimbo, D., 2013. Physical activity and the prevention of hypertension. Curr. Hypertens. Rep. 15, 659–668.

El Bcheraoui, C., Memish, Z., Tuffaha, M., Daoud, F., Robinson, M., Jaber, S., Mikhitarian, S., Al Saeedi, M., AlMazroa, M., Mokdad, A., Al Rabeeah, A., 2014. Hypertension and its associated risk factors in the Kingdom of Saudi Arabia, 2013: a national survey. Int. J. Hypertens.

Gay, H., Rao, S.G., Vaccarino, V., Ali, M.K., 2016. Effects of different dietary interventions on blood pressure: systematic review and meta-analysis of randomized controlled trials. Hypertension 67, 733–739.

Ibekwe, R., 2015. Modifiable risk factors of hypertension and socio-demographic profile in oghara, delta state; prevalence and correlates. Ann. Med. Health Sci. Res. 5 (1), 71–77.

Lally, P., van Jaarsveld, C.H.M., Potts, H.W.W., Wardle, J., 2010. How are habits formed: Modelling habit formation in the real world. Eur. J. Soc. Psychol. 40 (6), 998–1009.

Miller III, E.R., Alzahrani, H.A., Bregaglio, D.S., Christensen, J.K., Palmer, S.L., Alsharif, F.H., Matroud, A.S., Kanaani, K.A., Sunbul, T.J., D'almeida, J., Morrissey, S., Crockford, M., Rajanayagam, S.N., Sarhan, A.A., Azmi, W.H., Miller, A. R., Vrany, E.A., Al Natour, S., Dalcin, A.T., Ghamdi, M.J., Appel, L.J., 2021. Evaluation of a video-assisted patient education program to reduce blood pressure delivered through the electronic medical record: results of a quality improvement project. Am. J. Hypertens. 34 (12), 1328–1335.

Mills, K.T., Stefanescu, A., He, J., 2020. The global epidemiology of hypertension. Nat. Rev. Nephrol. 16 (4), 223–237.

Mushcab, H., AlSharif, F., Nazeer, A., Mollah, A., Matroud, A., Qahtani, S., Ghamdi, M., 2021. Tawazon- an intensive lifestyle diabetes prevention program: the Saudi Arabian Pilot. J. Multidiscip. Healthc. 14, 2767–2775.

NICE, 2019. Hypertension in Adults: Diagnosis and Management. National Institute for Health and Care Excellence, UK.

Nicoll, R., 2010. Hypertension and lifestyle modification: how useful are the guidelines? Br. J. Gen. Pract. 60 (581), 879–880.

Primatesta, P., Falaschetti, E., Gupta, S., Marmot, M.G., Poulter, N.R., 2001. Association between smoking and blood pressure evidence from the health survey for England. Hypertension 37 (2), 187–193.

Saudi MoH, High Blood Pressure (Hypertension), Saudi Ministry of Health, Riyadh.

Schmidt, B., Durao, S., Toews, I., Bavuma, C., Hohlfeld, A., Nury, E., Meerpohl, J., Kredo, T., 2020. Screening strategies for hypertension. Cochrane Database Syst. Rev. 5 (5). CD013212.

Unger, T., Borghi, C., Charchar, F., Khan, N.A., Poulter, N.R., Prabhakaran, D., Ramirez, A., Schlaich, M., Stergiou, G.S., Tomaszewski, M., Wainford, R.D., Williams, B., Schutte, A.E., 2020. 2020 International society of hypertension global hypertension practice guidelines. Hypertension 75 (6), 1334–1357.

USPSTF, 2020. Healthy Diet and Physical Activity for Cardiovascular Disease Prevention in Adults With Cardiovascular Risk Factors: Behavioral Counseling Interventions, 24 11 2020. [Online]. Available: https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/healthy-diet-and-physical-activity-counseling-adults-with-high-risk-of-cvd.

Wang, T., Chiang, C., Chao, T., Cheng, H., Wu, Y., Wu, Y., Lin, Y., Chen, M.Y., Ueng, K., Chang, W., Lee, Y., Wang, Y., Chu, P., Chao, T., Kao, H., Hou, C.J., Lin, T., 2022. 2022 Guidelines of the Taiwan Society of Cardiology and the Taiwan Hypertension Society for the Management of Hypertension. Acta Cardiol. Sin. 38 (3), 225–325.

WHO, 2021. Hypertension, 25 08 2021. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/hypertension.

Xiao, J., Ren, W., Liang, Y., Shen, H., Gao, Y., Chu, M., Li, Z., Wang, X., Zhang, Z., Zhuang, X., Yo, Y., 2020. Effectiveness of lifestyle and drug intervention on hypertensive patients: A randomized community intervention trial in Rural China. J. Gen. Intern. Med. 35, 3449–3457.