

Health care provider lifestyle modification advice for adults with hypertension in the United States

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Citation: Agbonlahor O, Osasuyi O, Mustapha T. Health care provider lifestyle modification advice for adults with hypertension in the United States. *EUR J ENV PUBLIC HLT.* 2023;7(3):em0133. <https://doi.org/10.29333/ejeph/12780>

ARTICLE INFO

Received: 30 Oct. 2022

Accepted: 15 Dec. 2022

ABSTRACT

Background: Health care providers' (HCP) advice for lifestyle modification is critical in the management and treatment of hypertension among adults. However, recent examination of the differences in receiving advice for lifestyle modification from HCP to adults with hypertension (HTN) by sociodemographic characteristics is limited.

Materials and methods: Data were obtained from the 2017-2018 national health and nutrition examination survey (n=1,524; representing 57 million Americans). HCP advice on lifestyle modification was defined in four categories (advice to control/lose weight, exercise, reduce salt in diet, and reduce fat/calories). Sociodemographic differences by HCP advice were evaluated using weighted adjusted logistic regression models for each outcome.

Results: Among the sample of adults with HTN, 42.3% received HCP advice to lose weight, 59% received advice to exercise, 49.2% received advice to reduce salt, and 46.4% received advice to reduce calories. Black (vs. White) adults with HTN had about twice and thrice higher odds of receiving HCP advice to exercise and reduce salt, respectively (95% CI: 1.12-2.51, 1.73-3.81). Adults aged 40-64 (vs. aged 18-39) had twice higher odds of receiving advice to lose weight (95% CI: 1.25-4.10). Adults who had no health insurance coverage (vs. those with health insurance coverage) had lower odds of receiving HCP advice to reduce calories/fat (OR: 0.53, 95% CI: 0.29-0.96).

Conclusion: HCPs are generally not advising lifestyle modification for the U.S. adults with HTN, and the likelihood of receiving advice differs by sociodemographic characteristics. HTN treatment and control strategies should prioritize HCP increasing lifestyle modification advice and equity in care for the U.S. adults.

Keywords: hypertension, health care provider, lifestyle modification advice, adults, sociodemographic characteristics

INTRODUCTION

Hypertension (high blood pressure) is a leading preventable contributor to mortality and disease burden globally [1]. Despite the relative accessibility of pharmacological and nonpharmacological (lifestyle modification) therapeutic approaches, efforts to control the epidemic of hypertension remains poor [2]. Hypertension is responsible for approximately 19.2% of mortality (10.8 million deaths) and 9.3% of disability-adjusted life years lost globally [3]. In the U.S., 47% of adults (116 million adults) have hypertension [4], and the disease increases their risks of developing ischemic stroke, myocardial infarction, abdominal aortic aneurysm, chronic kidney disease, and dementia [1, 3]. Moreover, according to the American Heart Association, the mortality rate attributable to hypertension increased by 34.2% from 2009 to 2019 [5], and hypertension accounts for about

\$131 billion of the U.S. health care costs [6], providing evidence that hypertension remains a critical public health issue that needs to be addressed. These unsustainable healthcare costs are due to the USA health care system's focus on pharmaceutical therapy and surgical procedures for the treatment of chronic diseases as opposed to preventive measures such as lifestyle modification counseling [7]. The multifactorial nature of hypertension suggests that environmental factors, lifestyle, and genetics may be important contributors to disease and associated mortality risks. Pathophysiological mechanisms behind hypertension including mitochondrial oxidative stress, activation of the sympathetic nervous system, and the impairment of renal pressure natriuresis have been discussed in the literature [8, 9]. Also, much work has been done on the effects of genetics, hemodynamics, and pharmacological therapy; however, lifestyle modification has not been rigorously evaluated in adults with hypertension [10].

Lifestyle modifications including changes in dietary patterns (salt intake, fat and/or calorie intake), increasing physical activity/exercise, and weight loss show utility in lowering blood pressure, and are generally recommended as the first step for treating hypertension or as an adjunct to medications for those already on drug therapy [10, 11]. Health care providers (HCPs) can play a fundamental role in hypertension control by identifying adults with lifestyle risk factors and utilizing health promotion strategies such as advising for lifestyle modifications to induce health behavior change. For example, previous research found that 62%-88% of the U.S. adults with hypertension made lifestyle modifications to reduce blood pressure after they received advice from HCPs [12, 13]. Despite these findings, and national public health recommendations for HCPs to advise on lifestyle modification, the prevalence of lifestyle modification advice from HCPs remains low [14].

Furthermore, health disparities with regards to hypertension burden and mortality persist disproportionately among underrepresented racial/ethnic groups, individuals with low income, uninsured, and low education level [5]. Indeed, African American adults are 2× more likely to be diagnosed with hypertension compared to white adults [15], adults with low income are 1.25× more likely to die from hypertension compared to those above the poverty level [16], and hypertension control is typically lower among the uninsured compared to those that are insured [17]. Sociodemographic characteristics such as age, race/ethnicity, sex, income, marital status, health care insurance status, and educational level have been found to influence lifestyle modification practice [14, 18, 19]. However, little is known about the current sociodemographic differences in the receipt of HCP lifestyle modification advice among the U.S. adults with hypertension. Two studies were done in 2009 and 2010 examining adults with hypertension and found that males, older adults, blacks, adults with a household income of <25,000, and those with insurance were more likely to report receiving advice for lifestyle modification from their HCPs [12, 13].

The current study adds to the literature as it utilizes a recent nationally representative national health and nutrition examination survey (NHANES) 2017-2018 data to examine the current prevalence of HCP lifestyle modification advice for the U.S. adults with hypertension, and the differences in the receipt of lifestyle modification advice among varying sociodemographic groups. Considering the health disparities in hypertension outcomes, the associated burden borne by minority groups in the U.S., and the influence HCPs have on promoting health behavior change, it is critical to understand whether differences in receipt of HCP lifestyle modification advice exist for the U.S. hypertensive adults from underrepresented groups. This may aid in implementing effective clinical and public health strategies to address the issue. Therefore, the purpose of this study is to:

- (a) examine the prevalence of HCP lifestyle modification advice among the U.S. adults diagnosed with hypertension (HTN) and
- (b) examine the differences in HCP lifestyle modification advice by sociodemographic characteristics.

MATERIALS AND METHODS

Data Collection

Data were obtained from the 2017-2018 NHANES, a cross-sectional, nationally representative survey of the civilian noninstitutionalized the U.S. population. NHANES employed a complex, stratified multistage cluster sample design to estimate the prevalence of health, nutrition, and potential risk factors among the U.S. population. Data on sociodemographic characteristics, lifestyle characteristics, body measurements, and medical conditions were obtained from conducting interviews and physical examinations during the cycle. Additional information about NHANES sampling methods and survey design can be found online [20].

Participants

A total of 9,254 participants completed the 2017-2018 NHANES. For our analysis, participants were excluded if they did not report being told they had HTN on two or more visits (n=408) or had missing information on HTN status (n=6,791), HCP lifestyle modification advice (n=6), and sociodemographic characteristics (n=525). Details of exclusion criteria are shown in the study flow chart (**Figure 1**). The final analytic sample included 1,524 adults with diagnosed HTN.

Primary Measures

Sociodemographic characteristics

Sociodemographic characteristics included age (18-39, 40-64, and 65-80), sex (female and male), race/ethnicity (Mexican American, other Hispanic, non-Hispanic White, non-Hispanic Black, and other race including multi-racial), country of birth (the USA and another country), education completed (less than 9th grade, 9th-11th grade, high school grad/GED, associate degree, and college grad or above), citizenship status (yes and no), marital status (married, not married), annual household income (<25,000, 25,000-<75,000, and 75,000 and over), and health insurance coverage (yes and no).

Health care professional advice

HCP lifestyle modification advice was defined from participants' responses (yes or no) to each of the following questions, "to lower your risk of a certain disease, during the past 12 months have you ever been told by a doctor or health professional to

- (a) control or lose weight,
- (b) increase your physical activity or exercise,
- (c) reduce salt in your diet, and
- (d) reduce the number of fat/calories in your diet."

Hypertension status

HTN status was defined from participants' responses (yes or no) to the question, "were you told on two or more different visits that you had hypertension, also called high blood pressure?" Participants who responded yes were included in the analysis as this paper focused on adults with a diagnosis of HTN.

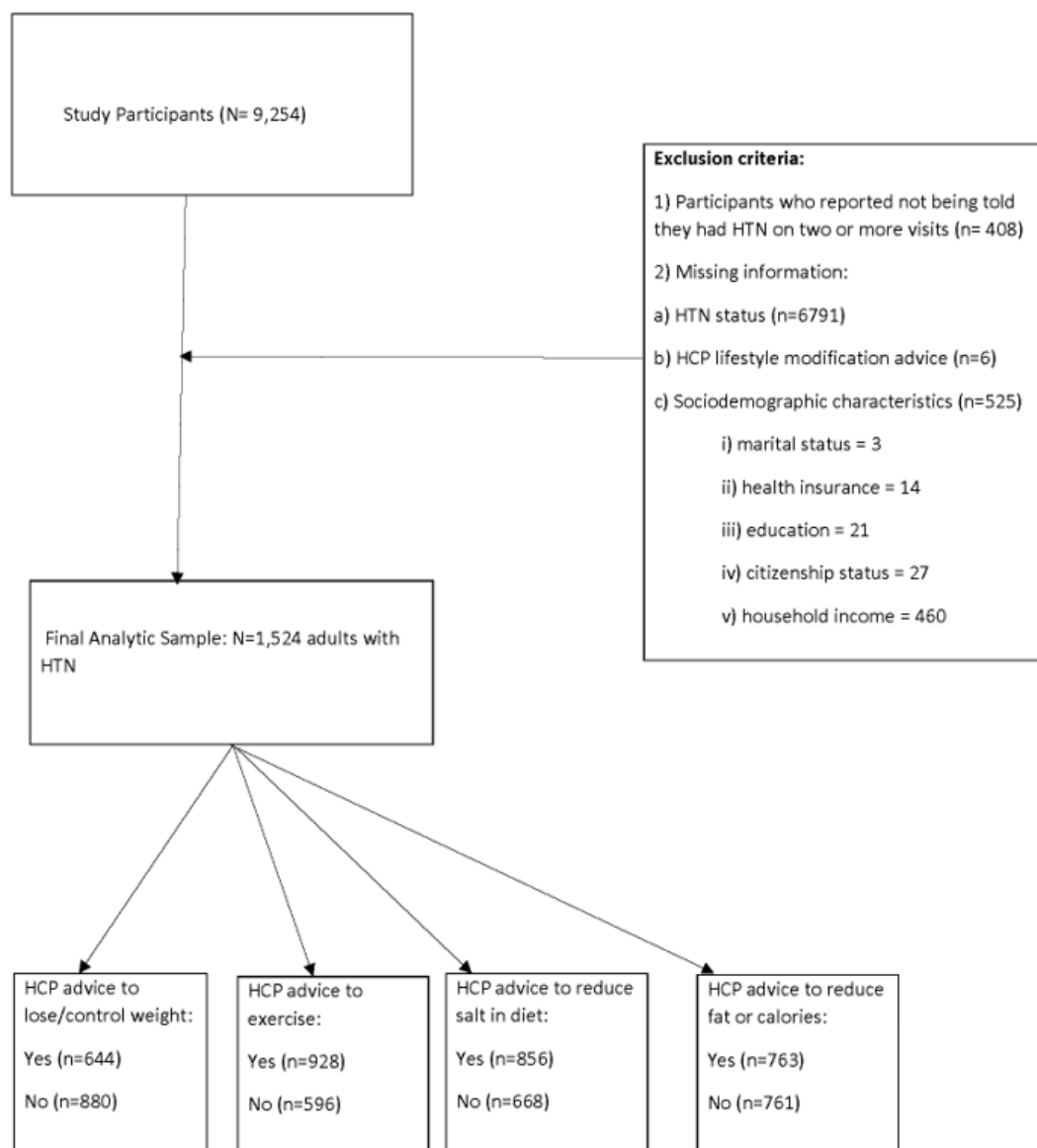


Figure 1. Study flow chart (2017-2018 national health and nutrition examination survey) (Source: Authors' own elaboration)

Statistical Analysis

Weighted percentages and confidence intervals of sociodemographic characteristics were examined. Sociodemographic characteristics by HCP lifestyle modification advice were evaluated using Chi-square tests of independence. Further pairwise tests were conducted to compare among sociodemographic groups by descriptive characteristics and HCP advice using chi-square tests of independence or Fisher's exact tests when appropriate. Multivariate adjusted logistic regression models for each outcome (HCP advice to control/lose weight, exercise, reduce salt in diet, and reduce fat/calories) were performed to examine associations between sociodemographic characteristics and HCP advice; the outcome referent group was no HCP advice. Adjusted odds ratios and 95% confidence intervals are reported. Results were considered statistically significant at $\alpha=0.05$. Data were analyzed using Stata 17.0. We accounted for the NHANES complex survey design and adjusted for the probability of non-response by using the svy command.

RESULTS

Descriptive Characteristics

Among the analytic sample of the U.S. adults with HTN, most were aged 40-64 (49.7%), male (50.2%), non-Hispanic White (66.6%), married (56.0%), had an associate degree (34.0%), had health care insurance coverage (91.4%), annual household income of 25,000-<75,000 (42.0%), were born in the U.S (85.9%), and are the U.S. citizens (95.7%) (**Table 1**).

Sociodemographic Differences

Sociodemographic differences by HCP advice are displayed in **Table 2**. Of the sample of adults with HTN, 42.3% reported receiving HCP advice to lose or control weight, 59% reported receiving HCP advice to exercise, 49.2% reported receiving HCP advice to reduce salt in diet, and 46.4% received advice to reduce calories/fat.

More adults who were aged 40-64 than 18-39 (58.7% vs. 8.8%, $p=0.001$), married than not married (61.3% vs. 38.7%, $p=0.038$), and NH White than Mexican American (61.7% vs.

Table 1. Sociodemographic characteristics of the U.S. adults diagnosed with hypertension (n=1,524)

Variables	Frequency	Percentage	Variables	Frequency	Percentage
Age			Education completed		
18-39	130	13.10	<9 th grade	120	3.50
40-64	701	49.70	9 th -11 th grade	185	8.40
65-80	693	37.20	High school/GED	383	28.50
Sex			Associate degree	514	34.00
Female	777	49.80	College grad or higher	322	25.60
Male	747	50.20	Race/ethnicity		
Marital status			Mexican American	125	4.50
Married	768	56.00	Other Hispanic	116	5.20
Not married	756	44.00	Non-Hispanic White	601	66.60
Health care insurance coverage			Non-Hispanic Black	436	13.30
Yes	1,392	91.40	Other races including multi-racial	246	10.40
No	132	8.60	Country of birth		
Annual household income			The USA	1,167	85.90
<25,000	444	19.30	Other country	357	14.10
25,000-<75,000	673	42.00	USA citizenship		
75,000 or bigger	407	38.70	Yes	1,419	95.70
			No	105	4.30

Note. Unweighted frequencies & weighted percentages

5.1%, $p=0.012$) reported receiving HCP advice to lose/control weight. Higher percentages of adults who were married reported receiving HCP advice to exercise than those who were not married (59.2% vs. 40.8%, $p=0.031$).

Of those adults who reported receiving HCP advice to reduce salt in diet, more were those who completed high school/GED than college graduates (33.6% vs. 20.6%, $p<0.001$), and non-Hispanic White than Black (59.2% vs. 17.9%, $p=0.001$). More adults who were aged 40-64 than 18-39 (56.5%

vs. 10.3%, $p=0.006$), married than not married (60.2% vs. 39.8%, $p=0.045$), and NH White than Mexican American (59.5% vs. 5.9%, $p<0.001$) reported receiving HCP advice to reduce calories/fat (**Table 2**).

Logistic Regression

After adjustment for sociodemographic characteristics among the sample of adults with HTN, adults aged 40-64 had twice higher odds of receiving HCP advice to lose or control

Table 2. HCP lifestyle modification advice by sociodemographic characteristics in adults with hypertension (n=1,524)

Variables (%)	HCP advice to lose or control weight			HCP advice to exercise			HCP advice to reduce salt in diet			HCP advice to reduce calories		
	N	Y	P	N	Y	P	N	Y	P	N	Y	P
	n=880	n=644		n=596	n=928		n=668	n=856		n=761	n=763	
	57.70%	42.30%		41.00%	59.00%		50.80%	49.20%		53.60%	46.40%	
Age			0.001			0.092			0.488			0.006
18-39	86 (16.3)	44 (8.8)		65 (16.5)	67 (10.8)		65 (14.1)	65 (12.1)		82 (15.6)	48 (10.3)	
40-64	359 (43.2)	342 (58.7)		242 (44.3)	459 (53.4)		294 (47.5)	407 (52.0)		316 (43.9)	385 (56.5)	
65-80	435 (40.5)	258 (32.5)		291 (39.1)	402 (35.8)		309 (38.4)	384 (35.9)		363 (40.5)	330 (33.2)	
Sex			0.748			0.223			0.775			0.900
Female	439 (49.7)	308 (50.9)		309 (52.1)	438 (48.9)		326 (50.9)	421 (49.6)		367 (50.0)	380 (50.4)	
Male	441 (50.3)	336 (49.1)		287 (47.9)	490 (51.1)		342 (49.1)	435 (50.4)		394 (50.0)	383 (49.6)	
Marital status			0.038			0.031			0.506			0.045
Married	426 (52.1)	342 (61.3)		282 (51.3)	486 (59.2)		348 (56.9)	420 (55.0)		365 (52.3)	403 (60.2)	
Not married	454 (47.9)	302 (38.7)		314 (48.7)	442 (40.8)		320 (43.1)	436 (45.0)		396 (47.7)	360 (39.8)	
Education completed			0.868			0.798			<0.001			0.402
<9 th grade (straight)	78 (4.0)	42 (2.9)		48 (3.8)	72 (3.3)		38 (2.6)	82 (4.5)		46 (2.9)	74 (4.3)	
9 th -11 th grade	108 (8.7)	77 (8.1)		67 (8.2)	118 (8.5)		65 (6.5)	120 (10.3)		77 (8.0)	108 (8.9)	
High school/GED	229 (28.3)	154 (28.9)		156 (30.1)	227 (27.5)		144 (23.6)	239 (33.6)		195 (26.8)	188 (30.5)	
Associate degree	276 (34.0)	238 (33.8)		186 (33.6)	328 (34.2)		241 (36.8)	273 (31.0)		255 (34.8)	259 (33.0)	
College grad or higher	189 (25.0)	133 (26.3)		139 (24.3)	183 (26.5)		180 (30.5)	142 (20.6)		188 (27.6)	134 (23.3)	
Race/ethnicity			0.012			0.110			0.001			<0.001
Mexican American	63 (4.1)	62 (5.1)		34 (3.5)	91 (5.2)		38 (3.3)	87 (5.8)		40 (3.3)	85 (5.9)	
Other Hispanic	56 (3.8)	60 (7.2)		43 (4.9)	73 (5.4)		43 (4.2)	73 (6.3)		39 (3.4)	77 (7.3)	
Non-Hispanic White	378 (70.3)	223 (61.7)		273 (71.2)	328 (63.4)		323 (73.9)	278 (59.2)		352 (72.8)	249 (59.5)	
Non-Hispanic Black	229 (11.8)	207 (15.2)		146 (10.5)	290 (15.2)		148 (8.8)	288 (17.9)		200 (11.6)	236 (15.2)	
Others including multi-racial	154 (10.1)	92 (10.8)		100 (9.8)	146 (10.8)		116 (10.0)	130 (10.8)		130 (9.0)	116 (12.0)	
Health care insurance coverage			0.146			0.062			0.523			0.068
Yes	795 (90.0)	597 (93.2)		528 (88.7)	864 (93.2)		602 (90.8)	790 (92.0)		684 (89.6)	708 (93.3)	
No	85 (10.0)	47 (6.8)		68 (11.3)	64 (6.8)		66 (9.2)	66 (8.0)		77 (10.4)	55 (6.7)	
Annual household income			0.279			0.767			0.104			0.646
<25,000	260 (20.3)	184 (17.8)		170 (20.3)	274 (18.6)		166 (16.4)	278 (22.2)		206 (18.1)	238 (20.6)	
25,000-<75,000	399 (43.3)	274 (40.3)		272 (42.0)	401 (42.0)		298 (42.2)	375 (41.8)		335 (42.1)	338 (41.9)	
75,000 or bigger	221 (36.4)	186 (41.9)		154 (37.7)	253 (39.4)		204 (41.4)	203 (36.0)		220 (39.8)	187 (37.5)	

Table 2 (Continued). HCP lifestyle modification advice by sociodemographic characteristics in adults with hypertension (n=1,524)

Variables (%)	HCP advice to lose or control weight			HCP advice to exercise			HCP advice to reduce salt in diet			HCP advice to reduce calories		
	N	Y	P	N	Y	P	N	Y	P	N	Y	P
	n=880 57.70%	n=644 42.30%		n=596 41.00%	n=928 59.00%		n=668 50.80%	n=856 49.20%		n=761 53.60%	n=763 46.40%	
Country of birth			0.212			0.298			0.332			0.102
The USA	658 (84.9)	509 (87.3)		468 (87.2)	699 (85.0)		518 (87.3)	649 (84.5)		601 (88.0)	566 (83.5)	
Other country	222 (15.1)	135 (12.7)		128 (12.8)	229 (15.0)		150 (12.7)	207 (15.5)		160 (12.0)	197 (16.5)	
USA citizenship			0.312			0.957			0.600			0.952
Yes	816 (95.1)	603 (96.6)		563 (95.7)	856 (95.8)		632 (96.2)	787 (95.3)		716 (95.8)	703 (95.7)	
No	64 (4.9)	41 (3.4)		33 (4.3)	72 (4.2)		36 (3.8)	69 (4.7)		45 (4.2)	60 (4.3)	

Note. Unweighted frequencies; weighted percentages; weighted p-values; HCP: Health care provider; Y: yes; N: No; & P: p-value

Table 3. Multivariate logistic regression (n=1,524)

Regression model variables	HCP advice to lose/control weight			HCP advice to exercise			HCP advice to reduce salt in diet			HCP advice to reduce fat/calories		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Ages: 40-64 vs. 18-39	2.26	1.25-4.10	0.010	1.60	0.97-2.66	0.065	1.13	0.63-2.02	0.663	1.64	0.91-2.97	0.094
Ages: 65-80 vs. 18-39	1.42	0.84-2.40	0.170	1.20	0.68-2.10	0.508	0.95	0.59-1.54	0.831	1.02	0.60-1.75	0.930
Female vs. male	1.03	0.77-1.39	0.818	1.16	0.89-1.52	0.245	0.95	0.64-1.42	0.801	0.98	0.75-1.29	0.882
Not married vs. married	0.72	0.51-1.02	0.063	0.72	0.54-0.96	0.028	0.95	0.71-1.28	0.726	0.68	0.47-0.99	0.045
<9 th grade vs. college grad	0.71	0.37-1.36	0.286	0.72	0.34-1.51	0.361	2.16	0.80-5.82	0.119	1.46	0.74-2.88	0.256
9 th -11 th grade vs. college grad	0.94	0.48-1.81	0.835	0.96	0.64-1.44	0.829	2.22	1.24-3.97	0.010	1.30	0.57-2.98	0.511
High school/GED vs. college grad	0.99	0.53-1.89	0.995	0.84	0.55-1.27	0.376	2.15	1.44-3.22	0.001	1.32	0.78-2.26	0.279
Associate vs. college grad	0.93	0.54-1.59	0.775	0.91	0.64-1.29	0.570	1.23	0.82-1.84	0.293	1.07	0.69-1.66	0.732
Mexican American vs. NH White	2.40	1.21-4.76	0.015	1.91	1.21-3.02	0.008	2.02	1.07-3.81	0.032	2.36	1.36-4.11	0.005
Other Hispanic vs. NH White	3.20	1.75-5.85	0.001	1.21	0.61-2.39	0.558	1.69	0.74-3.86	0.194	2.37	1.27-4.44	0.010
NH Black vs. NH White	1.60	1.19-2.12	0.004	1.68	1.12-2.51	0.015	2.57	1.73-3.81	<0.001	1.64	1.17-2.32	0.007
Other races vs. NH White	1.57	0.87-2.85	0.125	1.12	0.55-2.30	0.739	1.51	0.68-2.51	0.388	1.45	0.90-2.35	0.120
Insurance: No vs. yes	0.72	0.38-1.34	0.273	0.59	0.32-1.09	0.086	0.64	0.39-1.05	0.075	0.53	0.29-0.96	0.039
Citizen: No vs. yes	0.89	0.39-2.05	0.769	0.80	0.28-2.28	0.665	0.94	0.37-2.38	0.885	0.65	0.31-1.34	0.220
County of birth: Other country vs. US	0.51	0.27-0.95	0.037	1.09	0.71-1.67	0.675	0.99	0.61-1.62	0.992	1.06	0.72-1.54	0.757
Income: 25,000-<75,000 vs. <25,000	1.03	0.63-1.68	0.900	1.02	0.69-1.51	0.910	0.85	0.52-1.40	0.496	0.86	0.49-1.52	0.587
Income: 75,000 or > vs. <25,000	1.14	0.70-1.84	0.580	0.94	0.62-1.41	0.732	0.86	0.48-1.53	0.577	0.74	0.47-1.16	0.177

Note. A vs. B (B is reference); OR: Adjusted odds ratio; CI: Confidence intervals; Outcome referent group: No advice; HCP: Health care provider; NH: Non-Hispanic; & P: p-value

weight compared to those aged 18-39 (95% CI: 1.25-4.10) (Table 3).

Adults who were Black (compared to White), Mexican American (compared to White), and other Hispanic (compared to White) had approximately twice, thrice, and four times higher odds of receiving HCP advice to lose weight respectively (95% CI: 1.19-2.12, 1.21-4.76, 1.75-5.85). Adults born in another country (compared to the U.S. born) had lower odds of receiving HCP advice to lose weight (OR: 0.51, 95% CI: 0.27-0.95), and adults who were not married (vs married) had lower odds of receiving HCP advice to exercise (OR: 0.72, 95% CI: 0.27-0.95).

Black adults (compared to White), and Mexican American adults (compared to White) had approximately twice higher odds of receiving HCP advice to exercise (95% CI: 1.12-2.51, 1.21-3.02). Adults whose highest level of education completed was 9th-11th grade (vs. college graduates), and high school/GED (vs college graduates) had approximately twice higher odds of receiving HCP advice to reduce salt in diet (95% CI: 1.24-3.97, 1.44-3.22). Black adults (compared to White), and Mexican American adults (compared to White) had approximately thrice and twice higher odds of receiving HCP advice to reduce salt in diet respectively (95% CI: 1.73-3.81, 1.07-3.81).

Compared to married adults, adults who were not married had lower odds of receiving HCP advice to reduce calories/fat (OR: 0.68, 95% CI: 0.47-0.99). Adults who had no health

insurance coverage (vs those with health insurance coverage) had lower odds of receiving HCP advice to reduce calories/fat (OR: 0.53, 95% CI: 0.29-0.96).

DISCUSSION

We examined the prevalence of HCP lifestyle modification advice and the differences in the receipt of advice among varying sociodemographic groups of the U.S. adults with hypertension. HCP advice to exercise was the most frequent lifestyle modification prescribed, however, advice to lose weight, reduce salt in diet, and reduce fat/calories was generally not prescribed for adults with hypertension. These findings suggest that HCPs are missing a chance to advice on lifestyle modifications, and thus not appropriately utilizing lifestyle modifications as a treatment or ameliorative measure for hypertension. This is a cause for concern as lifestyle modifications including weight reduction, sodium reduction, and consuming a diet low in fat are well established for the treatment of hypertension and are generally recommended as a simple cost-effective approach for improving public health [10, 21]. The importance of lifestyle modification in adults with hypertension is evident in the literature. For example, a meta-analysis of 25 randomized controlled trials including 4,874 adults found that lifestyle modifications including weight reduction, reduction of caloric intake, and increased physical

activity reduced blood pressure significantly [22]. HCPs are ideally positioned to advise for lifestyle modifications as a treatment for hypertension but may be relying heavily on pharmaceutical therapy instead due to prior education. Thus, HCP training in clinical education and residency programs that focuses on the prescription of lifestyle modification for the prevention and treatment of hypertension is warranted, as it may aid in increasing HCP advice and reduce escalating health care costs and the public health burden associated with hypertension. Further, public health campaign messages about hypertension control should target HCPs focusing on the need for increasing lifestyle modification advice as an efficient, cost-effective strategy for better health outcomes among the USA adults.

Consistent with previous research [12, 13], our study found that adults diagnosed with hypertension, who were Non-Hispanic Black or older were more likely to receive lifestyle modification advice compared to those who were Non-Hispanic White or younger. Specifically, we found that older adults diagnosed with HTN are more likely to receive HCP advice to lose weight, and Non-Hispanic Blacks are more likely to receive advice to lose weight, exercise, reduce sodium, and reduce calories compared to their counterparts. Notably, we observed similar significant findings when comparing Mexican Americans and Non-Hispanic White adults, but this differs from previous research findings done on adults with HTN [12, 13]. The current study findings are promising because older adults and adults who are members of racial/ethnic minority groups are disproportionately vulnerable to hypertension burden and especially sensitive to the efficacy of lifestyle modifications on blood pressure control [23]. Indeed, the differences found by race/ethnicity and age may reflect HCPs' perceptions and knowledge of hypertension risk among these groups. However, more culturally sensitive public health efforts promoting lifestyle modifications in older adults and racial/ethnic populations are needed [23]. In addition, due to the increasing rates of hypertension in the U.S. young adults [24], the development and implementation of effective public health and health care policies targeting young adults are also critical going forward.

Furthermore, in the current study, adults who have health insurance were more likely than the uninsured to receive HCP advice to reduce fat/calories, and those with a high school/GED are more likely to receive advice to reduce salt in diet than college graduates. In contrast, previous studies did not find differences in receipt of HCP lifestyle modification advice by health insurance status or educational level [12, 13]. However, some inconsistencies exist as one study done between 2011 and 2016 on 11,467 the U.S. adults of the general population found receipt of HCP lifestyle modification advice to be more likely for the insured, but no differences by educational level [14]. The burden of hypertension is typically highest among the uninsured compared to the insured in the USA [17]; thus, our finding is a significant cause for concern. Because they are not covered, the uninsured may be unable to afford adequate medical care and thus have fewer contacts with an HCP. Thus, health care policies that make health insurance coverage more affordable and accessible to reach the uninsured are important to promote equity in hypertension control. Further, more research is needed in the future to examine differences in

receipt of HCP lifestyle modification advice by health insurance status among adults with hypertension.

Notably, married adults were more likely than those who were not married to receive HCP advice to exercise and reduce fat/calories. Significant disparities in hypertension and overall health outcomes for adults who are not married have been discussed extensively in research [25-27]. Thus, the finding of this study adds to the existing evidence of the need for public health efforts to promote and advocate increasing HCP advice for lifestyle modifications among unmarried populations. Although earlier studies have found differences in receipt of HCP lifestyle modification advice by sex and household income [12-14], our study found no evidence that corroborates those findings. Generally, HCPs perceive lifestyle modification to be not as effective or appealing compared to pharmaceuticals and less of an instant relief [14, 28]. Moreover, barriers to providing advice including knowledge, lack of confidence in counseling skills, unpleasant nature, non-compliance, and inadequate time have been reported by HCPs [14, 29]. These perceptions and beliefs may account for the low rates of lifestyle modification advice provided by HCP to adults with HTN. Clinical and public health strategies aimed at improving HCP perceptions and increasing comfort in engaging and advising for lifestyle modifications would increase the likelihood of behavior change.

A strength of this study is our use of a recent nationally representative dataset. However, the results of this study should be interpreted considering the following limitations. First, the NHANES data is cross-sectional and thus causality cannot be determined. Second, we relied on self-reported responses on HCP advice and HTN status, which may be subject to recall and response bias. Third, the study included only HTN patients and not HCPs; a study involving the latter may reveal insights not provided by a patient sample. Fourth, this study did not examine other lifestyle modifications for hypertension control such as increasing dietary intake of potassium, and reduction of caffeine, nicotine, and alcohol consumption. Despite these limitations, this study provides evidence of differences in receipt of HCP lifestyle modification advice among varying sociodemographic groups of the USA adults with HTN.

CONCLUSION

This study found that majority of adults diagnosed with HTN in the USA do not receive HCP advice for lifestyle modifications. Further, adults who are members of racial/ethnic minority groups, older, insured, married, and not college graduates were more likely to have received HCP advice for lifestyle modifications to treat hypertension. Considering these findings, the development and implementation of culturally sensitive clinical education and training programs for HCPs focusing on the prescription of lifestyle modification as a cost-effective treatment of hypertension are needed. Further, public health efforts should focus on developing new equitable policies ensuring HCP lifestyle modification advice is accessible and affordable for all adults diagnosed with HTN.

Author contributions: All co-authors have involved in all stages of this study while preparing the final version. They all agree with the results and conclusions.

Funding: No funding source is reported for this study.

Acknowledgments: The authors would like to thank Dave Roelfs for assistance with the analysis.

Declaration of interest: No conflict of interest is declared by the authors.

Ethical statement: Authors stated that ethical approval and informed consent were not required for this study as the national health and nutrition examination survey (NHANES) data is available to the public. However, the NHANES study data was approved by the US Centers for Disease Control and Prevention (CDC) Institutional Review Board. The authors would like to thank the CDC for making this data available to the public. However, the content, analysis, and interpretation of this data is solely the responsibility of the authors, and the CDC bears no responsibility for the content, analysis, or interpretation of the data.

Data sharing statement: Data supporting the findings and conclusions are available upon request from corresponding author.

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