Original Research Article

Adherence to Pharmacological Treatment and Factors Affecting the Adherence Among Hypertensive Patients Attending Primary Health Care Centers in Jazan, Saudi Arabia

ABSTRACT

We have studied the adherence to anti-hypertension (anti-HTN) medication of adult patients in the Jazan region of Saudi Arabia. We conducted interviews with patients who attend primary health care centers and focused on their socio-demographics, such as age, education and topographical location of their home. The data from the interviews was analyzed using the Hill-Bone scale to determine perfect and imperfect adherence to anti-HTN medication and found that 82.7% of the participants show imperfect adherence to medication. This is a significantly higher percentage than that found in other areas of Saudi Arabia and the Middle East. We further analyzed the data for correlations between sociodemographic characteristics and adherence to anti-HTN medication. This showed that patients living in the mountainous areas of Jazan have a stronger adherence to their medication than those living in the plains or on the coast. Also, those patients with an income of 5,000 RS or less are more likely to adhere to their medication than those with higher income. Other socio-demographic characteristics showed no strong correlation with medication adherence. Overall, anti-HTN medication adherence in the Jazan region is poor and we recommend the implementation of an educational program to highlight the importance of adhering to anti-HTN medication.

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Keywords: Primary health care; patient compliance; hypertension; Hill-Bone Scale

1. INTRODUCTION

Hypertension (HTN) is a major health problem globally because it can result in significant morbidity and a reduction in life expectancy. The majority of hypertensive patients have primary hypertension; however, 10 to 15% of patients have secondary hypertension [1]. HTN is responsible for 9.4 million deaths annually, either due to heart attack or stroke with a contribution of 45% and 51%, respectively [2]. Hypertension is a major public health issue and a leading preventable cause of premature death and disability around the world. Elevated adherence has recently been highlighted by the World Health Organization (WHO) as an important development need for minimizing cardiovascular disease. Poor adherence to long-term treatment is a worldwide problem with significant consequences [3]. Adherence to chronic diseases drugs are about fifty percent in developed countries, although they are much less in developing countries [4]. Studies conducted in three cities in Saudi Arabia showed that adherence level to medications was low; in particular the levels were 72% in Mecca [5], 54% in Jeddah [6] and about 53% in Tabuk [7]. This is comparable to other middle-Eastern regions, such as Palestine with 54.2% adherence [8] and Oman with 51.1% [9]. Proper management and control of raised blood pressure are critical for the avoidance of long-term complications and high economic cost associated with HTN [10]. Pharmacological treatment together with lifestyle changes have significant value in blood pressure reduction [11, 12]. The WHO defines medication

adherence as ”the extent to which a person’s behavior- taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider” [4]. Multiple international studies 2 have reported a strong association between adherence to HTN medication and controlling blood pressure [8, 13, 14, 15, 16, 17, 18]. It has been shown that poor adherence to medications results in various medical and psychosocial complications, low health-related quality of life, and increase in the health care costs [4, 19, 20]. In the kingdom of Saudi Arabia, HTN and cardiovascular diseases are considered the main risk factors for mortality [21]. About one in every four Saudi adults aged between 15 and 64 have elevated blood pressure [22]. It has further been shown that control of blood pressure is poor in Saudi patients [22, 23]. A national study in Saudi Arabia showed that 63% (total number = 1213) of patients with uncontrolled HTN exhibit blood pressure values within seriously high levels [22]. Similarly, studies in Saudi Arabia showed that the level of adherence to anti-HTN medications are significantly low [5, 7, 24]. While such data is available at a national level, insufficient data related to adherence to HTN medications is available for the Jazan region of Saudi Arabia. We are looking in particular at the primary health care setting, because this is where most adult HTN patients are managed. The aim of our study, the first of its kind as far as we know, is to evaluate the level of adherence to anti-HTN medications and which factors affect this adherence in the Jazan area.

2. METHODOLOGY

2.1 Study Design

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A cross-sectional study.

2.2 Study Area

This study was conducted in the primary health care centers in the Jazan region, which is located in the southwest of the kingdom of Saudi Arabia and 70 km from Yemen (south). Jazan is a port city. It stretches 300 km along the southern Red Sea coast and serves a large agricultural heartland. It covers an area of 11,671 km2 and has a population of 1,567,547 at the 2017 census [25]. There are 179 primary health care centers distributed in 12 districts across the region. For this study the region was divided into the three geographical topographies, plain, coastal, and mountainous which represent 65.9%, 19.9%, and 14.2% of the area, respectively.

2.3 Study Population

The participants in this study were patients with HTN who are attending the Chronic Disease Clinics in the selected primary health care centers in the Jazan region. The patients were included in this study when they were diagnosed with HTN for at least six months prior to the study, aged above 18 years old, using at least one anti-HTN medication, and were able to communicate in Arabic. In contrast, patients with mental health problems were excluded from the study.

2.4 Sampling Method

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A structured data collection form was used to collect the socio-demographic data of the patients, such as age, gender, residence etc.; medical data, such as the duration of the disease and presence of other co-morbidity; medication data such as the number and type of medication. In addition, a structured and validated Arabic version of the Hill-Bone HBP compliance to high blood pressure therapy scale (HB-HBP) [26] was employed. The Hill-Bone HBP consists of nine questions with four possible responses ranging from one (= all of the time) to four (= none of the time). The nine-item Hill-Bone Compliance scale was designed as a simple tool for clinicians to evaluate the self-reported adherence of patients. Each item has a four-point Likert response format, and the total score ranges from nine to 36, with higher scores reflecting better adherence [26]. We modified the original scale by removing three items which queried adherence to dietary recommendations and, another two items were removed due to their assessment of appointment keeping which was irrelevant to our study objectives [27]. The Hill-Bone HBP does not have an exact cutoff point but following previous research [27, 28] we divided the answers into two categories which represent the following: 1) perfect adherence (all items were answered as ’never’, resulting in a total score of 36) and 2) imperfect adherence (some items were 3 ± answered as ’sometimes’, ’most of the time’, or ’all of the time’,

resulting in a total score of less than 36). The data collection form was filled through direct interviews by the co-investigators.

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2.5 Sample Size and Sample Design

The sample size of this study was calculated by using the following formula for random sampling:

$$n = \frac{z^2_{1-\alpha} P(1-P)}{d^2}, \quad (1)$$

where n is the sample size, z is a standard normal distribution (1.96 to a confidence level of 95%), P is the anticipated population proportion and d is the absolute precision required on either side of the anticipated population proportion (in percentage points). The anticipated population proportion, P of the sample is estimated to be 50% because this is the safest choice for P since the sample size required is largest when P =50%. For a 95% confidence level, z=1.96, and then the formula becomes

$$n = \frac{1.96^2}{4d2} \quad (2)$$

Considering a 10% non-response rate, the required sample size is 440 patients. However, the actual collected sample was 226 HTN patients. We will return to a discussion of this apparent discrepancy later in the paper.

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2.6 Statistical Analysis

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The SPSS version 25 (Statistical Package for Social Sciences) software program was used for data analysis. Frequency distributions were obtained and descriptive statistics were calculated. Another level of data analysis was used to test some associations for which a Chi-Square test P -value less than 0.05 was considered significant. Further, regression analysis was used to examine the impact of all socio-demographic factors on the adherence to HTN medications. As the outcome (HTN medication adherence) is a binary variable, logistic regression with odds ratio as a measure of impact was used to assess the magnitude and the significance of these associations.

2.7 Ethical Consideration

The study was ethically approved by the Jazan University Scientific Research Ethics Committee with reference number REC40/3-084. Written consent forms were read, understood, and signed by participating patients. All patients were informed of their right not to participate or withdraw from the study at any time. The privacy and confidentiality of the data were maintained.

3. RESULTS

3.1 Socio-Demographics of the Participants

For this study the Jazan region was divided into the three geographical topographies, plain, coastal, and mountainous which represent 65.9%, 19.9%, and 14.2% of the area, respectively. The majority of the participants were Saudis, amounting to 209 (92.5%). Out of the analyzed sample 126 (55.8%) were male and 100 (44.2%) female with a mean age of 54.57 (14.48), ranging from 20 to 90 years old; most of them were married (78.3%), illiterate (41.1%), unemployed (41.2%) and with an income of 5,000 RS or less (63.7%). With regards to residency, 67.7% were living in villages, while 32.3% were living in cities.

3.2 Participant Adherence Scores

Table 3 presents the frequency and responses to the Hill-Bone medication adherence scale, the scores on the scale range from nine as a minimum score to 36 as a maximum score. Out of the 226 participants, 39 (17.3%) patients were considered to have perfect adherence. On the other hand, 187 (82.7%) were considered to have imperfect adherence to their HTN medications.

Table 1: The socio-demographic data of the participants.

Characteristic	Absolute number (Percentage)
Gender	
Male	126 (55.8)
Female	100 (44.2)
Age (Mean ± Standard deviation)	54.57 ± 14.48
Level of education	
Illiterate	94 (41.6)
Primary	25 (11.1)
Intermediate	23 (10.2)
Secondary	30 (13.3)
University or higher	54 (23.9)
Nationality	
Saudi	209 (92.5)
Non-Saudi	17 (7.5)
Employment status	
Governmental Employee	59 (26.1)
Private sector employee	3 (1.3)
Entrepreneurial	10 (4.4)
Unemployed	93 (41.2)
Retired	61 (27.0)
Income (per month) in RS	
5,000 or less	144 (63.7)
5,000-9,999	36 (15.9)
10,000-14,999	21 (9.3)
15,000 or higher	25 (11.1)
Marital Status	
Single	20 (8.8)
Married	177 (78.3)
Divorced	10 (4.4)
Widowed	19 (8.4)
Residence	
Village	153 (67.7)
City	73 (32.3)
Geographical area	
Plains	149 (65.9)
Coastal	45 (19.9)
Mountainous	32 (14.2)
Khat Chewing	
Khat user	47 (20.8)
Non-Khat user	153 (67.7)
Previous user	26 (11.5)
Shamma Use	
Shamma user	40 (17.7)

Non-Shamma user	178 (78.8)
Previous user	8 (3.5)
Smoking	
Smoker	27 (11.9)
Non-smoker	182 (80.5)
Previous smoker	17 (7.5)

Table 2: Medical and medication data of the participants.

Characteristic	**Absolute number (Percentage)**
Status of blood pressure	
Controlled	137 (60.6)
Uncontrolled	89 (39.4)
Co-morbidities	
Yes	120 (53.1)
No	106 (46.9)
Owning a Blood pressure measuring device	
Yes	66 (29.2)
No	160 (70.8)
Healthy Diet Style	
Yes	74 (32.7)
No	152 (67.3)
Number of HTN medications	
1	114 (55.9)
2	75 (36.8)
≥ 3	15 (7.4)
Number of other medications	
1	59 (44.4)
2	34 (25.6)
3	18 (13.5)
4	11 (8.3)
≥ 5	11 (15.5)
Physical activity	
Yes	132 (58.4)
No	94 (41.6)

Figure 1: Level of adherence among the participants.

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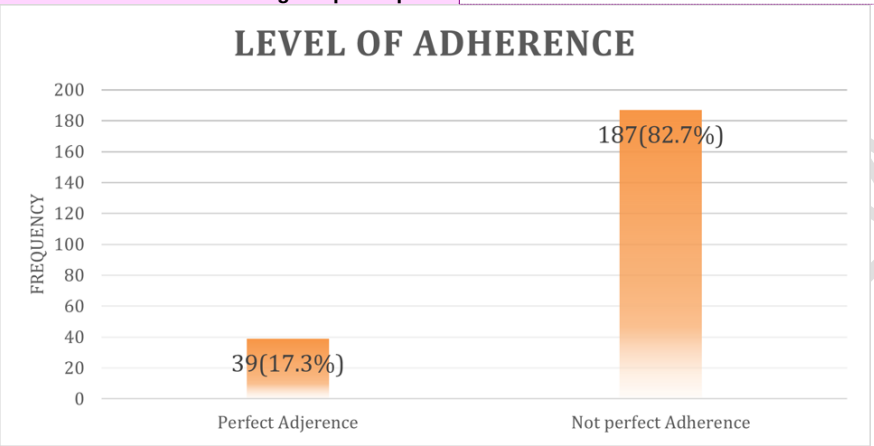

Table 3: Hill-Bone HBP Compliance to High Blood Pressure Therapy Scale (HB-HBP).

N	Item	All of the Time	Most of the Time	Some of the Time	None of the Time
1	How often do you forget to take your high blood pressure medicine?	21 (9.3)	23 (10.2)	67 (29.6)	115 (50.9)
2	How often do you decide NOT to take your high blood pressure medicine?	28 (12.4)	14 (6.2)	50 (22.1)	134 (59.3)
3	How often do you forget to get prescrip-tions filled?	20 (8.8)	6 (2.7)	53 (23.5)	147 (65.0)
4	How often do you run out of high blood pressure pills?	26 (11.5)	27 (11.9)	63 (27.9)	110 (48.7)
5	How often do you skip your high blood pressure medicine before you go to the doctor?	16 (7.1)	16 (7.1)	40 (17.7)	154 (68.1)
6	How often do you miss taking your high blood pressure pills when you feel bet-ter?	9 (4.0)	29 (12.8)	40 (17.7)	148 (65.5)
7	How often do you miss taking your high blood pressure pills when you feel sick?	8 (3.5)	12 (5.3)	30 (13.3)	176 (77.9)
8	How often do you take someone elses high blood pressure pills?	13 (5.8)	6 (2.7)	18 (8.0)	189 (83.6)
9	How often do you miss taking your high blood pressure pills when you are care-	16 (7.1)	18 (8.0)	56 (24.8)	136 (60.2)

	less?				

3.3 Factors Affecting Levels of Adherence Among HTN Patients

Table 1 shows the Chi-Square analysis of the socio-demographics, medical, and medications data of the patients to determine the association between these factors and different levels of adherence. The only significant value was observed in the geographical areas, with a P value of 0.012. Other factors did not exhibit a significant P value.

3.4 Association Between Socio-Demographic Factors and Hypertension Medication Adherence

The multivariate logistic regression showed that people who live in mountains were statistically significantly more likely to have perfect adherence to HTN medications (P value = 0.011) compared to other geographical areas in the Jazan region. Also, logistic regression revealed that participants who had an income of 5,000 or less had a statistically significant association with lower levels of perfect HTN medications adherence (P value = 0.035) as shown in Table 5.

Table 4: Analysis of the level of adherence and its related factors.

		Perfect Adherence (Percentage)	**Imperfect Adherence (Percentage)**	**P-valueof Chi-Square Test**
Age (Years)	45 and less > 45	6 (15.4) 33 (84.6)	54 (28.9) 133 (71.1)	0.083
Gender	Male Female	23 (18.3) 16 (16.0)	103 (81.7) 84 (84.0)	0.656
Marital Status	Single Married Divorced Widowed	3 (15.0) 31 (17.5) 2 (20.0) 3 (15.8)	17 (85) 146 (82.5) 8 (80.0) 16 (84.2)	0.984
Education Status	Illiterate Primary Intermediate Secondary University or higher	19 (20.2) 4 (16.0) 2 (8.7) 3 (10.0) 11 (20.4)	75 (79.8) 21 (84.0) 21 (91.3) 27 (90.0) 43 (79.6)	0.516
Geographical area	Plains Costal Mountainous	24 (16.1) 4 (8.9) 11 (34.4)	125 (83.9) 41 (91.1) 21 (65.6)	0.012*
Residence	Village City	27 (17.6) 12 (16.4)	126 (82.4) 61 (83.6)	0.822
Owning HTN measuring device at home	Yes No	10 (15.2) 29 (18.1)	56 (84.8) 131 (81.9)	0.591
Smoking	Yes No Previous smoker	2 (7.4) 32 (17.6) 5 (29.4)	25 (92.6) 150 (82.4) 12 (70.6)	0.165
Shamma use	Yes No	9 (22.5) 29 (16.3)	31 (77.5) 149 (83.7)	0.603

	Previous user	1 (12.5)	7 (84.5)	
Khat chewing	Yes No Previous chewer	7 (14.9) 25 (16.3) 7 (26.9)	40 (85.1) 128 (83.7) 19 (73.1)	0.372
Physical activity	Yes No	21 (15.4) 18 (20.0)	115 (84.6) 72 (80.0)	0.375
Status of blood pressure	Controlled Uncontrolled	26 (19.0) 13 (14.6)	111 (81.0) 76 (85.5)	0.395
Co-morbidities	Yes No	24 (20.0) 15 (14.2)	96 (80.0) 91 (85.8)	0.246
Healthy Diet Style	Yes No	15 (20.3) 24 (15.8)	59 (79.7) 128 (84.2)	0.403

Table 5: Logistic regression analysis for the association between socio-demographic factors and hypertension medication adherence.

Predictors	**Odds Ratios**	**CI**	**p**
(Intercept)	0.19	0.00 - 10.99	0.429
Age	1.03	0.99 - 1.08	0.119
Gender [Male]	0.73	0.22 - 2.34	0.603
Level of education [Intermediate]	0.19	0.02 - 1.33	0.126
Level of education [Primary]	0.61	0.12 - 2.61	0.525
Level of education [Secondary]	0.19	0.02 - 1.40	0.124
Level of education [University or higher]	0.81	0.13 - 4.92	0.817
Employment status [Governmental Employee]	1.45	0.17 - 16.11	0.746
Employment status [Private sector employee]	25.79	0.47 - 1279.41	0.093
Employment status [Retired]	0.70	0.10 - 6.27	0.723
Employment status [Unemployed]	1.16	0.17 - 10.42	0.887
Income per month in RS [15,000 or Higher]	0.29	0.05 - 1.40	0.131
Income per month in RS [5,000-9,999]	0.46	0.11 - 1.87	0.278
Income per month in RS [5,000 or less]	0.18	0.03 - 0.87	0.035
Marital Status [Married]	0.58	0.09 - 5.12	0.582
Marital Status [Single]	1.73	0.17 - 21.30	0.643
Marital Status [Widowed]	0.67	0.07 - 7.23	0.724
Residence [Village]	0.72	0.26 - 2.05	0.530
Geographical area [Mountainous]	10.77	1.98 - 80.73	0.011

Geographical area [Plains]	4.08	1.01 - 22.54	0.071
Khat Chewing [Non-Khat user]	0.44	0.12 - 1.63	0.211
Khat Chewing [Previous user]	2.11	0.52 - 8.64	0.293
Smoking [Previous smoker]	1.68	0.35 - 7.50	0.498
Smoking [Smoker]	0.32	0.05 - 1.54	0.180
Co-morbidities [yes]	1.90	0.70 - 5.40	0.214
Status of blood pressure [Uncontrolled]	0.81	0.34 - 1.87	0.619
Owning a Blood pressure measuring device [yes]	0.97	0.36 - 2.49	0.954
Healthy Diet Style [yes]	1.52	0.63 - 3.65	0.353
Number of HTN medications	0.83	0.41 - 1.56	0.577
Using other medications [yes]	0.54	0.18 - 1.56	0.254
Observations R2 Tjur	226 0.148		

DISCUSSION

Adherence to HTN medications is a major factor in controlling blood pressure (BP) and preventing the serious complications of uncontrolled BP. This study was conducted based on earlier studies in Saudi Arabia, which found that there was poor blood pressure control and low medication adherence. However, as far as we are aware, there is no previous study that focused on the Jazan region. Therefore, we conducted this study in that region to assess the level of adherence and determine if any factors are affecting the adherence, such as Khat chewing or Shamma consumption which is more prevalent in Jazan, and the rich geographical variety [5, 7, 24]. In this study we found that the imperfect adherence to HTN medications with 82.7% is high compared to Jeddah, for example, with 72% [6]. Similar studies conducted locally used another classification to classify compliance with HTN medication as adherent and non-adherent. However, their results for non- adherence are still comparable with our results for imperfect adherence and were reported to be lower than those found in the present study: Mecca 54%, [5], Khobar 65.8% [29], Tabuk 53% [7], Palestine 54.2% [8], Oman 51.1% [9], and Lebanon 22.4% [18]. Global studies, on the other hand, conducted in the USA, UK, France, and Malaysia showed high levels of adherence to HTN medications [17, 30, 31]. Differences in our results can be explained by the different methodologies applied, study population and settings. Furthermore, previous studies utilized yes/no responses for adherence questions [32], which limited the options participants could choose from. Moreover, other researches utilized the pill-counting method [33] and pharmacy records [34]. Finally, the findings of the current study are based on the self-reports of medication adherence of the patients using a Likert (Hill-Bone) scale. This scale was created primarily to assess the level of adherence in hypertension patients [35]. In other studies, scale testing revealed a high level of validity and reliability [6, 26, 32, 35]. The results of our study were based on direct interviews with the patients using the Hill- Bone medication adherence scale, while some of the previous studies employed self-administered Hill-Bone questionnaires, which may decrease the response rate [6, 17]. This study focused on the socio-demographic characteristics of the patients, such as age, gender, level of education, residence, and geographical area of the residence, medical data like co-morbidity, the status of the BP control, and owning BP measuring device at home. The major association found in our study, which was different from other studies conducted in Saudi Arabia, was the association between different levels of adherence and different geographical areas. The second most significant association was the stronger adherence to anti-HTN medication of patients with an income of 5,000 RS or less compared to those with higher income. Our study further revealed that there was no association between Khat chewing, Shamma consumption, and smoking, and the level of adherence to anti-HTN medications. In contrast with other studies, the association between age, gender, and absence of co-morbidity, and the different levels of adherence were found to be insignificant [5, 31]. This is mostly due to the two differences in the study design, as mentioned above. The main limitation of the present study is that we were not able to collect the remaining samples due to the COVID-19 pandemic.

Further, to the best of our knowledge, no similar studies have been conducted in the Jazan region so that we have no reference data to compare against.

4. Conclusion and Recommendations

The level of adherence is significantly low in the patients attending primary health care centers in Jazan and because the adherence to medication has a great impact on hospitalization and complications of HTN patients, this gives reason for the development of a health education program about the adherence to HTN medications. There was no strong association between different levels of adherence and patient factors except geographical areas and income of 5,000 RS or less, which exhibited a significant association with a P value of 0.012 and 0.035, respectively. In addition, the small sample size of the present study warrants another study in the region with a larger sample size to measure the level of adherence and the factors affecting the adherence among HTN patients**.**

Consent and Ethical approval

The study was ethically approved by the Jazan University Scientific Research Ethics Committee with reference number REC40/3-084. Written consent forms were read, understood, and signed by participating patients. All patients were informed of their right not to participate or withdraw from the study at any time. The privacy and confidentiality of the data were maintained.

References

[1] Rivas AM, Pena C, Kopel J, Dennis JA, Nugent K. Hypertension and Hyperthyroidism: Association and Pathogenesis. Am J Med Sci. 2021 Jan;361(1):3-7. doi: 10.1016/j.amjms.2020.08.012. Epub 2020 Aug 10. PMID: 33012487.

[2] Day, W. H. (2013). World Health Organization. A global brief on Hypertension. https://doi.org/10. 1136/bmj.1.4815.882-a

[3] Cimmaruta D, Lombardi N, Borghi C, Rosano G, Rossi F, Mugelli A. Polypill, hypertension and medication adherence: The solution strategy? Int J Cardiol. 2018 Feb 1;252:181-186. doi: 10.1016/j.ijcard.2017.11.075. Epub 2017 Nov 23. PMID: 29180263.

[4] Burkhart, P. V, Sabat´e, E. (2003). Adherence to long-term therapies: evidence for action. Journal of Nursing Scholarship: An Official Publication of Sigma Theta Tau International Honor Society of Nursing, 35(3), 207. https://doi.org/10.1016/S1474-5151(03)00091-4

[5] Khayyat, S. M., Khayyat, S. M. S., Hyat Alhazmi, R. S., Mohamed, M. M. A., Hadi, M. A. (2017). Predictors of medication adherence and blood pressure control among Saudi hypertensive patients attending primary care clinics: A cross-sectional study. PLoS ONE, 12(1), 1–12. https://doi.org/10.1371/journal.pone.0171255

[6] Alsolami, F., Correa-Velez, I., Hou, X. Y. (2015). Factors affecting antihypertensive medications adher- ence among hypertensive patients in Saudi Arabia. American Journal of Medicine and Medical Sciences, 5(4), 181-189. https://doi.org/10.5923/j.ajmms.20150504.07

[7] Khalil, S. A., Elzubier, A. G. (1997). Drug compliance among hypertensive patients in Tabuk, Saudi Ara- bia. Journal of Hypertension, 15(5), 561–565. https://doi.org/10.1097/00004872-199715050-00013

[8] Al-Ramahi, R. (2015). Adherence to medications and associated factors: A cross-sectional study among Palestinian hypertensive patients. Journal of Epidemiology and Global Health, 5(2), 125–132. https://doi.org/10.1016/j.jegh.2014.05.005

[9] Sherwood, G., Alkhasawneh, E., Knafl, G., Barksdale, D., Wu, J.-R., Al-Noumani, H. (2017). Relation- ship Between Medication Adherence and Health Beliefs Among Patients with Hypertension in Oman: Pilot study. Sultan Qaboos University Medical Journal, e329-333. https://doi.org/10.18295/squmj. 2017.17.03.012

[10] NICE. (2015). Hypertension in adults: diagnosis and management. [Online], (August 2011). Retrieved from https://www.nice.org.uk/guidance/cg127

[11] Frisoli, T. M., Schmieder, R. E., Grodzicki, T., Messerli, F. H. (2011). Beyond salt: Lifestyle modifi- cations and blood pressure. European Heart Journal, 32(24), 3081–3087. https://doi.org/10.1093/ eurheartj/ehr379

[12] Islam, Q. T. (2015). JNC 8: Evidence-Based Guideline for the Management of High Blood Pressure in Adults in 2014. Bangladesh Journal of Medicine, 25(1), 1–2. https://doi.org/10.3329/bjmed.v25i1. 25069

[13] De Geest, S., Sabat´e, E. (2003). Adherence to Long-Term Therapies: Evidence for Action. Euro- pean Journal of Cardiovascular Nursing, 2(4), 323–323. https://doi.org/10.1016/S1474-5151(03) 00091-4

[14] Hyre, A. D., Krousel-Wood, M. A., Muntner, P., Kawasaki, L., DeSalvo, K. B. (2007). Prevalence and predictors of poor antihypertensive medication adherence in an urban health clinic setting. Journal of Clinical Hypertension (Greenwich, Conn.), 9(3), 179–186. https://doi.org/10.1111/j.1524-6175. 2007.06372.x

[15] Khatib, R., Yusuf, S., Nieuwlaat, R., McKee, M., Haynes, R. B., Schwalm, J.-D., Khan, M. (2014). Patient and Healthcare Provider Barriers to Hypertension Awareness, Treatment and Follow Up: A Systematic Review and Meta-Analysis of Qualitative and Quantitative Studies. PLoS ONE, 9(1), e84238. https://doi.org/10.1371/journal.pone.0084238

[16] Oliveira-Filho, A. D., Barreto-Filho, J. A., Neves, S. J. F., Lyra Junior, D. P. De. (2012). Associa- tion between the 8-item Morisky Medication Adherence Scale (MMAS-8) and blood pressure control. Arquivos Brasileiros de Cardiologia, 99(1), 649–658. Retrieved from http://www.ncbi.nlm.nih.gov/ pubmed/22688844

[17] Paraidathathu, T., Azuana, Nur Sufiza, A. (2012). Medication adherence among hypertensive patients of primary health clinics in Malaysia. Patient Preference and Adherence, 613. https://doi.org/10. 2147/ppa.s34704

[18] Yassine, M., Al-Hajje, A., Awada, S., Rachidi, S., Zein, S., Bawab, W., Salameh, P. (2016). Evaluation of medication adherence in Lebanese hypertensive patients. Journal of Epidemiology and Global Health, 6(3), 157–167. https://doi.org/10.1016/j.jegh.2015.07.002

[19] Burnier, M. (2006). Medication Adherence and Persistence as the Cornerstone of Effective Antihyper- tensive Therapy. American Journal of Hypertension, 19(11), 1190–1196. https://doi.org/10.1016/ j.amjhyper.2006.04.006

[20] Osterberg, L., Blaschke, T. (2005). Adherence to Medication. New England Journal of Medicine, 353(5), 487–497. https://doi.org/10.1056/NEJMra050100

[21] Institute for Health Metrics and Evaluation (IHME) IHME, Universityof Washington, Seattle, Wash, U. (2017). "GBD arrow Diagram, Saudi Arabia. Risk of deaths. 1990–2010,." Retrieved March 24, 2019, from http://www.healthdata.org/saudi-arabia

[22] Saeed, A. A., Al-Hamdan, N. A., Bahnassy, A. A., Abdalla, A. M., Abbas, M. A. F., Abuzaid, L. Z. (2011). Prevalence, awareness, treatment, and control of hypertension among Saudi adult population: A national survey. International Journal of Hypertension, 2011. https://doi.org/10.4061/2011/174135

[23] Al-Nozha, M. M., Abdullah, M., Arafah, M. R., Khalil, M. Z., Khan, N. B., Al-Mazrou, Y. Y., Al- Mobeireek, A. (2007). Hypertension in Saudi Arabia. Saudi Medical Journal, 28(1), 77-84. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17206295

[24] Mahmoud, M. I. H. (2012). Compliance with treatment of patients with hypertension in Almadinah Almunawwarah: A community-based study. Journal of Taibah University Medical Sciences, 7(2), 92–98. https://doi.org/10.1016/j.jtumed.2012.11.004

[25] Statistics, G. A. for. (2017). Population Characteristics surveys. Retrieved from https://www.stats.gov.sa/sites/default/files/msh_lkhsys_lskny_2017_.pdf

[26] Kim, M. T., Hill, M. N., Bone, L. R., Levine, D. M. (2000). Development and testing of the Hill-Bone Compliance to High Blood Pressure Therapy Scale. Prog Cardiovasc Nurs, 15(3), 90–96. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10951950

[27] Krousel-Wood, M., Jannu, A., Re, R. N., Muntner, P., Desalvo, K. (2005). Reliability of a medication adherence measure in an outpatient setting. The American Journal of the Medical Sciences, 330(3), 128–133.

[28] Karademir, M., Koseoglu, I. H., Vatansever, K., Van Den Akker, M. (2009). Validity and reliability of the Turkish version of the Hill–Bone compliance to high blood pressure therapy scale for use in primary health care settings. The European journal of general practice, 15(4), 207-211.

[29] Al-Sowielem, E. (1998). Compliance and knowledge of hypertensive patients attending PHC centers in Al-Khobar, Saudi Arabia. Eastern Mediterranean Health Journal, 4(2), 301–307.

[30] Marshall, I. J., Wolfe, C. D. A., McKevitt, C. (2012). Lay perspectives on hypertension and drug adherence: Systematic review of qualitative research. BMJ (Online), 345(7867), 1–16. https://doi. org/10.1136/bmj.e3953

[31] Lefort, M., Neufcourt, L., Pannier, B., Va¨ısse, B., Bayat, S., Grimaud, O., Girerd, X. (2018). Sex differences in adherence to antihypertensive treatment in patients aged above 55: The French League Against Hypertension Survey (FLAHS). Journal of Clinical Hypertension, 20(10), 1496–1503. https://doi.org/10.1111/jch.13387

[32] Song, H., Song, Y., Han, H., Nam, S., Nguyen, T., Kim, M. (2011). Psychometric Evaluation of Hill-Bone Medication Adherence Subscale. Asian Nursing Research, 5(3), 183-188. doi: 10.1016/j.anr.2011.09.007.

[33] Chin, J. J. (2001). Doctor-patient relationship: a covenant of trust. Singapore Medical Journal, 42(12), 579.

[34] Koschack, J., Marx, G., Schnakenberg, J., Kochen, M., Himmel, W. (2010). Comparison of two self- rating instruments for medication adherence assessment in hypertension revealed insufficient psychome- tric properties. Journal of Clinical Epidemiology, 63(3), 299-306. doi: 10.1016/j.jclinepi.2009.06.011.

[35] Lambert, E. V., Steyn, K., Hill, M. N., Stender, S. C., Everage, N. J., Breeden, G. (2002). Cross-cultural validation of the Hill-Bone compliance to high blood pressure therapy scale in a South African, primary health care setting. American Journal of Hypertension, 15(4S), 10.1016/s0895-7061(02)02817-0.