Original Article

The Relationship between Health Literacy and Hypertension Control: A Cross-Sectional Study

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Abstract

Background: *Uncontrolled hypertension is a major public health problem among patients in developed and developing countries. The present study was conducted to investigate the prevalence and causes of uncontrolled hypertension to facilitate the design of more effective methods of hypertension control.*

Methods: *This cross-sectional study was conducted on 303 adults with hypertension. The Standard Health Literacy Questionnaire was used to collect data. Uncontrolled hypertension was ascertained based on the WHO definition. A multiple logistic regression model was used at a 95% confidence level. Variables considered were confounders including age, sex, marital status, family size, income (monthly mean), smoking (past or current), education level, and physical activity (times in a week).*

Results: *The mean (SD) age of the participants (n=303) was 59.3(12.7) years, and 57.4% were men. The prevalence of uncontrolled hypertension was 50.5%. The mean score of health literacy among patients with controlled hypertension was higher than that among patients with uncontrolled hypertension (64.83±23.72 vs 46.28±22.19; P<0.001). The odds of uncontrolled hypertension decreased by 3% in the patients (OR: 0.97; P=0.06). Adherence to treatment (OR: 0.13; P<0.001), salt consumption per package purchased per month (OR: 4.40; P=0.001), increased physical activity per hour per week (OR: 0.56; P<0.001), current or passive cigarette smoking (OR: 4.59; P=0.010), a positive history of chronic diseases (OR: 2.62; P=0.027), and increased family size (per 1 child) (OR: 0.57; P<0.001) were associated with uncontrolled hypertension.*

Conclusion: *The results showed a borderline association between increased health literacy and hypertension control. Additionally, increased salt consumption, reduced physical activity, small family size, and underlying diseases (eg, diabetes, chronic heart disease, and renal disease) could increase the odds of uncontrolled hypertension in Iranian society.*

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Introduction

Hypertension is a formidably challenging public health concern given its association with premature deaths around the world. This health problem is a predictor of cardiovascular diseases.

Uncontrolled hypertension refers to a condition in which, after 2 recent medical visits and despite medical therapy, systolic blood pressure is ≥140 mmHg or diastolic blood pressure is ≥90 mm Hg. Poor hypertension control, including noncompliance with treatment, is the crucial cause of the increased prevalence of patients who cannot control their blood pressure.[1-3] Currently, the number of people with hypertension is estimated to be 1.13 billion globally, two-thirds of whom live in low and middle-income countries (WHO. Hypertention: Key facts. https://www.who.int/health-topics/hypertension). The global Sustainable Development Goal for non-communicable diseases is to reduce the prevalence of hypertension by 25% by 2025. Moreover, uncontrolled hypertension is a major public health problem among patients in developed and developing countries. In 2015, 1 out of 4 males and 1 out of 5 females had hypertension, and 4 out of 5 people with hypertension had difficulty controlling their hypertension (CDC. Facts about Hypertension. https://www.cdc.gov/bloodpressure/facts.htm).

The Seventh National Survey of Risk Factors (2016) for Non-communicable Diseases of Iran reported that 27.01% of people had hypertension: 25.7% among males and 28.2% among females. Based on the World Health Organization (WHO) stepwise approach to risk factor surveillance, STEPs, the rate of the effective care of hypertension was reported to be 39.41% in males and 36.5% in females in 2016.[4] Although hypertension accounts for 50% of heart disease complications, it is possible to reduce the stroke rate (33%) and renal complications (10%–15%) by controlling blood pressure. Despite the vast knowledge about the risks of hypertension and increased access to effective antihypertensive therapy, hypertension still globally affects a large portion of the population.[5,6]

Previous studies have shown that nonadherence to antihypertensive drugs, being overweight, nonadherence to physical exercise, and nonadherence to alcohol withdrawal are independent predictors of uncontrolled hypertension.[7] Research has also shown that the odds of uncontrolled hypertension are higher in single people, families with low incomes, patients with lower adherence to antihypertensive drugs, and patients with albuminuria or decreased renal function.[8] Regarding the high prevalence of noneffective hypertension care, the present study was conducted to investigate the prevalence and causes of uncontrolled hypertension with a view to facilitating the design of more effective methods of hypertension control.

Methods

The present cross-sectional study was conducted on a sample of patients with physician-diagnosed hypertension who had medical records in health centers in the Iranian province of Hamadan in the second half of 2019. The patients were selected via stratified random sampling from 24 comprehensive urban health service centers (CURHCs) in Hamadan Province. Then, based on the sample size calculated for each province and a table of random numbers between 4 and 10, CURHCs and health houses were selected.

The results of a study by Masilela et al[9] were drawn upon to calculate the sample size, which reported the prevalence of uncontrolled hypertension at 57.3%. The value of maximum acceptable error acceptance was considered to be 0.09 at the 95% confidence level.

The inclusion criteria of the study were hypertension, age >18 years, and antihypertensive consumption. Pregnant and elderly people with Alzheimer's disease were not included in this study. According to the WHO guideline, hypertension is diagnosed if, when it is measured on 2 different days, the systolic blood pressure reading on both days is ≥140 mmHg and/or the diastolic blood pressure reading on both days is ≥90 mmHg.

In this study, uncontrolled hypertension was ascertained based on the WHO definition. Thus, uncontrolled hypertension was considered a condition in which, after at least 2 recent medical visits and despite medical therapy, systolic blood pressure was ≥140 mmHg or diastolic blood pressure was ≥90 mmHg. Antihypertensive medication was ascertained based on self-reports, and blood pressure status was measured by physicians during periodic care. Blood pressure was measured in the included health centers according to the WHO standards. The following data were collected for 2 study groups: patients with controlled hypertension and those with uncontrolled hypertension: demographic characteristics, smoking (yes [past/current] or no), drinking alcohol (yes or no), physical activity (hours in the week), adherence to antihypertensive drugs (yes or no), and a history of hypertension in first-degree family members (yes or no). The Health Literacy Questionnaire was employed to collect data related to health literacy. The questionnaire, which encompasses 33 main items, was designed by Tavousi et al,[10] and its validity and reliability have been reported to be acceptable.

The main items included access (6 questions; the score range =6–30), reading skills (4 questions: the score range =4–20), comprehension (7 questions; the score range =7–35), evaluation (4 questions; the score range =4–20), and decision and application of health information application (12 questions; the score range =12–60). For each study participant, a score between 33 and 165 was obtained, with a higher score indicating good health literacy and a lower one showing lower health literacy. This score was converted

into a range from 0 to 100 by the difference of the raw score obtained from the minimum possible raw score divided by the difference of the maximum possible score from the minimum possible score. Accordingly, based on the obtained scores, health literacy was classified as inadequate (0–50), fairly inadequate (50–66), adequate (66–84), and excellent (84–100). Multivariable logistic regression analyses were performed to identify factors associated with uncontrolled hypertension at a 95% confidence level. The backward-selection method was applied to choose the variables in this model. For the removal of variables from the model, the P value was set at 0.2. Eventually, data analysis was done using the Stata 11 software (Stata-Corp, College Station, TX, USA) at a confidence interval of 95%.

The study protocol was approved by the Institutional Review Board (IRB) of the Ethics Committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1398.835). Informed consent was confirmed by the IRB.

Results

This cross-sectional study was conducted on 303 adults with hypertension, of whom 153 (50.5%) had uncontrolled hypertension. The mean age of the group with uncontrolled hypertension was higher than that of the controlled hypertension group (59.3 y vs 50.6 y; P<0.001). Uncontrolled hypertension was observed in 57.4% and 54.1% of males and females, respectively (P=0.049). In general, the controlled hypertension group had fewer visits to health centers for medical visits (P=0.03). The mean health literacy score was higher in the group with uncontrolled hypertension than in the controlled hypertension group (46.28±22.19 vs 64.83±23.72; P<0.001). Table 1 presents the other demographic information of the study patients.

The simultaneous effects of factors related to uncontrolled hypertension were examined using a multiple logistic regression model, which showed that treatment adherence

Table 1. Baseline characteristics of the participants*

Variable	Uncontrolled Hypertension (n=153)	Controlled Hypertension (n=150)	P
Age (y)	59.3±12.7	50.6±11.6	<0.001
Sex (%)			0.049
Male	57.4	42.7	
Female	54.1	45.9	
Marital status (%)			0.120
Married	85.6	91.3	
Single/divorced/widowed	14.4	8.7	
Number of children	3.94±1.73	3.30±1.92	0.001
Income (monthly mean in million)	1.85±0.94	2.34±1.11	<0.001
Smoking (%)			0.001
Current/past	22.9	8.7	
Education Level (%)			<0.001
Higher than diploma	3.9	14.7	
Diploma/below diploma	15.0	19.3	
Primary School	36.6	44.0	
Illiterate	44.4	22.0	
FHH† (%)	52.9	50.7	
Physical activity (times in a week)	2.0±1.83	3.64±1.38	<0.001
SPP††	1.14±0.56	0.82±0.33	<0.001
Health literacy score (mean)	46.28±22.19	64.83±23.72	<0.001
Access	18.18±7.12	22.48±6.62	<0.001
Reading	10.05±5.59	13.53±5.65	<0.001
Understanding	19.75±7.42	24.52±7.40	<0.001
Appraisal	10.79±4.24	13.42±4.18	<0.001
Decision	35.29±9.06	44.67±10.28	0.001
Systolic blood pressure (mmHg)	141.10±9.59	121.36±9.32	<0.001
Diastolic blood pressure (mmHg)	94.28±5.91	78.76±5.52	<0.001
Frequency of checkups (%)			0.003
4 times per year	31.4	38.00	
6 times per year	21.00	14.00	
12 times per year	22.2	35.3	
24 times per year	25.5	12.7	

*Unpaired *t* test and analysis of variance (ANOVA) were used for quantities variables and the χ^2 test for qualitative variables.
†Familial history of hypertension
††Number of salt packages purchased per month

Table 2. Role of related factors in uncontrolled hypertension

Variable	Adjusted Odds Ratio	P	95% CI
Adherence to treatment (yes/no)	0.13	<0.001	0.06-0.29
Age (y)	1.04	0.096	0.99-1.10
Sex (female/male)	0.96	0.917	0.42-2.19
Education (per year)	1.10	0.662	0.71-1.71
Income (1 million)	1.00	0.112	0.99-1.00
Marriage (married/unmarried)	0.96	0.944	0.29-3.14
Child number (per 1)	0.57	<0.001	0.42-0.77
FHH[†](yes/no)	1.19	0.627	0.60-2.36
Chronic diseases (yes/no)	2.62	0.027	1.11-6.14
NSPP[††] (per 1)	4.40	0.001	1.84-10.52
Physical activity (hours per week)	0.56	<0.001	0.44-0.72
Smoking (yes/no)	4.59	0.010	1.44-14.65
Health literacy (per 1 score)	0.97	0.068	0.95-1.00
Frequency of checkups			
6 times per year/3 times per year	2.86	0.039	1.06-7.74
12 times per year/3 times per year	1.35	0.483	0.58-3.15
24 times per year/3 times per year	2.40	0.071	0.90-6.36

[†]Familial history of hypertension
[††]Number of salt packages purchased per month

reduced the odds of uncontrolled hypertension by 88% (OR, 0.13; P<0.001). For 1 year of age increase in the patients, the odds of uncontrolled hypertension rose 1.04 times (P=0.096). No association was found between sex (OR, 0.96), income increase (OR, 1.00), and hypertension control. Per 1 child increase, the odds of uncontrolled hypertension in the study population fell by 43% (OR, 0.057; P<0.001). Per 1 package of salt increase per month, the odds of uncontrolled hypertension in the patients increased by 4.40 (OR, 4.40; P=0.001). Per 30 minutes of increase in physical activity, the odds of uncontrolled hypertension in the study participants dropped by 44% (OR, 0.56; P<0.01). Current or passive cigarette smokers had higher odds of uncontrolled hypertension by 4.59 times (OR, 4.59; P=0.010). In patients with a history of 6 visits to CURHCs compared with those with 3 visits per year, the odds of uncontrolled hypertension increased by 2.86 (P=0.039). Moreover, per 1 unit of increase in health literacy, the odds of uncontrolled hypertension decreased by 3% in the patients (OR, 0.97; P=0.068) (Table 2).

Discussion

In the present study, the prevalence of uncontrolled hypertension was very significant for 50.49% of patients with hypertension. Similar rates of uncontrolled hypertension have been reported in other studies, including 48% in Ethiopia,[11] 30%–62% in Iran,[12-15] 29% in the United States,[16] and 56% in South Africa.[9] In a systematic review in 2016, uncontrolled hypertension had a pooled prevalence rate of 62% and a prevalence rate of 73% in low-income countries.[17] Studies have shown that the high prevalence of uncontrolled hypertension may be due to socioeconomic factors, social networks, family support, low education status, and poverty.[16,18,19] In the present study, the percentage of illiterate patients was higher in the uncontrolled hypertension group than in the group with controlled hypertension (44.4% vs 22.0%). Nonetheless, our multivariate model revealed no statistically significant relationship between education and uncontrolled hypertension. Patients who failed to control their hypertension also had lower incomes (1.8 vs 2.3 million), although we observed no significant relationship in the multivariate model. The large size of the family can improve the blood pressure of patients, especially the elderly. It is likely due to children's sense of responsibility toward their parents, which could lead to better care of elderly patients, including the correct use of antihypertensive drugs. Our multivariate analysis demonstrated that the odds of uncontrolled hypertension in patients decreased significantly per 43% increase per child (1–0.57).

Several studies have indicated that the issue of health literacy, independent of other variables, is effective in adherence to the treatment of diseases.[20,21] Moreover, in the current research, the health literacy score was higher among patients who adhered to treatment (64.8 vs 46.3), suggesting the effectiveness of treatment adherence in the successful control of hypertension. Further, based on our multivariate analysis, adherence to pharmacological treatment significantly reduced the odds of uncontrolled hypertension by 87%. Another noteworthy point is that health literacy was inversely associated with uncontrolled hypertension; still, the relationship was borderline significant, suggesting that the significance could become considerable in larger sample sizes.

According to our results, the mean age of patients with uncontrolled hypertension was higher than that of patients with controlled hypertension (59.3 y vs 50.6 y). Furthermore,

in the multivariate model, the effect of age after considering the effects of other variables was borderline significant. An age increase is always associated with the subsequent increase in other underlying diseases, including diabetes and cardiovascular diseases,[22] which may make it more difficult to control hypertension. Moreover, reduced physical activity in the elderly exacerbates the problem of hypertension control. In the present study, we observed a strong negative correlation between increased age and physical activity (r= −0.50). Our multivariate analysis showed that with increased physical activity, the probability of uncontrolled hypertension declined significantly by 47%. Besides, with increasing age, the health literacy score (a significant factor in controlling chronic diseases) decreased negatively and strongly (r= −0.70). Similar studies have found an inverse relationship between age and health literacy[23] and age and physical activity.[24] Our results also revealed that females could control hypertension more than males (45.9 vs 42.7), although the relationship between sex and the outcome was not significant in the multivariate analysis. Also according to our findings, females with uncontrolled hypertension scored lower than males with uncontrolled hypertension (66.4 vs 64.03) in health literacy decision-making, which includes salient aspects of disease control measures. The same result has been reported in several studies.[25] We determined the effect of diet on uncontrolled hypertension based on the mean number of packages of salt purchased by households per month. We used this criterion because the most important nutrient affecting hypertension was identified to be salt consumption, and people usually have difficulty remembering or they underestimate salt consumption estimation.[26] The present study showed that 1 salt package increase per month increased the odds of uncontrolled hypertension in patients by 4.01 times. The same result has been reported in several studies.[27,28] In this study, in order to prevent the bias of self-reporting and recall bias in the estimation of the amount of salt consumption, we used the number of salt packages purchased by households during 1 month as a proxy of the amount of salt consumption.

Another important finding in this study was that the odds of uncontrolled hypertension in smokers were higher by 4.73 times (statistically significant). Several studies have also reported that smoking can lead to elevated blood pressure. The present study showed that smoking in patients delayed the process of controlling hypertension, despite the recognized harmful effects of smoking.[29,30]

In the present study, patients with unsuccessful hypertension control more frequently had a history of underlying diseases, including diabetes, cardiovascular diseases, and renal disease, and this relationship was significant in the multivariate analysis. The concomitant presence of hypertension and kidney disease not only affects physicians' ability to achieve the recommended goals of hypertension control under pharmacological treatment but also increases the risk of cardiovascular diseases, including myocardial infarction, stroke, and renal failure.[31,32]

Finally, in the current investigation, patients with unsuccessful hypertension control visited CURHCs more frequently than patients with successful hypertension control (statistically significant). Due to the complications of other symptoms of hypertension (eg, headache and dizziness), patients with unsuccessful hypertension control felt a higher risk and sought checkups more frequently. Furthermore, patients who controlled their hypertension were more relaxed and did not seek medical visits.

Another important reason for the high prevalence of uncontrolled hypertension was a coincidence of the present study with the emergence of the coronavirus (COVID-19), resulting in a decrease in the number of checkups, a reduction in physical activity, and an increase in psychological stress.

The present study was conducted to examine the prevalence of uncontrolled hypertension as a chronic, dangerous disease underlying other controllable diseases. One of the most important limitations of this investigation is that due to the cross-sectional nature of the study design, the relationships identified in this study are not necessarily related to causal relationships, and cohort or case studies are needed in this regard.

Conclusion

The results of the current study showed a borderline association between increasing health literacy and hypertension control. Additionally, increased salt consumption, reduced physical activity, small family size, and underlying diseases (eg, diabetes, chronic heart disease, and renal disease) could increase the odds of uncontrolled hypertension in Iranian society.

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