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Association Between Hypertension Awareness and Preventive Health Behaviors Among Healthcare Workers: Evidence from the SHAHWAR Study

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Abstract

Introduction: Current evidence does not clearly support an association between hypertension awareness and improved cardiovascular outcomes. This study aimed to investigate the relationship between awareness of high blood pressure and adoption of healthy lifestyle behaviors among healthcare workers (HCWs) in Iran.

Methods: We analyzed cross-sectional data from 1,178 HCWs enrolled in the SHAHWAR cohort study. Anthropometric measurements, blood pressure assessments, structured health interviews, and physical examinations were conducted by trained investigators. Multivariable logistic regression models were applied to evaluate the association between hypertension awareness and preventive behaviors, including salt intake, smoking status, physical activity, and body mass index (BMI).

Results: Among the 1,178 participants (58.7% women; mean age 39.4 ± 7.8 years), the prevalence of hypertension was 27% (age-standardized: 29.2%). Hypertension was significantly more prevalent in men than in women (38.8% vs. 19.0%, $p < 0.001$) and increased with age. Awareness (38.2% vs. 26.5%, $p = 0.028$) and control (85.1% vs. 58.1%, $p = 0.004$) of hypertension were significantly higher among women and younger individuals. Smoking and BMI ≥25 were more common among hypertensive individuals compared with non-hypertensive individuals (9.7% vs. 4.5%, $p = 0.001$; and 72.3% vs. 27.7%, $p < 0.001$, respectively). Smoking was not associated with hypertension awareness, treatment, or control. However, blood pressure control was significantly poorer among participants with

BMI ≥25. Among women, hypertension awareness was associated with a higher proportion of individuals with BMI <25 (36.0% vs. 18.8%; p = 0.028). Similarly, among participants younger than 38 years, awareness was linked to a higher prevalence of BMI <25 (51.2% vs. 25.9%; p = 0.011) and lower salt intake (75.6% vs. 53.7%; p = 0.028).

Conclusion: Despite their medical knowledge and professional status, hypertension awareness among HCWs does not appear to exceed that of the general population. The findings highlight suboptimal adherence to healthy lifestyle behaviors among HCWs with hypertension and emphasize the need for more effective lifestyle counseling and targeted educational interventions.

Keywords: Hypertension, Prevalence, Awareness, Health care workers, Iran

1 Introduction

Among the established risk factors for cardiovascular diseases (CVD), hypertension is supported by the strongest body of evidence and scientific documentation (1, 2). According to the 2017 American College of Cardiology (ACC)/American Heart Association (AHA) guideline, which defines hypertension as blood pressure ≥ 130/80 mmHg (3), approximately 26.4% of the global adult population was affected by hypertension in 2020 (4). More recent estimates from the World Health Organization indicate that around 1.4 billion adults aged 30-79 years were living with hypertension worldwide in 2024 (5). Following the release of the 2017 ACC/AHA guideline, the estimated prevalence of hypertension has increased substantially (6). A similar trend has been observed in Iran, where the prevalence rates rose markedly from 29.9% to 53.7% (7, 8).

Hypertension is typically asymptomatic; therefore, awareness, treatment, and effective control are critical for preventing both short- and long-term complications (9, 10). Previous studies have shown that hypertension awareness, treatment, and control vary significantly by region, sex, income level, and

educational attainment (11-13). However, relatively few studies have specifically examined the relationship between hypertension awareness and the adoption of healthy lifestyle behaviors. Due to the limited evidence, current findings do not clearly support a direct link between awareness of hypertension and improved cardiovascular outcomes (14, 15). Moreover, there is no consistent evidence demonstrating that awareness of high blood pressure leads to positive behavioral changes, such as increased physical activity, maintenance of a normal body mass index (BMI), or reduced salt intake (16, 17).

Healthcare workers (HCWs) are frequently exposed to multiple risk factors for hypertension, including occupational stress, long working hours, shift work, and unhealthy dietary patterns (18). Despite their medical knowledge and professional responsibilities, it remains unclear whether HCWs adequately monitor and manage their own health status (19, 20). Given their background, HCWs might be expected to exhibit higher levels of hypertension awareness and better adherence to preventive health behaviors compared with the general population. However, evidence examining the impact of

working in the healthcare sector on these outcomes remains limited (21).

To the best of our knowledge, no study has specifically investigated the association between hypertension awareness and health-related behaviors, such as physical activity, maintenance of normal BMI, and reduced salt intake among HCWs. Therefore, the present study aims to determine the prevalence, awareness, treatment, and control of hypertension among HCWs based on the 2025 ACC/AHA guideline (22) and evaluate the association between hypertension awareness and key preventive health behaviors.

2 Methods

2.1 Study design and population

This study was conducted using data from the recruitment phase of the SHAhroud Healthcare Workers Associated Research (SHAHWAR) study, which included 1,178 volunteer participants enrolled between October 2019 and February 2020. The SHAHWAR study, designed by Shahroud University of Medical Sciences, is a prospective cohort study aimed at investigating risk factors for non-communicable diseases among university healthcare staff. Detailed descriptions of the study design and methodology have been published elsewhere (23, 24).

2.2 Data collection

Anthropometric measurements, blood pressure assessments, structured health interviews, and physical examinations were conducted by trained personnel. The structured interview collected information on socioeconomic characteristics, medical history, and lifestyle factors, including dietary habits, physical activity, and tobacco use (cigarette and hookah).

Blood pressure was measured twice in both arms after the participant had rested in a seated position for at least five

minutes. For analysis, the higher mean value obtained from one arm was considered as the participant's blood pressure (25). Measurements were performed using a regularly calibrated sphygmomanometer with an appropriately sized cuff (Riester, Germany).

2.3 Variable definitions

According to the 2025 ACC/AHA guideline (22), hypertension was defined as any of the following: a prior physician diagnosis of hypertension, systolic blood pressure (SBP) ≥ 130 mmHg, diastolic blood pressure (DBP) ≥ 80 mmHg, or self-reported use of antihypertensive medications. Elevated blood pressure was defined as SBP 120-129 mmHg and DBP <80 mmHg (22).

Hypertension awareness was assessed through direct interviews with participants. During the interviews, participants were asked, 'Has a doctor ever diagnosed you with high blood pressure?' Those who responded affirmatively were classified as 'aware' of their hypertension. Additionally, participants who were using antihypertensive medications were asked about their physician's diagnosis of high blood pressure and were also classified as 'aware' if they reported receiving such a diagnosis. Unawareness was defined as having measured blood

pressure ≥ 130/80 mmHg without prior physician diagnosis or use of antihypertensive medications.

Treatment was defined as self-reported use of antihypertensive medication among participants aware of their hypertension. Blood pressure control was defined as the proportion of participants on antihypertensive treatment who had both SBP and DBP readings below 130 mmHg and 80 mmHg, respectively, in accordance with the ACC/AHA criteria.

Health-related variables included BMI, smoking status, salt intake, and physical activity. BMI was categorized as <25 and ≥25 kg/m². Physical activity was assessed using the validated Persian version of the International Physical Activity Questionnaire (IPAQ) (17), with cut off of metabolic equivalent of task (MET)-minutes ≥ 600 per week to define adequate activity. Regarding smoking, participants were categorized as current smokers, former smokers, and never smokers. Due to the significant number of participants who reported using tobacco products other than cigarettes, the use of alternative tobacco products (e.g., hookah) was also included in the analysis. Salt intake was estimated using a food frequency questionnaire (FFQ) (26), which assessed 24-hour salt

consumption based on table salt use, salt used in cooking, and intake of high-sodium foods (11). According to World Health Organization (WHO) recommendations, salt intake exceeding 5 grams per day was classified as high (27).

2.4 Ethics approval and consent to participate

The study protocol was approved by the Research Review Board of Shahroud University of Medical Sciences and received ethical approval from the institutional Research Ethics Committee (Ethics code: IR.SHMU.REC.1397.033). The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment.

2.5 Statistical analysis

Descriptive statistics were used to summarize the data. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were reported as frequencies and percentages. Associations between categorical variables were assessed using the chi-square test or Fisher's exact test, as appropriate. Normality of continuous variables was assessed using the Shapiro–Wilk test. For comparisons between two independent groups, the independent samples t-

test was used for normally distributed variables, while the Mann-Whitney U test was applied for non-normally distributed data.

A predefined analytical framework was applied to examine the association between hypertension awareness and health-related behaviors. Separate regression models were constructed for each outcome variable, including smoking status, salt intake, BMI, physical activity, and biochemical markers. In all models, hypertension awareness was considered the main independent variable of interest. A consistent set of sociodemographic covariates (age, sex, marital status, educational level, and work type) was included in each model based on prior evidence and their potential confounding effects. This approach allowed the independent assessment of the association between hypertension awareness and each health-related outcome. In each regression model, hypertension awareness together with predefined sociodemographic covariates were included as independent variables. Multicollinearity among independent variables was assessed using variance inflation factors (VIFs). Potential interaction effects between hypertension awareness and key

demographic variables were examined by including interaction terms in the regression models. The proportion of missing data was minimal (<5%), and complete-case analysis was applied. Participants with missing values in any of the variables included in a given model were excluded from that specific analysis. All statistical analyses were performed using SPSS software, version 23. A two-sided p-value of < 0.05 was considered statistically significant.

3 Results

3.1 Baseline characteristics

A total of 1,178 participants were included in the analysis, of whom 58.7% were female. The mean age was 39.4 ± 7.8 years with an age range of 24 to 68 years. The majority of participants were married (86.6%) and had a university degree (74.9%). Most participants were classified as overweight or obese based on BMI. Mean serum lipid levels and fasting blood sugar (FBS) are presented in Table 1.

3.2 Prevalence of hypertension and its awareness, treatment, and control

The mean SBP and DBP in the study population were 109.54 ± 13.60 mmHg and 72.27 ± 9.57 mmHg, respectively. According to the 2025 ACC/AHA guideline, 59 participants (5.0%) had elevated blood pressure and 318 individuals (27.0%) were classified as hypertensive. The age-standardized prevalence of hypertension was 29.3% according to the national population census (28). Among hypertensive participants, 31.3% were aware of their condition. Of those aware, 90.9% reported receiving antihypertensive medication, and among those treated, 72.2% achieved blood pressure control (Figure 1).

The prevalence of hypertension was higher in men compared with women (38.8% vs. 19.0%, $p < 0.001$). In contrast, awareness (38.2% vs. 26.5%, $p = 0.028$) and control (85.1% vs. 58.1%, $p = 0.004$) were significantly higher among women. Hypertension was more prevalent among older participants (≥38 years: 34.7% vs. <38 years: 17.7%, $p < 0.001$) and increased progressively with age (Figure 2). However, hypertension awareness (43.2% vs. 25.7%, $p = 0.003$) and control (84.2% vs. 62.7%, $p = 0.026$) were higher among younger individuals.

Regarding education, participants with non-university education had a higher prevalence of elevated blood pressure (7.8% vs. 4.1%, $p = 0.012$) and hypertension (33.1% vs. 24.9%, $p = 0.007$). However, hypertension control was significantly better among those with a university degree (78.3% vs. 52.4%, $p = 0.020$) (Table 2).

3.3 Health behaviors and biochemical correlates

Smoking was significantly more prevalent among hypertensive individuals compared with normotensive participants (9.7% vs. 4.5%, $p = 0.001$), although smoking status was not associated with hypertension awareness, treatment, or control. BMI was

strongly associated with hypertension, with a higher prevalence observed among overweight/obese participants (72.3% vs. 27.7%, $p < 0.001$). Moreover, blood pressure control was significantly poorer among participants with BMI ≥25 compared with those with BMI <25 (60.0% vs. 84.0%, $p = 0.045$). No significant associations were found between salt intake or physical activity and hypertension awareness, treatment, or control.

Biochemically, hypertensive participants had significantly higher levels of total cholesterol (184.9 vs. 176.6, $p = 0.001$), triglycerides (171.4 vs. 127.5, $p < 0.001$), low density lipoprotein (LDL) cholesterol (108.3 vs. 101.1, $p < 0.001$), and FBS (104.4 vs. 97.0, $p < 0.001$), along with lower high-density lipoprotein (HDL) cholesterol levels (49.4 vs. 52.0, $p = 0.002$), compared with normotensive individuals. Among hypertensive participants, those who were aware of their condition had significantly lower triglycerides (159.8 vs. 174.4, $p = 0.006$), LDL (102.9 vs. 110.7, $p = 0.008$), and FBS (98.9 vs. 107.0, $p = 0.002$) compared with those who were unaware. Similarly, participants with controlled hypertension had lower triglyceride

levels compared with uncontrolled hypertension (135.6 vs. 217.0, p = 0.011) (Table 3).

3.4 Correlates of hypertension awareness

Among women, hypertension awareness was associated with a higher proportion of individuals with BMI <25 (36.0% vs. 18.8%; p = 0.028). Similarly, among participants <38 years, awareness was associated with a higher prevalence of BMI <25 (51.2% vs. 25.9%; p = 0.011) and lower salt intake (<5 g/day: 75.6% vs. 53.7%; p = 0.028) (Table S1).

Awareness was also associated with more favorable biochemical profiles across multiple subgroups. Among women, awareness was linked to lower total cholesterol (177.4 vs. 192.6, p = 0.014), triglycerides (122.3 vs. 164.3, p = 0.004), LDL (100.9 vs. 112.8, p = 0.008), and FBS (97.8 vs. 102.1, p = 0.039). Among men, awareness was associated with lower FBS levels (100.1 vs. 109.9, p = 0.039). In participants aged <38 years, awareness was associated with lower triglycerides (119.0 vs. 171.4, p = 0.003), LDL (96.9 vs. 109.2, p = 0.018), and FBS (95.9 vs. 102.6, p = 0.016). Similarly, in participants aged ≥38 years, awareness was associated with lower FBS (101.0 vs. 108.5, p = 0.049).

Among married participants, awareness was associated with lower triglycerides (162.4 vs. 177.6, p = 0.005), LDL (102.5 vs. 110.4, p = 0.012), and FBS (98.7 vs. 108.0, p = 0.001). Among participants with a university education, awareness was associated with lower total cholesterol (175.6 vs. 188.4, p = 0.013), triglycerides (149.0 vs. 184.0, p = 0.003), LDL (99.4 vs. 111.6, p < 0.001), and FBS (96.5 vs. 104.9, p < 0.001). Among non-shift workers, awareness was also associated with lower triglycerides (144.9 vs. 170.3, p = 0.029) and FBS (97.8 vs. 105.6, p = 0.015) (Table S1).

3.5 Multivariable analysis

In multivariable models adjusting for sex, age, marital status, educational level, and work type, hypertension awareness was significantly associated with lower LDL (B = -6.24; 95% CI: -12.23 to -0.24; p = 0.042) and lower FBS (B = -6.11; 95% CI: -11.98 to -0.24; p = 0.041) (Table 4).

Among covariates, male sex was strongly associated with higher odds of smoking (adjusted OR: 23.25; 95% CI: 2.87 to 188.56; p = 0.003), higher triglyceride levels (B = 34.56; 95% CI: 10.35 to 58.78; p = 0.005), and lower HDL (B = -6.03; 95% CI: -8.94 to -3.12; p < 0.001). Older age (≥38 years) was

associated with higher total cholesterol (B = 11.89; 95% CI: 2.33 to 21.44; p = 0.015) and triglycerides (B = 38.68; 95% CI: 10.69 to 66.68; p = 0.007). Married participants had lower HDL levels (B = -6.28; 95% CI: -10.79 to -1.76; p = 0.007). Finally, participants with a university education had significantly lower odds of smoking compared with those with non-university education (adjusted OR: 0.19; 95% CI: 0.07 to 0.50; p = 0.001). It would be worth noting that all VIF values were within acceptable ranges and no statistically significant interaction effects were observed.

4 Discussion

This study provides valuable and representative estimates of hypertension awareness, treatment, and control among HCWs in northeast Iran. The findings indicated that 5% of participants had elevated blood pressure and 27% met the criteria for hypertension according to the 2025 ACC/AHA guidelines (age standardized prevalence: 29.3%). Notably, fewer than one-third of hypertensive individuals were aware of their condition. Among those aware, nearly 90% reported receiving treatment, and approximately two-thirds of treated individuals achieved blood pressure control.

The prevalence of hypertension observed in this study (27%; age standardized 29.3%) was lower than estimates reported for the general adult population in Iran (53.7%) (7). Likewise, higher prevalence rates have been reported in the general populations of China (46.4%) and the United States (45.4%) (29, 30). Using the JNC8 criteria, the prevalence of hypertension has been estimated at 36.9%, 25.2%, and 39.6% in Lebanon, Oman, and Morocco, respectively (31, 32), and approximately 27% in Iran, Kuwait, and Egypt (33-35). Therefore, when compared with other studies, the prevalence in our sample remains relatively low.

This discrepancy is likely attributable, at least in part, to the younger age distribution of our study population, with nearly 70% of participants aged under 43 years. However, even after age standardization, the prevalence remained lower than that of the general population, a finding consistent with previous reports among employed or healthier subgroups (36, 37).

Despite their medical knowledge and access to healthcare resources, nearly two-thirds of hypertensive HCWs were unaware of their condition. Estimates of unawareness in the general Iranian population and the United State adult population are approximately 62.9% and 40.1%, respectively (7, 38). This level of unawareness is concerning for public health, as hypertension often remains undiagnosed due to its asymptomatic nature (39). Although HCWs might be expected to have higher awareness due to their professional background, our findings suggest that factors such as age, BMI, and lifestyle behaviors may play a more influential role. Furthermore, the relatively young mean age of participants may partly explain the lower awareness levels observed, as awareness is generally lower among younger individuals (7).

Consistent with previous studies, the prevalence of hypertension increased with age, while blood pressure control declined among older individuals (7, 29, 30, 40-42). In line with earlier research, male sex was associated with a higher prevalence of hypertension and elevated blood pressure, while female sex was associated with greater awareness and better control (7, 12, 14). These findings may reflect gender differences in health-seeking behavior, risk factor profiles, and adherence to treatment. Moreover, lower educational attainment was associated with a higher prevalence of hypertension and elevated blood pressure; however, blood pressure control was better among individuals with higher education levels. This might suggest that health literacy can influence disease management more than awareness alone (43). Also, our findings indicated higher rates of elevated blood pressure among non-shift workers, contrary to some previous studies (44, 45). This may be explained by differences in age distribution and occupational roles, as non-shift workers in our sample were more likely to be older and engaged in sedentary administrative positions.

Encouragingly, treatment and control rates of hypertension among aware individuals were relatively high compared with the

general population. Approximately 90% of aware participants were receiving antihypertensive treatments, and 67% of treated individuals had controlled blood pressure, which was substantially higher than the control rate of 39.1% reported in the Iranian general population (7). This likely reflects better access to healthcare services and medications among HCWs (46).

Despite this, our study found no significant association between hypertension awareness and the adoption of healthier lifestyle behaviors among HCWs. Smoking was more prevalent among hypertensive individuals, and awareness, treatment, or control did not appear to influence smoking behavior. Similarly, no meaningful associations were observed between awareness and salt intake or physical activity. These findings are consistent with previous studies suggesting that awareness alone does not necessarily translate into behavioral change. For instance, Kim et al. showed that most of the lifestyle characteristics of Koreans with hypertension who were aware of their condition were comparable to those who were unaware (47). It would be worth noting that the cross-sectional design of our study limits the ability to establish temporal relationships and it is possible that

individuals may have adopted unhealthy behaviors prior to diagnosis.

Several studies suggest that, due to work-related stress, health-related behaviors among HCWs are often suboptimal and personal health monitoring, such as regular blood pressure measurement, may not be prioritized (48, 49). In contrast, some evidence indicates that greater awareness of CVD risk factors among employees is positively associated with the adoption of preventive health behaviors (50). However, studies in the general population have shown that hypertension awareness does not necessarily translate into healthier lifestyles, and even individuals receiving antihypertensive treatment do not consistently adopt behavioral changes that improve blood pressure control (38, 51). Similar pattern have been observed in other chronic disease contexts, such as diabetes (52). Collectively, these findings suggest that awareness alone is insufficient to drive meaningful changes in health-related behaviors.

There is substantial evidence supporting the effectiveness of structured interventions and support programs in promoting healthy lifestyle changes among individuals with hypertension

(53). For HCWs, as for the general population, strategies such as self-monitoring (54), primary healthcare (PHC)-based services (55), and workplace screening programs (56) may enhance awareness and facilitate the adoption of healthier behaviors. Improving hypertension awareness among HCWs requires systemic and organizational approaches, including ongoing education, increased emphasis on personal health, and regular blood pressure monitoring. Occupational health services could play a more active role by systemically identifying and managing hypertension and related risk factors. In addition, integrating PHC-based care plans tailored to HCWs may help identify affected individuals and address modifiable lifestyle risk factors more effectively.

To the best our knowledge, this is the first study to evaluate the relationship between hypertension awareness and the adoption of healthy lifestyle behaviors among HCWs in Iran. Although the sample size was relatively modest, the use of a standardized national protocol enhances the reliability of the findings and supports their generalizability to similar HCW populations.

Several limitations should be considered when interpreting these results. First, due to the cross-sectional design, the

temporal relationship between hypertension awareness and health-related behaviors cannot be determined, and causal inferences cannot be made. Although no significant associations were observed between awareness and most lifestyle factors, the possibility of reverse causation should still be considered. It is possible that individuals with healthier behaviors are more likely to engage with healthcare services and therefore become aware of their hypertension status. Conversely, individuals with less healthy lifestyles may also have more frequent healthcare encounters, increasing the likelihood of diagnosis. Therefore, the direction of the relationship between awareness and health behaviors remains unclear. Second, some variables, such as salt intake assessed through FFQ may be subject to measurement error and recall bias, which should be considered when interpreting the findings. Third, although the analyses were adjusted for key sociodemographic variables (i.e., gender, age, marital status, education, and work type), several important confounders, including alcohol consumption, overall diet quality, occupational stress, workload, and family history of hypertension, were not included and may have influenced the

results. Finally, as the study population consisted exclusively of HCWs from a single university system with a relatively young age distribution, the generalizability of the findings to the broader population may be limited.

5 Conclusion

In conclusion, hypertension awareness among HCWs, despite their professional knowledge, does not appear to be higher than that of the general population. Although causal relationships cannot be established, the findings suggest that awareness alone does not lead to the adoption of healthier lifestyle behaviors among HCWs. These results highlight the need for more effective lifestyle counseling and targeted educational interventions to improve health behaviors in this population.

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Author Contributions

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Ethical approval

The Ethics Review Committee of the Shahroud University of Medical Sciences, has approved the study (IR.SHMU.REC.1397.033).

Informed consent

Written informed consent was obtained from the participants for the study participation.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Data availability statement

The datasets were generated by PERSIAN cohort study prior the current study and data are available from the corresponding author on reasonable request.

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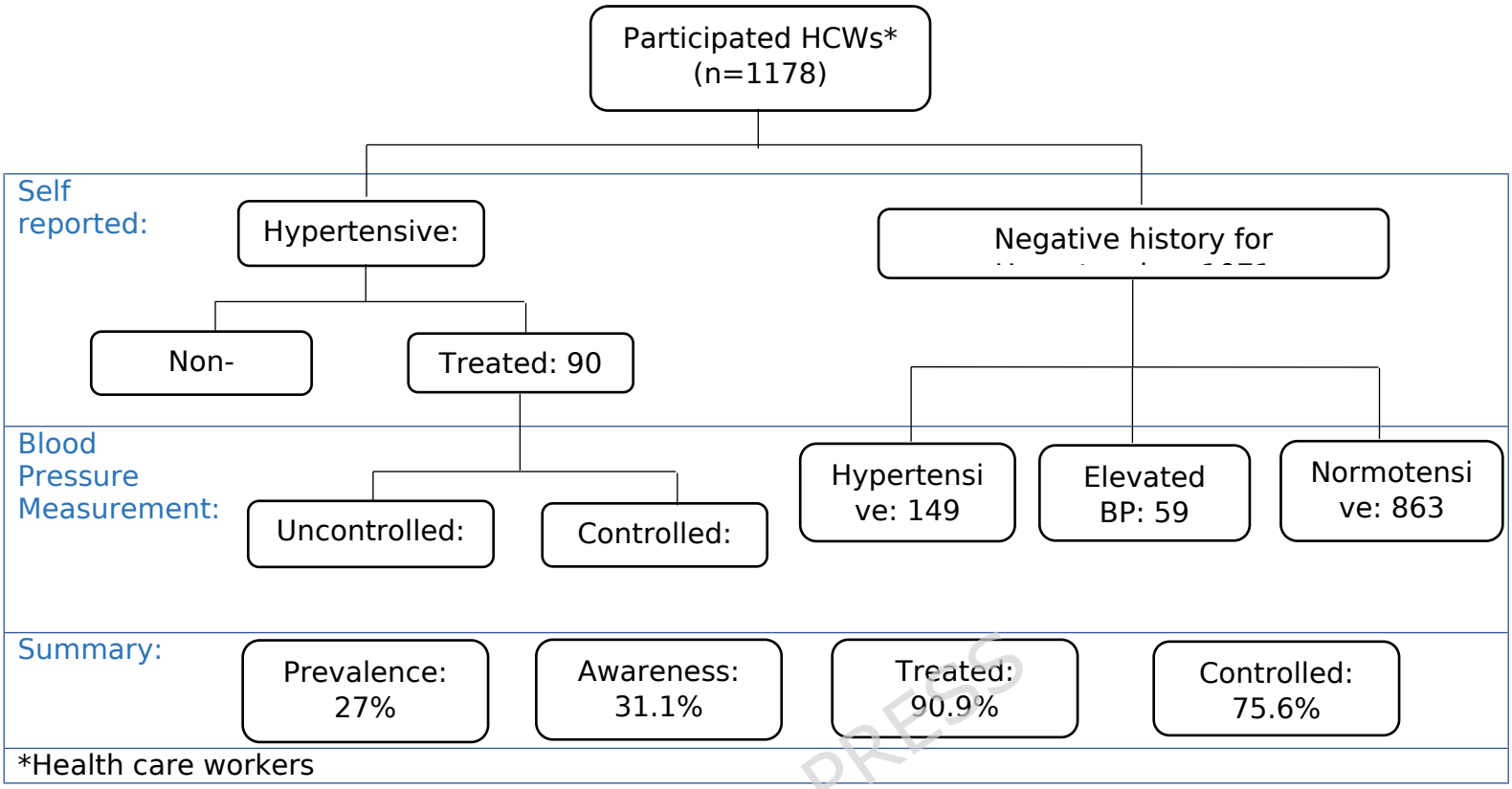

Figure 1. Flow diagram of hypertensive study participants classification according ACC/AHA 2025.

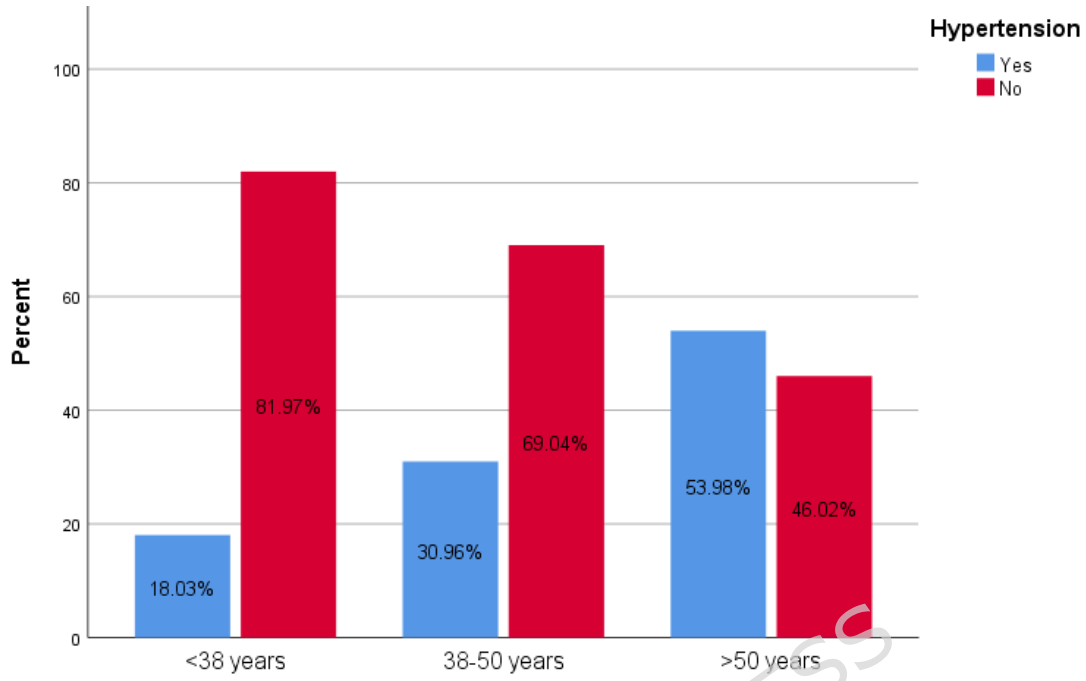

Figure 2. Number of cases in different age groups according to hypertension.

Table 1. Demographic characteristics of participants.

Variables		**Total population (n = 1178)**
Age (years)		39.4 ± 7.8
	≥38	639 (54.2)
	<38	536 (45.5)
Gender	Female	691 (58.7)
	Male	477 (40.5)
Marital status	Married	1020 (86.6)
	Single	158 (13.4)
Education	University education	882 (74.9)
	Non-university education	296 (25.1)
Work type	Shift work	490 (41.6)
	Non-shift work	682 (57.9)
BMI	Underweight (<18.5)	29 (2.5)
	Healthy weight (18.5–24.9)	483 (41)
	Overweight (25–29.9)	483 (41)
	Obesity (≥30)	177 (15)
Total cholesterol (mg/dL)		178.9 ± 35.0
Triglyceride (mg/dL)		139.6 ± 84.3
HDL (mg/dL)		51.3 ± 13.6
LDL (mg/dL)		103.1 ± 24.3
FBS (mg/dL)		99.07 ± 18.50

Continuous variables are reported as mean ± standard deviation (SD) and categorical variables are reported as N (%).
Abbreviations: HDL: High-density lipoprotein; LDL: Low-density lipoprotein; FBS: Fasting blood sugar; and BMI: Body-mass index.

Table 2. Prevalence of elevated blood pressure, hypertension, awareness, treated, and controlled hypertension by participant's characteristics.

Variables		Elevated blood pressure N (%)	Hypertension N (%)	Awareness N (%)α	Treated N (%)β	Controlled N (%) μ
Gender	Female	25 (3.6)	131 (19.0)	50 (38.2)	47 (94)	40 (85.1)
	Male	34 (7.1)	185 (38.8)	49 (26.5)	43 (87.8)	25 (58.1)
p-value		**0.006**	**<0.001**	**0.028**	0.318	**0.004**
Age	≥38	36 (5.6)	222 (34.7)	57 (25.7)	51 (89.5)	32 (62.7)
	<38	22 (4.1)	95 (17.7)	41 (43.2)	38 (92.7)	32 (84.2)
p-value		0.235	**<0.001**	**0.003**	0.731	**0.026**
Marital status	Married	52 (5.1)	280 (27.5)	89 (31.8)	81 (91)	58 (71.6)
	Single	7 (4.4)	38 (24.1)	10 (26.3)	9 (90)	7 (77.8)
p-value		0.719	0.369	0.539	1.000	1.000
Education	University education	36 (4.1)	220 (24.9)	75 (34.1)	69 (92)	54 (78.3)
	Non-university education	23 (7.8)	98 (33.1)	24 (24.5)	21 (87.5)	11 (52.4)
p-value		**0.012**	**0.007**	0.104	0.684	**0.020**
Work type	Shift work	15 (3.1)	119 (24.3)	33 (27.7)	31 (93.9)	23 (74.2)
	Non-shift work	44 (6.5)	198 (29.0)	65 (32.8)	58 (89.2)	42 (72.4)
p-value		**0.009**	0.079	0.336	0.714	0.857
Total		59 (5)	318 (27)	99 (31.1)	90 (90.9)	65 (72.2)

α: among hypertensive participants (n = 318), β: among hypertension aware participants (n = 99), μ: among received medication (n = 90)

Table 3. Prevalence of hypertension and its awareness, treatment, and control according to health behaviors and biochemical markers.

Abbreviations: MET: Metabolic equivalent of task; and BMI: Body-mass index.

Variables		**Hypertension N (%)**		**p-value**	**Awareness N (%)**		**p-value**	**Treated N (%)**		**p-value**	**Controlled N (%)**		**p-value**
Total		Yes	No		Yes	No		Yes	No		Yes	No	
		318 (27.0)	845 (71.7)		99 (31.3)	216 (67.9)		90 (90.9)	9 (9.1)		65 (72.2)	25 (27.8)	
Smoking	Yes	31 (9.7)	38 (4.5)	**0.001**	5 (5.1)	25 (11.6)	0.067	5 (5.6)	0 (0)	1.000	3 (4.6)	2 (8.0)	0.615
	No	287 (90.3)	807 (95.5)		94 (94.9)	191 (88.4)		85 (94.4)	9 (100.0)		62 (95.4)	23 (92.0)	
BMI	≥ 25	230 (72.3)	427 (50.5)	**0.000**	68 (68.7)	159 (73.6)	0.366	30 (33.3)	8 (88.9)	0.266	39 (60.0)	21 (84.0)	**0.045**
	< 25	88 (27.7)	416 (49.2)		31 (31.3)	57 (26.4)		60 (66.7)	1 (11.1)		26 (40.0)	4 (16.0)	
Salt intake	≥ 5gr/24h	94 (29.6)	245 (29.0)	0.850	25 (25.3)	69 (31.9)	0.228	22 (24.4)	3 (33.3)	0.688	15 (23.1)	7 (28.0)	0.629
	< 5gr/24h	224 (70.4)	600 (71.0)		74 (74.7)	147 (68.1)		68 (75.6)	6 (66.7)		50 (76.9)	18 (72.0)	
Physical activity	MET-minutes ≥ 600 per week	286 (89.9)	777 (92.0)	0.274	88 (88.9)	195 (90.3)	0.705	80 (88.9)	8 (88.9)	1.000	59 (90.8)	21 (84.0)	0.455
	MET-minutes < 600 per week	32 (10.1)	68 (8.0)		11 (11.1)	21 (9.7)		10 (11.1)	1 (11.1)		6 (9.2)	4 (16.0)	
Total cholesterol (mg/dL)		184.9 ± 36.6	176.6 ± 34.0	**0.001**	179.5 ± 35.9	187.0 ± 35.7	0.084	177.9 ± 35.9	195.1 ± 33.8	0.172	179.5 ± 34.0	173.8 ± 41.0	0.212
Triglyceride (mg/dL)		171.4 ± 107.7	127.5 ± 70.2	**<0.001**	159.8 ± 131.3	174.4 ± 92.4	**0.006**	158.2 ± 128.5	176.0 ± 164.7	0.898	135.6 ± 67.0	217.0 ± 210.5	**0.011**
HDL (mg/dL)		49.4 ± 13.1	52.0 ± 13.7	**0.002**	48.8 ± 13.0	49.5 ± 13.0	0.541	48.3 ± 12.9	53.6 ± 14.5	0.292	49.9 ± 13.3	44.0 ± 10.7	0.069
LDL (mg/dL)		108.3 ± 24.6	101.1 ± 23.8	**<0.001**	102.9 ± 22.8	110.7 ± 24.8	**0.008**	102.7 ± 23.1	105.1 ± 20.0	0.760	103.9 ± 24.5	99.4 ± 19.3	0.409
FBS (mg/dL)		104.4 ± 24.1	97.0 ± 15.5	**<0.001**	98.9 ± 15.3	107.0 ± 27.0	**0.002**	98.9 ± 15.5	99.6 ± 13.7	0.995	97.8 ± 15.3	101.6 ± 15.8	0.258

Table 4. Adjusted odds ratios (ORs) and B together with 95% confidence intervals (CIs) for the association between hypertension awareness and health behaviors and biochemical markers.

Variable	Smoking (Yes:No)[α]	p-value	BMI (≥ 25:< 25)[α]	p-value	High Salt Intake (≥ 5:< 5 gr/24h)[α]	p-value	Physically Inactive (MET-minutes < 600:≥ 600 per week)[α]	p-value	Total Cholesterol (mg/dL)[β]	p-value	Triglyceride (mg/dL)[β]	p-value	HDL (mg/dL)[β]	p-value	LDL (mg/dL)[β]	p-value	FBS (mg/dL)[β]	p-value
Main variable																		
Hypertension awareness	0.43 (0.13, 1.35)	0.148	0.82 (0.48, 1.42)	0.485	0.57 (0.32, 1.01)	0.055	1.16 (0.52, 2.60)	0.720	-5.25 (-14.07, 3.57)	0.242	-5.02 (-30.87, 20.83)	0.703	-0.83 (-3.94, 2.27)	0.597	**-6.24 (-12.23, -0.24)**	**0.042**	**-6.11 (-11.98, -0.24)**	**0.041**
Covariates																		
Gender (Male: Female)	**23.25 (2.87, 188.56)**	**0.003**	0.72 (0.43, 1.22)	0.223	0.68 (0.41, 1.13)	0.135	1.20 (0.55, 2.62)	0.642	-3.52 (-11.79, 4.74)	0.402	**34.56 (10.35, 58.78)**	**0.005**	**-6.03 (-8.94, -3.12)**	**<0.001**	-0.65 (-6.27, 4.97)	0.820	5.19 (-0.31, 10.69)	0.064
Age (≥38:<38)	0.85 (0.25, 2.88)	0.795	1.65 (0.92, 2.95)	0.091	0.59 (0.33, 1.07)	0.083	0.63 (0.26, 1.50)	0.293	**11.89 (2.33, 21.44)**	**0.015**	**38.68 (10.69, 66.68)**	**0.007**	2.63 (-0.73, 5.99)	0.125	6.40 (-0.10, 12.89)	0.053	3.76 (-2.60, 10.12)	0.245
Marital status (Married: Single)	0.75 (0.13, 4.18)	0.740	1.12 (0.50, 2.49)	0.783	0.66 (0.32, 1.40)	0.281	0.44 (0.17, 1.17)	0.098	-9.39 (-22.23, 3.46)	0.151	6.31 (-31.33, 43.94)	0.742	**-6.28 (-10.79, -1.76)**	**0.007**	-3.65 (-12.38, 5.09)	0.412	3.55 (-5.00, 12.10)	0.414
Academic education (University: Non-university)	**0.19 (0.07, 0.50)**	**0.001**	0.81 (0.44, 1.48)	0.489	1.04 (0.57, 1.88)	0.900	0.83 (0.34, 2.01)	0.685	3.13 (-6.17, 12.43)	0.508	23.70 (-3.56, 50.95)	0.088	1.67 (-1.60, 4.94)	0.317	0.72 (-5.60, 7.05)	0.822	-5.76 (-11.95, 0.43)	0.068
Work type (Shift: Non-shift)	1.90 (0.82, 4.40)	0.137	1.24 (0.73, 2.11)	0.420	1.18 (0.71, 1.98)	0.519	0.82 (0.37, 1.79)	0.611	6.81 (-1.48, 15.10)	0.107	22.75 (-1.56, 47.05)	0.066	1.48 (-1.44, 4.39)	0.319	4.53 (-1.10, 10.17)	0.115	3.33 (-2.19, 8.85)	0.236

α: Reported as adjusted OR (95%CI); β: Reported as B (95%CI)
Abbreviations: MET: Metabolic equivalent of task; and BMI: Body-mass index.
All models were adjusted for gender, age, marital status, academic education, and work type.