

---

# **Risk/Protective Factors of Non-adherence to Prescribed Anti-Hypertensive Medication among Adult Hypertension Patients in the United States, BRFSS, 2017**

*Hairui Yu and Jiunn-Jye Sheu*

---

## **Abstract**

About three in ten Americans with hypertension do not take medication to control their blood pressure. The risk and protective factors of non-adherence to prescribed anti-hypertensive medication have not been well investigated. Participants who were aware of their hypertension, advised by healthcare professional to take anti-hypertensive medication but were not adhering to treatment recommendations ( $n=8,416$ ) were retrieved from 2017 Behavioral Risk Factor Surveillance System (BRFSS) survey. A series of 30 related variables were selected and analyzed using bivariate logistic and stepwise multiple logistic regression analysis. The results showed that participants who had a primary health care provider ( $OR=6.79$ ), had a routine checkup ( $OR=5.48$ ), had a flu shot or spray ( $OR=2.85$ ), were unemployed ( $OR=2.35$ ), not binge drinking ( $OR=2.09$ ), annual household income \$10,000 or higher ( $OR=1.77$ ), female ( $OR=1.69$ ), without depression ( $OR=1.41$ ), and did not do exercise in past 30 days ( $OR=1.40$ ) significantly predicted adherence to anti-hypertensive medication. The younger a participant was, the lower the likelihood of adherence. Patient education and healthcare services that aims to educate/serve younger males who do not have a primary healthcare provider, a routine checkup, and a flu shot/spray are suggested. Future studies should focus on prevention and management of high-risk populations.

## **Introduction**

Controlled hypertension refers to an existing state of hypertension under control by therapy, and uncontrolled hypertension is defined as untreated hypertension or hypertension not responding to current therapeutic regimen (Centers for Disease Control and Prevention, 2017a). High blood pressure can increase the

risk for severe health conditions, including heart attack, stroke, heart failure, and kidney disease (American Heart Association, 2018; Centers for Disease Control and Prevention, 2018). Almost 1,000 deaths each day in the U.S. are attributed to high blood pressure (Centers for Disease Control and Prevention, 2018). Americans accessed their healthcare providers more than 55 million times to treat high blood pressure in 2009 (Go et al., 2013) and one in five hypertensive adult Americans do not know their blood pressures are high (Farley, Dalal, Mostashari, & Frieden, 2010). Taking anti-hypertensive medication prescribed by doctors can control elevated blood pressure, however, approximately 30% of Americans with hypertension do not take medication to control their blood pressure (Centers for Disease Control and Prevention, 2018). Due to the increased prevalence of non-adherence to anti-hypertensive medication and the consequential severe health conditions, it is important to investigate the

---

Hairui Yu, MA, CHES, Graduate Student  
University of Alabama at Birmingham  
Birmingham, AL  
Email: hayu@uab.edu

\*Jiunn-Jye Sheu, PhD, MSPH, MCCHES,  
Professor  
College of Health and Human Services,  
University of Toledo,  
2801 W. Bancroft St., MS#119  
Toledo, OH 43606-3390  
Email: jiunnjye.sheu@utoledo.edu

\*Corresponding Author

contributing risk and protective factors to the non-adherence behavior.

Adherence or compliance is commonly defined as the extent to which the patient's behavior follow the medical advice, while in reality non-adherence is common for many medical treatments (Sansom-Fisher & Clover, 1995). Non-adherence to anti-hypertensive medication can result in fluctuation of blood pressure, which leads to increased mortality (Ettehad et al., 2016; Firdaus, Sivaram, & Reynolds, 2008). However, a higher proportion (above 80%) of uncontrolled hypertensive patients were non-adherent to anti-hypertensive medications (Abegaz, Shehab, Gebreyohannes, Bhagavathula, & Elnour, 2017). Many social and behavioral factors contribute to non-adherence of anti-hypertensive medication. In this study, non-adherence was defined as when a patient was told by a healthcare provider to have high blood pressure, was advised to take anti-hypertensive medication, but was not taking the medication at the time of the survey for this study. This study was aimed to identify sociodemographic, healthcare, and health behavioral risk/protective factors that were associated with non-adherence to prescribed anti-hypertensive medications among patients who were aware of their hypertensive status.

## Methods

### Participants

Data from 2017 Behavioral Risk Factor Surveillance System (BRFSS) survey were extracted for analysis. BRFSS is a nationwide system of telephone surveys that focus on behavioral risk factors. It has been designed and administered by the Centers for Disease Control and Prevention (CDC) to investigate the health-related risk behaviors, chronic health conditions, and use of preventive services among residing population older than 18 years in the U.S. The factors assessed by the 2017 BRFSS include health status, quality of life, chronic diseases, drinking, cancer screening, HIV or AIDS knowledge among others. The questionnaires consist of 18-minute core portion and the 5- to

10-minute interview for modules and state-added questions. In the 2017 BRFSS, 53 states/territories used Computer-Assisted Telephone Interview (CATI) systems. All responses were self-reported through either landline or mobile telephone. When the landline telephone survey was conducted, responses were collected from a randomly selected adult in a household. When the mobile phone survey was administered, interviewers collect responses from adults who lived in a private residence, including college dormitories, with a working mobile telephone. The overall response rate of BRFSS 2017 for all states, territories, and Washington, DC was 45.1% with a range from 30.6% to 64.1% (Centers for Disease Control and Prevention, 2017b).

Respondents were included in this study if they answered yes to the questions "Have you ever been told by a doctor, nurse or other health professional that you have high blood pressure?", "Has a doctor or other health professional ever advised you to take medication to help lower or control your high blood pressure?", and either yes or no to the question "Are you currently taking medicine for your high blood pressure?". Through the three questions, non-adherence respondents were defined as the ones who were told to have high blood pressure, were advised to take anti-hypertensive medication, but were not currently taking medication at the time of the survey. Adherence respondents were defined as being told they had high blood pressure, were advised to take anti-hypertensive medication, and were taking medication at the time of the survey.

### Measurement Data

In this study, variables related to demographics, health behaviors, health conditions, and healthcare services were accessed. The demographic variables included:

- Race/ethnicity (module section number 1, question number 12)
- Age in six groups (module section number 8, question number 14)
- Sex of respondent (core section number 8, question number: 1)

- Marital status (core section number 8, question number 6)
- Employment status (core section number 8, question number 15)
- Annual household income from all sources (core section number 8, question number 17)
- Body mass index (BMI) (module section number 8, question number 18)

The healthcare service variables included:

- “Do you have one person you think of as your personal doctor or health care provider?” (core section number 3, question number 2)
- “About how long has it been since you last visited a doctor for a routine checkup?” (core section number 3, question number 4)
- “Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Service?” (core section number 3, question number 1)
- “During the past 12 months, have you had either a flu shot or a flu vaccine that was sprayed in your nose?” (core section number 15, question number 1)
- “Not including over-the-counter (OTC) medications, was there a time in the past 12 months when you did not take your medication as prescribed because of cost?” (core section number 10, question number 6)

The health condition variables included:

- “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” (core section number 2, question number 2)
- “During the past 12 months, have you experienced confusion or memory loss that is happening more often or is getting worse?” (module section number 22, question number 1)

The health behavior variables included:

- “Considering all types of alcoholic

beverages, how many times during the past 30 days did you have 5 or more drinks for men or 4 or more drinks for women on an occasion?” (core section number 11, question number 3)

- “During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?” (core section number 13, question number 1)

Responses to each question were classified into two categories (yes/no).

## Data Analysis

Univariate analysis was conducted using frequencies and cross tables for all variables. Bivariate association was examined for the outcome variable (adherence to anti-hypertensive medication) using Chi-square test and odds ratios by binary logistic regression. Stepwise binary multiple logistic regression analysis was performed to further examine the associations between the selected explanatory variables and the outcome variable. Regression coefficients, standard errors, odds ratios and 95% confidence intervals (CIs), Cox & Snell R Square and Nagelkerke R square were estimated. IBM SPSS Statistics 23 was utilized for all statistical analyses.

## Results

In the 2017 BRFSS, 8,416 participants (1.9% of the 2017 BRFSS sample) reported they knew they had high blood pressure and were advised by healthcare professionals to take anti-hypertensive medications. Among this sample, 7,723 (91.8%) reported they currently took medication while 693 (8.2%) reported that they did not take medication to control hypertension currently and were therefore classified as non-adherents. Table 1 displays the distribution of the selected variables among adherents and non-adherents as well as the bivariate associations between the selected explanatory variables and adherence.

**Table 1**

**Bivariate associations of selected explanatory variables and current HBP medication adherence among patients who were aware of their hypertension and were advised by doctors**

Variable	Not take HBP medication currently, n (%)	Take HBP medication currently, n (%)	Odds Ratio	95% CI	Chi-square, df
Have personal doctor or health care provider?					
Yes	310 (4.0)	7,401 (96.0)	6.79	5.49 - 8.40	399.96
No	153 (22.1)	538 (77.9)			1
Routine checkup					
Not within one year	209 (30.5)	476 (69.5)	5.48	4.56 - 6.58	396.62
Within past one year	569 (7.4)	7,095 (92.6)			1
Healthcare coverage					
Yes	200 (2.6)	7,501 (97.4)	4.43	3.35 - 5.86	127.89
No	73 (10.6)	618 (89.4)			1
Flu shot/spray ever					
Yes	3,062 (39.8)	4,640 (60.2)	2.85	2.42 - 3.35	169.58
No	451 (65.3)	240 (34.7)			1
Not see doctor because of cost					
Yes	118 (17.1)	573 (82.9)	2.43	1.96 - 3.05	69.55
No	602 (7.8)	7,109 (92.2)			1
Employment Status					
Employed	331 (47.9)	360 (52.1)	2.35	2.01 - 2.75	118.48
Not employed	2,164 (28.1)	5,527 (71.9)			1
Binge Drinking					
Yes	116 (35.5)	211 (64.5)	2.09	1.64 - 2.66	36.44
No	629 (20.8)	2,388 (79.2)			1
Annual Household Income					
< \$10,000	56 (9.7)	521 (90.3)	1.77	1.32 - 2.38	14,79
\$10,000+	363 (5.7)	5,985 (94.3)			1
Respondents Sex					
Male	364 (52.5)	329 (47.5)	1.69	1.45 - 1.98	44.71
Female	3,051 (39.5)	4,672 (60.5)			1
Depression					
Yes	205 (29.7)	485 (70.3)	1.41	1.19 - 1.67	15.43
No	1,776 (23.1)	5,919 (76.9)			1
Exercise in past 30 days					
Yes	476 (68.8)	216 (31.2)	1.40	1.19 - 1.66	15.74
No	4,713 (61.1)	2,996 (38.9)			1

*Table continues on next page*

**Table 1 continued**

<b>Variable</b>	<b>Not take HBP medication currently, n (%)</b>	<b>Take HBP medication currently, n (%)</b>	<b>Odds Ratio</b>	<b>95% CI</b>	<b>Chi-square, df</b>
Difficulty concentrating or remembering					
Yes	124 (18.0)	563 (82.0)	1.31	1.07 - 1.61	6.83
No	1,104 (14.4)	6,580 (85.6)			1
Marital Status					
Unmarried	413 (59.9)	276 (40.1)	1.23	1.05 - 1.44	6.59
Married	4,211 (54.9)	3,464 (45.1)			1
BMI					
Under + normal weight	160 (24.4)	495 (75.6)	1.22	1.01 - 1.47	4.35
Overweight + obese	1,518 (20.9)	5,729 (79.1)			1
Race					
White	513 (8.1)	5,853 (91.9)	ref		11.97
Black	140 (8.2)	1,559 (91.8)	0.98	0.80 - 1.19	3
Hispanic	15 (18.5)	66 (81.5)	0.39	0.22 - 0.68	
Other	25 (9.3)	245 (90.7)	0.86	0.56 - 1.31	
Age					
65+	213 (4.5)	4,556 (95.5)	ref		548.16
55 - 64	185 (8.8)	1,926 (91.2)	0.49	0.40 - 0.60	5
45 - 54	131 (13.1)	871 (86.9)	0.31	0.25 - 0.40	
35 - 44	93 (24.9)	280 (75.1)	0.14	0.11 - 0.19	
25 - 34	49 (39.5)	75 (60.5)	0.07	0.05 - 0.11	
18 - 24	22 (59.5)	15 (40.5)	0.03	0.02 - 0.06	

The proportions of non-adherence differed by age, sex, and race/ethnicity. Nearly 60% of participants aged 18-24, 40% of participants aged 25-34, 25% of participants aged 35-44, 13% of participants aged 45-54, 9% of participants aged 55-64, and 5% of participants aged 65 or older reported non-adherence. A negative dose-response relationship between age and proportion of non-adherence existed as subjects aged. More than half of male participants reported non-adherence while about 40% of female reported non-adherence. When examining non-adherence by race/ethnicity, approximately one fifth of Hispanics reported non-adherence while 8.1% of Caucasians, 8.2% of African Americans, and 9.3% of other races reported non-adherence.

When examining the impact of health care access, bivariate analyses showed that respondents who had a primary health care provider were about 7 times more likely to adhere to anti-hypertensive medication ( $OR=6.79$ ;  $95\% CI=5.49-8.40$ ) than subjects who did not have a primary health care provider. Respondents who had routine checkups were about 5.5 times more likely to adhere to anti-hypertensive medication ( $OR=5.48$ ;  $95\% CI=4.56-6.58$ ) than the ones who did not have routine examinations. Respondents who had healthcare access were about 4.5 times more likely to adhere to anti-hypertensive medication ( $OR=4.43$ ;  $95\% CI=3.35-5.86$ ) than subjects who did not have primary healthcare access. Respondents who ever had a flu shot or

spray were about 3 times more likely to adhere to anti-hypertensive medication ( $OR=2.85$ ; 95% CI=2.42-3.35) than subjects who did not. Respondents who saw a doctor without concerns about cost were approximately twice as likely to adhere to anti-hypertensive medication ( $OR=2.43$ ; 95% CI=1.96-3.05) than subjects who had concerns about the cost of healthcare. Unemployed respondents were about twice as likely to adhere to anti-hypertensive medication ( $OR=2.35$ ; 95% CI=2.01-2.75) than employed subjects. Respondents who did not report binge drinking were approximately twice as likely to adhere to anti-hypertensive medication ( $OR=2.09$ ; 95% CI=1.64-2.66) than subjects who reported binge drinking.

Respondents whose annual household income was \$10,000 or higher were about 2 times more likely to adhere to anti-hypertensive medication ( $OR=1.77$ ; 95% CI=1.32-2.38) than those whose income was lower. Female respondents were about 2 times more likely to adhere to anti-hypertensive medication ( $OR=1.69$ ; 95% CI=1.45-1.98) than males. Respondents without depression were approximately 1.5 times more likely to adhere to anti-hypertensive medication ( $OR=1.41$ ; 95% CI=1.19-1.67) than subjects diagnosed with depression. The respondents who had not exercised in past 30 days were about 1.4 time more likely to adhere to anti-hypertensive medication ( $OR=1.40$ ; 95% CI=1.19-1.66) than those who did exercise. Respondents who had difficulty concentrating or remembering more often or getting worse (module section 22, question 1) were about 1.3 times more likely to adhere to anti-hypertensive medication ( $OR=1.31$ ; 95% CI=1.07-1.61) than who did not have these issues. Married respondents were about 1.2 times more likely to adhere to anti-hypertensive medication ( $OR=1.23$ ; 95% CI=1.05-1.44) than the unmarried subjects. Respondents who were overweight or obese were about 1.2 times more likely to adhere to anti-hypertensive medication ( $OR=1.22$ ; 95% CI=1.01-1.47) than the ones who were underweight or at normal weight.

After the stepwise procedures, the final

binary logistic regression model showed five significant predictors (Table 2). After adjustment of other variables, respondents who had routine checkups were about 4 times ( $OR=4.12$ ; 95% CI=2.97-5.72) more likely to adhere to anti-hypertensive medications than the ones who did not have routine checkups. In addition, the respondents who had a primary health care provider were about 2.5 times ( $OR=2.49$ ; 95% CI=1.62-3.84) more likely to adhere to anti-hypertensive medications than their counterparts without a primary care provider. Females were about twice ( $OR=1.93$ ; 95% CI=1.43-2.60) more likely than males to adhere to anti-hypertensive medications. Moreover, the respondents who had a flu shot or spray were about twice ( $OR=1.80$ ; 95% CI=1.34-2.42) more likely to adhere to anti-hypertensive medications than subjects who had not received a flu shot or spray. When aged 65 or older was set as the reference group, a dose response relationship existed by age descent, i.e. the younger a respondent was, the lower an adherence likelihood incurred. The odds ratios ranged from aged 18-24 ( $OR=0.57$ ; 95% CI=0.39-0.84), aged 25-34 ( $OR=0.39$ ; 95% CI=0.26-0.58), aged 35-44 ( $OR=0.17$ ; 95% CI=0.11-0.27), aged 45-54 ( $OR=0.11$ ; 95% CI=0.06-0.21), to aged 55-64 ( $OR=0.03$ ; 95% CI=0.01-0.09).

## Discussion

Results indicated the non-adherents to anti-hypertensive medications displayed some common socio-demographic characteristics. The present study showed that younger adults, Hispanics, males, unmarried, employed, and those with lower annual household income were more likely to become non-adherents when compared with their counterparts.

## Socio-Demographic Variables

In this study, younger population groups were more likely to be non-adherent than older groups. Nearly 60% of hypertensive participants aged 18-24 reported non-adherence. The youngest group aged 18-24 had extremely higher likelihood to be non-adherent ( $OR=0.03$ ; 95% CI=0.02-0.06) than

**Table 2**

*Predictors of non-adherence to antihypertensive medications among patients who were aware of their hypertension and were advised by doctors*

Variable	$\beta$	S.E.	Odds Ratio	95% CI
Routine checkup not within one year	1.42	0.17	4.12	2.97 - 5.72
No personal doctor or health care provider	0.91	0.22	2.49	1.62 - 3.84
Male	0.66	0.15	1.93	1.43 - 2.60
No flu shot/spray ever	0.59	0.15	1.80	1.34 - 2.42
Age				
65+			ref	
55 - 64	-0.56	0.19	0.57	.39 - 0.84
45 - 54	-0.95	0.21	0.39	0.26 - 0.58
35 - 44	-1.78	0.24	0.17	0.11 - 0.27
25 - 34	-2.21	0.33	0.11	0.06 - 0.21
18 - 24	-3.68	0.64	0.03	0.01 - 0.09

Note: Cox & Snell R Square = .125, Nagelkerke R Square = .261

those aged 65 or older. Previous studies showed that respondents aged 18-44 accounted for 45.3% (95% CI=32.7-57.9; p=0.0009) of non-adherence in taking anti-hypertensive medication (Tong, Chu, Fang, Wall, & Ayala, 2016). Respondents 75 years or older were 3 times more likely to be adherents than (OR=3.03; 95% CI= 2.00-4.55) than those 45 years or younger (Cho & Kim, 2014). The findings from previous studies were similar to the findings in the present study.

According to the Health Belief Model, a possible explanation was that older adults may experience chronic diseases and understand the severity of these diseases, which may motivate this group to be more compliant. (Janz & Becker, 1984). The young adults lacked perceived severity and vulnerability, which may prevent them from developing habits of taking medication.

In the study, Hispanic respondents were more likely (OR=0.39; 95% CI=0.22-0.68) to be non-adherent than Non-Hispanic Whites. The result aligned with prior research that showed Hispanic respondents were 2.61 times more likely to be non-adherent (OR=2.61; 95% CI=1.43-4.77) compared to Non-Hispanic Whites (Tong et al.,

2016). More than half (51%) of Latino migrant and seasonal farmworkers had poor adherence to anti-hypertensive medication (Hall, Lee, Clark, & Perilla, 2016). Researchers analyzed Hispanic non-adherent from the social-ecological perspective and called for culture-sensitive education programs, especially focusing on the blood pressure knowledge and acculturation (Hall et al., 2016).

In the study, males were about twice as likely to be non-adherent (OR=1.93; 95% CI=1.43-2.60) than females. These results differ from previous studies in which females were 1.3 times more likely to be non-adherent (OR=1.3; RR=0.883) than male (Abegaz et al., 2017). Both genders were likely to be non-adherent and might hold different views of taking medication. Some researchers noted men were more likely to believe that they had recovered and stopped taking medication, while more females reported filling the prescription but not actually taking the medication (Thunander Sundbom & Bingefors, 2012). Further research is needed to explore why gender difference on anti-hypertensive medication adherence results are inconsistent.

Prior research found that people with annual lower annual household income (<\$25,000) were about 2 times more likely to be non-adherent (OR=2.18; 95% CI=1.44-3.32) than those had higher income (Tong et al., 2016). The findings in the present research were aligned with these results. Previous research found the unemployed population were more likely to be adherent (OR=0.78; 95% CI=0.628-0.975; p=0.029) compared to employed population (Kang et al., 2015). Findings from previous studies were similar to the current study.

### **Health Behavior Variables**

Health behavior can influence the anti-hypertensive medication adherence. In this study, respondents who reported binge drinking were about 2 times more likely to be non-adherents (OR=2.09; 95% CI=1.64-2.66) than those who did not, which align with findings from previous studies. Some researchers reported binge drinking was associated with a higher risk (OR=1.62; 95% CI 1.45–1.82) of anti-hypertensive medication non-adherence (Pajak et al., 2013; Piano, Mazzucco, Kang, & Phillips, 2017). Binge drinking more than one episode per week may increase the risk of hypertension (men PR=1.26, 95% CI=1.08-1.53; women PR=1.49, 95% CI=0.87-2.56) (Fan et al., 2013).

In the current study respondents who exercised in the past 30 days were 1.40 times more likely to be non-adherent (OR=1.40; 95% CI=1.19-1.67) than those who did not. Prior research reported “I am exercising more” was one of most common barriers to medication adherence and stated that hypertensive population may ignore the effectiveness of hypertensive medication, and believe that exercise may benefit hypertension control (Tong et al., 2016). The results from the present study implied that the adoption of an exercise regimen might not be an indicator for anti-hypertensive medication adherence. Health educators need to raise the awareness of anti-hypertensive medication among population with risky behavior as well as those who are already consistent exercisers.

### **Healthcare Variables**

Healthcare access can impact the treatment of hypertension. In the present research, subjects who did not have routine checkups within one year were approximately 4 times more likely to be non-adherent (OR=4.12; 95% CI=2.97-5.72) than who had routine checkups. The findings were similar to prior research in that being unable to follow up with healthcare providers was identified as the barrier for hypertension control (Barengo et al., 2014; Maimaris et al., 2013). Outpatient visits were also associated with a small decrease in hypertensive non-adherence (OR=0.97; 95% CI=0.97–0.98) in Medicaid population statewide (Bailey et al., 2014). Lack of checkups and management by healthcare providers impeded the medication adherence by hypertensive patients (Legido-Quigley et al., 2015; Risso-Gill et al., 2015). The present research found that hypertensive populations who lacked health insurance coverage and money for hypertension treatment were more likely to be non-adherent. The findings were consistent to previous research that indicated having healthcare coverage and reduced medication co-payments contributed to the improvement of hypertension control and medication adherence (Maimaris et al., 2013).

The relationship between receiving flu shots/spray is still not clear despite the fact the present study found hypertensive population without ever having flu shots/ spray were about 2 times more likely to be non-adherents (OR=1.80; 95% CI=1.34-2.42) than those received the flu shot/spray. Some researchers found that people may refuse flu vaccines because of the misunderstanding of vaccination side effects, perceived poor severity of influenza, and perceived poor vaccination effectiveness, even if they had chronic conditions (Bodeker, Remschmidt, Schmich, & Wichmann, 2015; Stapleton, Digby, & Gilmour, 2017).

People who are aware of their hypertension but choose not to adhere to anti-hypertensive medication is but one type of risk-taking behavior. Due to the severe consequences of uncontrolled hypertension, such as stroke and other circulatory

life-threatening diseases, adherence to anti-hypertensive medication is especially important. Patient education and healthcare services that aims to educate younger males who do not have primary healthcare provider, who did not have routine checkups, and who did not have flu shots/spray is suggested. Future study emphasizing prevention and management of this high-risk population is also indicated.

## References

- Abegaz, T. M., Shehab, A., Gebreyohannes, E. A., Bhagavathula, A. S., & Elnour, A. A. (2017). Nonadherence to antihypertensive drugs: A systematic review and meta-analysis. *Medicine*, 96(4), e5641-e5641. doi:10.1097/MD.00000000000005641
- American Heart Association. (2018). *The facts about high blood pressure*. Retrieved from <https://www.heart.org/en/health-topics/high-blood-pressure/the-facts-about-high-blood-pressure>
- Bailey, J. E., Hajjar, M., Shoib, B., Tang, J., Ray, M. M., & Wan, J. Y. (2014). Risk factors associated with antihypertensive medication nonadherence in a statewide Medicaid population. *American Journal of Medical Sciences*, 348(5), 410-415. doi:10.1097/MAJ.0b013e31825ce50f
- Barengo, N. C., Khatib, R., Schwalm, J.-D., Yusuf, S., Haynes, R. B., McKee, M., . . . Nieuwlaat, R. (2014). Patient and healthcare provider barriers to hypertension awareness, treatment and follow up: A systematic review and meta-analysis of qualitative and quantitative studies. *PLoS One*, 9(1). doi:10.1371/journal.pone.0084238
- Bodeker, B., Remschmidt, C., Schmich, P., & Wichmann, O. (2015). Why are older adults and individuals with underlying chronic diseases in Germany not vaccinated against flu? A population-based study. *BMC Public Health*, 15. doi:10.1186/s12889-015-1970-4
- Centers for Disease Control and Prevention. (2017a). *ICD-10-CM official guidelines for coding and reporting*. Retrieved from [https://www.cdc.gov/nchs/data/icd/10cmguidelines\\_2017\\_final.pdf](https://www.cdc.gov/nchs/data/icd/10cmguidelines_2017_final.pdf)
- Centers for Disease Control and Prevention. (2017b). *Behavioral Risk Factor Surveillance System overview: BRFSS 2017*. Retrieved from [https://www.cdc.gov/brfss/annual\\_data/2017/pdf/overview-2017-508.pdf](https://www.cdc.gov/brfss/annual_data/2017/pdf/overview-2017-508.pdf)
- Centers for Disease Control and Prevention. (2018). *High blood pressure*. Retrieved from <https://www.cdc.gov/bloodpressure/index.htm>
- Ettehad, D., Emdin, C. A., Kiran, A., Anderson, S. G., Callender, T., Emberson, J., . . . Rahimi, K. (2016). Blood pressure lowering for prevention of cardiovascular disease and death: a systematic review and meta-analysis. *The Lancet*, 387(10022), 957-967. doi:10.1016/s0140-6736(15)01225-8
- Farley, T. A., Dalal, M. A., Mostashari, F., & Frieden, T. R. (2010). Deaths Preventable in the U.S. by Improvements in Use of Clinical Preventive Services. *American Journal of Preventive Medicine*, 38(6), 600-609. doi:<https://doi.org/10.1016/j.amepre.2010.02.016>
- Firdaus, M., Sivaram, C. A., & Reynolds, D. W. (2008). Prevention of cardiovascular events by treating hypertension in older adults: an evidence-based approach. *Journal of Clinical Hypertension*, 10(3), 219-225. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/18326964>
- Go, A. S., Mozaffarian, D., Roger, V. L., Benjamin, E. J., Berry, J. D., Borden, W. B., . . . Turner, M. B. (2013). Heart disease and stroke statistics--2013 update: a report from the American Heart Association. *Circulation*, 127(1), e6-e245. doi:10.1161/CIR.0b013e31828124ad
- Hall, E., Lee, S. Y., Clark, P. C., & Perilla, J. (2016). Social ecology of adherence to

- hypertension treatment in Latino migrant and seasonal farmworkers. *Journal of Transcultural Nursing*, 27(1), 33-41. doi:10.1177/1043659614524788
- Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly*, 11(1), 1-47. doi:10.1177/109019818401100101
- Legido-Quigley, H., Camacho Lopez, P. A., Balabanova, D., Perel, P., Lopez-Jaramillo, P., Nieuwlaat, R., . . . McKee, M. (2015). Patients' knowledge, attitudes, behaviour and health care experiences on the prevention, detection, management and control of hypertension in Colombia: a qualitative study. *PLoS One*, 10(4), e0122112. doi:10.1371/journal.pone.0122112
- Maimaris, W., Paty, J., Perel, P., Legido-Quigley, H., Balabanova, D., Nieuwlaat, R., & McKee, M. (2013). The influence of health systems on hypertension awareness, treatment, and control: a systematic literature review. *PLoS Medicine*, 10(7), e1001490. doi:10.1371/journal.pmed.1001490
- Pajak, A., Szafraniec, K., Kubinova, R., Malyutina, S., Peasey, A., Pikhart, H., . . . Bobak, M. (2013). Binge drinking and blood pressure: cross-sectional results of the HAPIEE study. *PLoS One*, 8(6), e65856. doi:10.1371/journal.pone.0065856
- Piano, M. R., Mazzuco, A., Kang, M., & Phillips, S. A. (2017). Cardiovascular consequences of binge drinking: An integrative review with implications for advocacy, policy, and research. *Alcoholism, Clinical and Experimental Research*, 41(3), 487-496. doi:10.1111/acer.13329
- Risso-Gill, I., Balabanova, D., Majid, F., Ng, K. K., Yusoff, K., Mustapha, F., . . . McKee, M. (2015). Understanding the modifiable health systems barriers to hypertension management in Malaysia: a multi-method health systems appraisal approach. *BMC Health Service Research*, 15, 254. doi:10.1186/s12913-015-0916-y
- Sanson-Fisher, R. W., & Clover, K. (1995). Compliance in the treatment of hypertension. A need for action. *American Journal of Hypertension*, 8(10 Pt 2), 82S-88S. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/8845090>
- Stapleton, K., Digby, G., & Gilmour, J. (2017). A survey of uptake and barriers to the seasonal influenza vaccination in respirology patients at an Ontario academic hospital. *Chest*, 152(4), 574a-574a. doi:10.1016/j.chest.2017.08.604
- Thunander Sundbom, L., & Binge fors, K. (2012). Women and men report different behaviours in, and reasons for medication non-adherence: a nationwide Swedish survey. *Pharmacy Practice*, 10(4), 207-221. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/24155839>
- Tong, X., Chu, E. K., Fang, J., Wall, H. K., & Ayala, C. (2016). Nonadherence to antihypertensive medication among hypertensive adults in the United States—HealthStyles, 2010. *Journal of Clinical Hypertension*, 18(9), 892-900. doi:10.1111/jch.12786

# **Risk/Protective Factors of Non-adherence to Prescribed Anti-Hypertensive Medication among Adult Hypertension Patients in the United States, BRFSS, 2017**

## **CHES®/MCCHES® Continuing Education Credit Opportunity**

To receive a FREE CHES®/MCCHES® continuing education credit for reading and analyzing this article, please send a document with your name, your CHES®/MCCHES® number, the name of the manuscript, and your responses for all ten questions to [HealthEdEditor@EtaSigmaGamma.org](mailto:HealthEdEditor@EtaSigmaGamma.org) or [kwilson@tamu.edu](mailto:kwilson@tamu.edu).

1. High blood pressure may increase the risk for \_\_\_\_\_.
  - a. Heart attack
  - b. Kidney disease
  - c. Stroke
  - d. All of the above
  
2. Literature showed that more than \_\_\_\_ of uncontrolled hypertensive patients was non-adherent to anti-hypertensive medications.
  - a. 80%
  - b. 60%
  - c. 40%
  - d. 20%
  
3. In this study, non-adherence was defined as when a patient \_\_\_\_\_.
  - a. Was told by a healthcare provider to have high blood pressure
  - b. Was advised to take anti-hypertensive medication
  - c. Did not take the medication currently at the time of survey
  - d. Combination of all of the above
  
4. In this study, data from \_\_\_\_\_ was extracted for analysis.
  - a. National Health and Nutrition Examination Survey
  - b. Youth Risk Behavior Surveillance System
  - c. Behavioral Risk Factor Surveillance System
  - d. National Survey of Family Growth
  
5. All the responses were self-reported through \_\_\_\_\_.
  - a. Landline telephone
  - b. Mobile phone
  - c. Either A or B
  - d. Neither A nor B

6. This study did NOT retrieve \_\_\_\_\_ variable from the date base.
- Health behavior
  - Geographic
  - Demographic
  - Health service
7. Based off the findings from this study, the non-adherents to anti-hypertensive medications presented common socio-demographic characteristics, which include(s):
- Younger population
  - Male
  - Lower household income
  - All of the above
8. In this study, \_\_\_\_\_ respondents were more likely to be non-adherent than other groups, which was aligned with prior research.
- African American
  - Asian
  - Non-Hispanic Whites
  - Hispanic
9. Based off the findings from this study, \_\_\_\_\_ (which predictor) may NOT be associated with non-adherence to antihypertensive medications
- No flu shot/spray ever
  - Dental cleaning within one year
  - No personal doctor or health care provider
  - Male
10. Based off the findings from this study, respondents with which of the following characteristic(s) are more likely to be non-adherents of anti-hypertensive medication?
- Binge drinkers
  - Having depression
  - Exercise in the past 30 days
  - All of the above