

## 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

**Background:** Hypertension (HTN) is a major health problem globally because it can result in significant morbidity and a reduction in life expectancy, HTN is responsible for 9.4 million deaths annually, either due to heart attack or stroke with a contribution of 45% and 51%, respectively

**Objective:** Evaluate the level of adherence to anti-HTN medications and which factors affect this adherence in the Jazan area

**Methodology:** The researcher investigated the adherence to anti-hypertension (anti-HTN) medication of participants aged more than 18 in the Jazan region of Saudi Arabia, they 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 were analyzed using the Hill-Bone scale to determine perfect and imperfect adherence to anti-HTN medication

**Results:** 82.7% of the participants show imperfect adherence to medication which is a significantly higher percentage than that found in other areas of Saudi Arabia and the Middle East. The researchers 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 (OR = 10.77,  $P$  value = 0.011). 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 (OR = 0.18,  $P$  value = 0.035). Other socio-demographic characteristics showed no strong correlation with medication adherence.

**Conclusion:** Overall, anti-HTN medication adherence in the Jazan region is poor and researchers recommend the implementation of an educational program to highlight the importance of adhering to anti-HTN medication.

*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 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 Area

This is a cross-sectional 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 km<sup>2</sup> 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.

### 2.2 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.

### 2.3 Sampling Method

The study area was divided into three categories based on geographical distribution, an interview-based questionnaire was used by the co-investigators to collect the data from the participants who attend the clinic of chronic diseases in primary health care centers. 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 (= never). 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 according to the following previous studies [27, 28] we divided the answers into two categories which represent perfect adherence (all the 9 items were answered as 'never', resulting in a total score of 36) and imperfect adherence (some items were answered as sometimes; most of the time; or all of the time, resulting in a total score of less than 36).

## 2.4 sample size determination

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

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

Considering a 10% non-response rate, the required sample size is 440 patients. However, the actual collected sample was 226 HTN patients. We faced two issues, because of that we were not able to complete the collection of all remaining samples, the interview method that was used to collect data interfered with the primary health care physician's worktime and the COVID-19 pandemic lockdown.

## 2.5 Statistical Analysis

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. The dependent variable used to build up the regression model was adherence categories. Adherence to HTN medications was obtained from adherence score based on HillBone medication adherence scale and questionnaire. The score was categorized to a binary variable (being in perfect adherence and imperfect adherence as explained in sampling method section) which was used in the analysis. The multivariant were used beside to Hillbone are based on several

local studies [5,6], the prevalence of Khat Chewing and Shamma consumption are high in Jazan region [36,37]. We used those variables in the analysis to test some association.

### 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.**

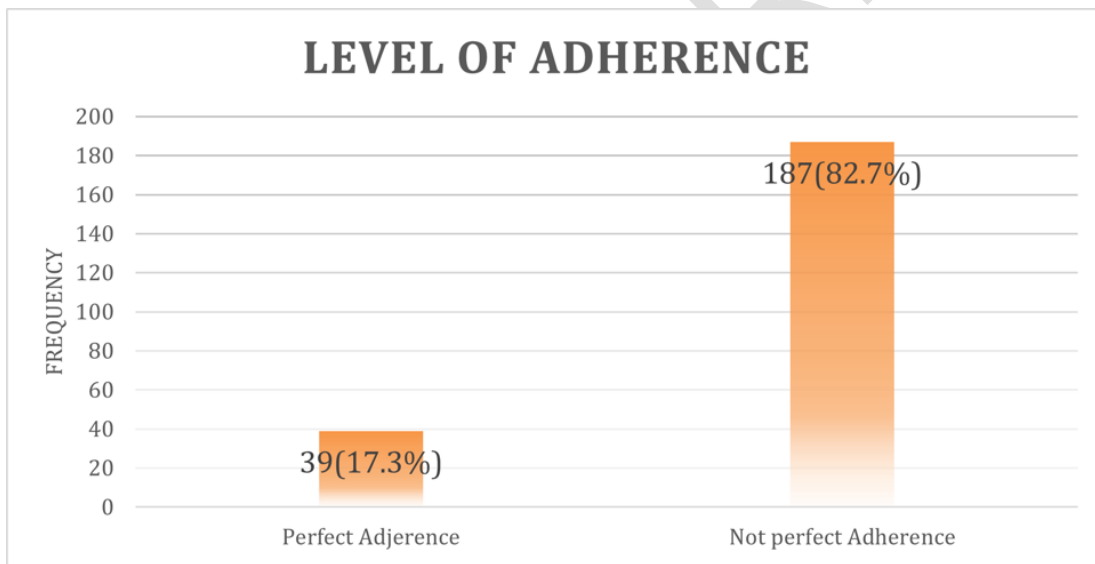
| Characteristic                      | Absolute number (Percentage) |
|-------------------------------------|------------------------------|
| Gender                              |                              |
| Male                                | 126 (55.8)                   |
| Female                              | 100 (44.2)                   |
| Age (Mean $\pm$ Standard deviation) | 54.57 $\pm$ 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)  |
| <b>Marital Status</b>    |            |
| Single                   | 20 (8.8)   |
| Married                  | 177 (78.3) |
| Divorced                 | 10 (4.4)   |
| Widowed                  | 19 (8.4)   |
| <b>Residence</b>         |            |
| Village                  | 153 (67.7) |
| City                     | 73 (32.3)  |
| <b>Geographical area</b> |            |
| Plains                   | 149 (65.9) |
| Coastal                  | 45 (19.9)  |
| Mountainous              | 32 (14.2)  |
| <b>Khat Chewing</b>      |            |
| Khat user                | 47 (20.8)  |
| Non-Khat user            | 153 (67.7) |
| Previous user            | 26 (11.5)  |
| <b>Shamma Use</b>        |            |
| Shamma user              | 40 (17.7)  |
| Non-Shamma user          | 178 (78.8) |
| Previous user            | 8 (3.5)    |
| <b>Smoking</b>           |            |
| Smoker                   | 27 (11.9)  |
| Non-smoker               | 182 (80.5) |
| Previous smoker          | 17 (7.5)   |

**Table 2: Medical and medication data of the participants.**

| <b>Characteristic</b>                           | <b>Absolute number<br/>(Percentage)</b> |
|---|---|
| <b>Status of blood pressure</b>                 |   |
| Controlled                                      | 137 (60.6)                              |
| Uncontrolled                                    | 89 (39.4)                               |
| <b>Co-morbidities</b>                           |   |
| Yes   | 120 (53.1)                              |
| No  | 106 (46.9)                              |
| <b>Owning a Blood pressure measuring device</b> |   |
| Yes   | 66 (29.2)                               |
| No  | 160 (70.8)                              |
| <b>Healthy Diet Style</b>                       |   |
| Yes   | 74 (32.7)                               |
| No  | 152 (67.3)                              |
| <b>Number of HTN medications</b>                |   |
| 1   | 114 (55.9)                              |
| 2   | 75 (36.8)                               |
| ≥ 3   | 15 (7.4)                                |
| <b>Number of other medications</b>              |   |
| 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.**

**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 prescriptions 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 better?    | 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 else's 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 careless?   | 16 (7.1)  | 18 (8.0)  | 56 (24.8) | 136 (60.2) |

### 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 (OR = 10.77, 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 significantly lower levels of adherence to HTN medications compared to other salary groups (OR = 0.18, 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-value of Chi-Square Test |
|----------------|--|---|--|----------------------------|
| Age (Years)    | 45 and less<br>> 45                      | 6 (15.4)<br>33 (84.6)                         | 54 (28.9)<br>133 (71.1)                        | 0.083                      |
| Gender         | Male<br>Female                           | 23 (18.3)<br>16 (16.0)                        | 103 (81.7)<br>84 (84.0)                        | 0.656                      |
| Marital Status | Single<br>Married<br>Divorced<br>Widowed | 3 (15.0)<br>31 (17.5)<br>2 (20.0)<br>3 (15.8) | 17 (85)<br>146 (82.5)<br>8 (80.0)<br>16 (84.2) | 0.984                      |

|                                     |  |   |   |        |
|-------------------------------------|--|---|---|--------|
| Education Status                    | Illiterate<br>Primary<br>Intermediate<br>Secondary<br>University or higher | 19 (20.2)<br>4 (16.0)<br>2 (8.7)<br>3 (10.0)<br>11 (20.4) | 75 (79.8)<br>21 (84.0)<br>21 (91.3)<br>27 (90.0)<br>43 (79.6) | 0.516  |
| Geographical area                   | Plains<br>Costal<br>Mountainous  | 24 (16.1)<br>4 (8.9)<br>11 (34.4)                         | 125 (83.9)<br>41 (91.1)<br>21 (65.6)                          | 0.012* |
| Residence                           | Village<br>City  | 27 (17.6)<br>12 (16.4)                                    | 126 (82.4)<br>61 (83.6)                                       | 0.822  |
| Owning HTN measuring device at home | Yes<br>No  | 10 (15.2)<br>29 (18.1)                                    | 56 (84.8)<br>131 (81.9)                                       | 0.591  |
| Smoking                             | Yes<br>No<br>Previous smoker   | 2 (7.4)<br>32 (17.6)<br>5 (29.4)                          | 25 (92.6)<br>150 (82.4)<br>12 (70.6)                          | 0.165  |
| Shamma use                          | Yes<br>No<br>Previous user   | 9 (22.5)<br>29 (16.3)<br>1 (12.5)                         | 31 (77.5)<br>149 (83.7)<br>7 (84.5)                           | 0.603  |
| Khat chewing                        | Yes<br>No<br>Previous chewer   | 7 (14.9)<br>25 (16.3)<br>7 (26.9)                         | 40 (85.1)<br>128 (83.7)<br>19 (73.1)                          | 0.372  |
| Physical activity                   | Yes<br>No  | 21 (15.4)<br>18 (20.0)                                    | 115 (84.6)<br>72 (80.0)                                       | 0.375  |
| Status of blood pressure            | Controlled<br>Uncontrolled   | 26 (19.0)<br>13 (14.6)                                    | 111 (81.0)<br>76 (85.5)                                       | 0.395  |
| Co-morbidities                      | Yes<br>No  | 24 (20.0)<br>15 (14.2)                                    | 96 (80.0)<br>91 (85.8)  | 0.246  |
| Healthy Diet Style                  | Yes<br>No  | 15 (20.3)<br>24 (15.8)                                    | 59 (79.7)<br>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   | 0.42 |
| Age   | 1.03        | 0.99 - 1.08    | 0.11 |
| Gender [Male]                               | 0.73        | 0.22 - 2.34    | 0.60 |
| Level of education [Intermediate]           | 0.19        | 0.02 - 1.33    | 0.12 |
| Level of education [Primary]                | 0.61        | 0.12 - 2.61    | 0.52 |
| Level of education [Secondary]              | 0.19        | 0.02 - 1.40    | 0.12 |
| Level of education [University or higher]   | 0.81        | 0.13 - 4.92    | 0.81 |
| Employment status [Governmental Employee]   | 1.45        | 0.17 - 16.11   | 0.74 |
| Employment status [Private sector employee] | 25.79       | 0.47 - 1279.41 | 0.09 |
| Employment status [Retired]                 | 0.70        | 0.10 - 6.27    | 0.72 |

|  |       |              |           |
|--|-------|--------------|-----------|
| Employment status [Unemployed]                 | 1.16  | 0.17 - 10.42 | 3<br>0.88 |
| Income per month in RS [15,000 or Higher]      | 0.29  | 0.05 - 1.40  | 7<br>0.13 |
| Income per month in RS [5,000-9,999]           | 0.46  | 0.11 - 1.87  | 1<br>0.27 |
| Income per month in RS [5,000 or less]         | 0.18  | 0.03 - 0.87  | 8<br>0.03 |
| Marital Status [Married]                       | 0.58  | 0.09 - 5.12  | 5<br>0.58 |
| Marital Status [Single]                        | 1.73  | 0.17 - 21.30 | 2<br>0.64 |
| Marital Status [Widowed]                       | 0.67  | 0.07 - 7.23  | 3<br>0.72 |
| Residence [Village]                            | 0.72  | 0.26 - 2.05  | 4<br>0.53 |
| Geographical area [Mountainous]                | 10.77 | 1.98 - 80.73 | 0<br>1    |
| Geographical area [Plains]                     | 4.08  | 1.01 - 22.54 | 0.07<br>1 |
| Khat Chewing [Non-Khat user]                   | 0.44  | 0.12 - 1.63  | 0.21<br>1 |
| Khat Chewing [Previous user]                   | 2.11  | 0.52 - 8.64  | 0.29<br>3 |
| Smoking [Previous smoker]                      | 1.68  | 0.35 - 7.50  | 0.49<br>8 |
| Smoking [Smoker]                               | 0.32  | 0.05 - 1.54  | 0.18<br>0 |
| Co-morbidities [yes]                           | 1.90  | 0.70 - 5.40  | 0.21<br>4 |
| Status of blood pressure [Uncontrolled]        | 0.81  | 0.34 - 1.87  | 0.61<br>9 |
| Owning a Blood pressure measuring device [yes] | 0.97  | 0.36 - 2.49  | 0.95<br>4 |
| Healthy Diet Style [yes]                       | 1.52  | 0.63 - 3.65  | 0.35<br>3 |
| Number of HTN medications                      | 0.83  | 0.41 - 1.56  | 0.57<br>7 |
| Using other medications [yes]                  | 0.54  | 0.18 - 1.56  | 0.25<br>4 |
| Observations                                   | 226   |              |           |
| R2 Tjur  | 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.

#### Ethical Approval and consent

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.

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