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The Association Between Access To Care And Blood Pressure Control Among Individuals With Hypertension: Evidence From The Coronary Artery Risk Development In Young Adults (cardia) Cohort

Luming Yang
94lumingyang@gmail.com

The association between access to care and blood pressure control among individuals with hypertension: Evidence from The Coronary Artery Risk Development in Young Adults (CARDIA) cohort

Name:Luming Yang

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Department: School of Public Health

Chronic Disease Epidemiology, Yale University School of Public Health

Advisor/Committee Chair: Judith Lichtman

Committee Members: Norrina Bai Allen

Abstract

Background: Hypertension is a major risk factor for cardiovascular disease (CVD). Blood pressure control is important to reduce cardiac risk for individuals with hypertension. Reduced access to health care may be associated with and blood pressure control.

Methods: To address this issue, the study included participants with hypertension who were enrolled in The Coronary Artery Risk Development in Young Adults(CARDIA) cohort. Using a cross-sectional study design, we examined whether the main predictor---access to care was associated with blood pressure control, which is the primary outcome. The potential mediator is Medicate adherence ,which was defined using Morisky Scale. We included demographic factors and risk factors into the analysis and performed Student's test, chi-square test, Fischer exact test, multivariable logistic regression model and conducted stratified analysis to determine whether decreased access to care was associated with poorer blood pressure control.

Results: Among 1,280 participants with hypertension (44.61% men, mean age 50.49 ± 3.52), 55.23% had 2+ barriers to care, 25.31% had 1 barrier, and 19.45% reported no barriers. Decreased access to care was associated with poorer blood pressure control ($p<0.001$). Medication adherence was not associated with neither controlled blood pressure ($P = 0.794$) nor access to care($P=0.456$). In terms of the stratified analysis, the association between access to care and blood pressure status remains significant even among people using medication(OR = 1.63,95%CI: 1.17-2.27 for 1 barrier vs. 0 barrier; OR = 1.98, 95%CI: 1.33-2.96for 2+barriers vs. 0 barrier). Statistically, no significant association observed among people not on medication, which may be resulted from lack of power. Nevertheless, the odds ratio estimates suggested that the direction of the association remains consistent with the former results(OR=1.09 for 1 barrier vs, 0 barrier;OR=1.43 for 2+ barrier vs. 0 barrier) .

Conclusion: An increased number of reported barriers to health care was associated with poorer blood pressure control among patients with hypertension. Lack of medication adherence is not a mediator when predicting the controlled blood pressure. According to the stratified analysis, the significant association between barrier to care and blood pressure control still exist even among people using anti-HTN medication.

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Luming Yang

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Abbreviation Index

CARDIA The Coronary Artery Risk Development in Young Adults

CVD Cardiovascular Disease

SBP Systolic Blood Pressure

DBP Diastolic Blood Pressure

BMI Body Mass Index

HHS Health & Human Services

HTN Hypertension

1. Introduction

High blood pressure is one of the major risk factors for cardiovascular disease (CVD) and stroke.[1] Hypertension is responsible for 16% of the deaths in 2015 and the death rate attributable to high blood pressure has been increased by 10.5% since 2005. [1] According to the guideline of American Heart Association in 2017, blood pressure was categorized into 4 levels: normal, elevated, stage 1 hypertension (SBP/DBP > 130/80) and stage 2 hypertension (SBP/DBP > 140/90). Adults with stage 2 hypertension have significantly increased risk of CVD and a gradient of higher CVD risk among non-stage2-hypertensive people with higher blood pressure.[2] In the US, one in three adults suffers from hypertension and the prevalence of hypertension has been increasing overtime.[3] Moreover, based on the data of JNC 7 report, the new definition for hypertension will increase the population prevalence from 32% to 46% [4]. In addition, there is a trend of increased incidence rate of hypertension during one's lifetime. In fact, the residual lifetime risk for hypertension for middle-aged and elderly individuals can be as large as 90%,[5] which poses a significant public health burden.

Given the strong association between blood pressure and CVD morbidity and mortality, the ultimate goal of blood pressure control is CVD risk reduction[6]. A cross-sectional study reported an increased odds of self-reported hypertension among those who lack healthcare.[7] Another study shows that adults without any type of health insurance have significantly poorer control of blood pressure.[8] A study among adults with diabetes found that lack of regular primary care are less likely to control their blood pressure.[9]

Anti-hypertensive medication can effectively decrease blood pressure and reduce the risk of mortality from

CVD.[10] Poor medicine adherence can adversely affect blood pressure control. Moreover, medicine adherence has been shown to be a significant mediator of the association between blood pressure management and pharmacist care.[11-12] Low medication adherence and poor blood pressure control may occur because individuals are unable to afford medication due to a lack of healthcare insurance. Even among individuals who are on medications, it is possible that blood pressure control may differ by the number of access barriers. However, there have been few studies focusing on the relationship between barrier to care and poor blood pressure control or between medical adherence and blood pressure control to date. This goal of this study is to explore the relationship between barriers to care and blood pressure control, and examine whether medical adherence is a mediator for this association.

2. Method

2.1 Dataset description

The Coronary Artery Risk Development in Young Adults (CARDIA) is a longitudinal cohort study examining the development of clinical and subclinical cardiovascular disease. The study began in1985-1986 and 5115 participants were recruited from four centers around United States: Birmingham, Alabama; Chicago, Illinois; Minneapolis, Minnesota; and Oakland, California. Sampling rates of age, gender, race and education are controlled so that number of people in different subgroups would be approximately same in the four sites stated above (45 % aged 18–24 years and 55 % aged 25–30 years; 55 % male and 45 % female; 52 % black and 48 % white; 40 % with ≤high school and 60 % ≥high school). Data were collected in 1987-1988 (Year 2), 1990-1991(Year 5), 1992-1993 (Year 7), 1995-1996 (Year 10), 2000-2001 (Year 15), 2005-2006 (Year 20), 2010-2011 (Year 25) and 2015-2016 (Year 30). The retention rates were 90%, 86%, 81%, 79%, 74%, 72%, 72%, and 71%, respectively. The data in the study includes data from 2010-2011 (Year 25), which will briefly be written as Year 2010 in the text below.

2.2 Access to care

The primary exposure of interest is having a barrier to accessing care during the past two years. The composite barriers to care variable was developed from four questions asked in 2011 “Do you have an usual source of medical care? By that, we mean the place you go if you need a check-up or if you are ill?” People answering “No” would be coded as “1” (having barrier to care). “Was there anytime during the past two years when you did not seek medical care because it was too expensive or health insurance did not cover it?” People reporting “Yes” would be coded as “1”, “In the past two years have you always had health insurance or other medical coverage for health care?” People reporting “No” would be coded as “1”; “How hard do you think it is for you (and your family) to pay for medical care?”, People answering “Very hard” ,”Hard”, ”Somewhat hard” would be coded as “1”. Previous studies using CARDIA dataset used the first three dichotomous variables to define barrier to care[13-14] . Since our study intended to create a three-level derived categorical variable to present the general condition of barrier to care, we included the fourth variable stated above. The three-level ordinal variable ***score*** was created by summing the results of the four question above: a score of 0 means there is no self-reported barrier to care, a score of 1 reflects at least one self-reported barrier to care, and a score ≥2 reflects at least two self-reported barriers to care.

2.3 Controlled blood pressure

The primary outcome was the control of blood pressure. Measurement of systolic and diastolic blood pressure were recorded with a random-zero sphygmomanometer by trained and certified technicians. There were a total of three measurements with one-minute intervals between assessments, and the we used the mean of the second and the third blood pressure measurement. Although the newest standard of hypertension made by American Heart Association (ACA) in 2017 regarded people with SBP>=130 mmHg or DBP>=80

mmHg as hypertensive[4], our cross-sectional study at year 2010-2011 defined participants with SBP>= 140 mmHg or DBP >= 90 mmHg as hypertensive. Diabetic participants with SBP>= 130 mmHg or DBP >= 80 mmHg were considered hypertensive. Our hypertensive sample included participants who answered "Yes" to "Has a doctor or nurse ever said that you have high blood pressure or hypertension?", but responded "No" to the subset question "Was this during pregnancy?". We also included participants who met our hypertensive criteria based on blood pressure measurement above the normal pressure at year 2010.

Among our hypertensive population, non-diabetic participants with SBP<140 mmHg and DBP<90 mmHg were categorized has having controlled blood pressure while diabetic participants with SBP< 130mmHg and DBP < 80 mmHg were regarded as having controlled blood pressure. Among the 1280 hypertensive participants, 719 (56.2%) were categorized as having their blood pressure controlled based on our definition.

2.4 Potential mediator

The medical adherence was evaluated by Morisky Scale using four questions: 1. "Do you ever forget to take your medicine?"; 2. "Are you careless at times about taking your medicine?"; 3. "When you feel better, do you sometimes stop taking your medicine?"; and 4. "Sometimes if you feel worse when you take the medicine, do you stop taking it?" We created a five-level categorical variable for medical adherence ranging from 0-4, with a score of 0 representing the highest level of medication adherence, and a score of 4 reflecting the lowest level of medication adherence. Data on medical adherence were asked at year 1995, year 2000 and year 2005. We used the data that was closest to year 2010 for the analyses.

2.5 Potential confounders

In terms of potential confounders, we included sex, race, age. In addition, we defined socioeconomic status

by education level (<12 years, 12-16 years, >16 years), employment status (full time, part time, unemployed) and annual pre-tax family income (<25,000 /year,25,000-50,000/year,>50,000 /year). The categories were defined based on 2012 HHS Poverty Guidelines. Risk factors included current smokers (defined as those who reported smoking at least 5 cigarettes per week for the last three months) versus non-smokers/former smokers. Family history was defined as at least one self-reported parents known to be hypertensive. We defined diabetic participants by a self-reporting question "has a doctor or nurse ever said that you have diabetes (high sugar in blood or urine)" . Participants answering "Yes" (except females reported having diabetes only during pregnancy) were defined as diabetic. Self-reported anti-HTN medicine use was defined by the questions, "Are you taking medications for high blood pressure?". Body mass index (BMI) was calculated as weight(kg) divide height(m) in square. BMI was regarded as a continuous variable in univariate study and a three-level ordinal variable (< 25 kg/m^2, 25 - <30 kg/m^2, >30 kg/m^2) in logistic analysis. Because taking medication could be correlated with having access to care, this variable was not included in the staged logistic analysis.

2.6 Statistical Method

Participants without missing information for the covariate and outcomes variables were included in the analyses. First, we conducted univariate analysis to assess the frequency of all covariables among samples. In addition, we used analysis of variance test and chi-square analysis to compare the distribution of participants' characteristics among participants across the categories of barriers to care(=0, =1, >=2). We then used Student's test and chi-square analysis to exam the association between each predictor and uncontrolled blood pressure.

Second, we calculated the correlation coefficients between each access to care component, between

predictor of access to care and HTN-medication use, and between barrier to care scores and anti-HTN medication use.

Third, we used multivariable logistic regression to exam the independent association between barrier to care score and uncontrolled blood pressure, and then we used the same method to exam the independent association between each access to care's predictor and uncontrolled blood pressure. We explored covariates for social demographic variables, risk factors and medication adherence using staged model. We then stratified analysis by anti-HTN medication use by performing multivariable logistic regression and staged model.

All analysis was performed with SAS 9.4 software (Statistical Analysis Software) for windows. Figures and tables were created by Excel of Office 2013.

3. Results

3.1 Description of overall samples and distribution of predictors by barrier to care scores

As shown in ***Figure 1***, among the 1280 participants with hypertension in the study, 55.4% are female and 64.1% are non-Hispanic black, 17.5% of the samples have an education level less than 12 years, and 53.8% of the samples have an education of 12-16 years. Approximately, 55. 3% of the study population reported no barrier to care, 25.31% reported at least on barrier, and 19.5% reported 2 or more barriers to care. Approximately 85% of participants reported health insurance, 95% had health resources, 15.1% reported not seeking care within the past two years, and 38.3% reported payment difficulty.

Figure 2 shows that among participants with 2+ reported barriers to care, 67.9% report no health insurance, and 67.1% have not sought care for 2 years. More than 90% of reporting at least two_ barriers report payment difficulty. Among participants who report one barrier, 80.9% report payment difficulty, as compared with 5.9% who report no health care, 8.0% who have not sought care within the past 2 years, and 5.3% who report no health resources.

3.2 Participant Characteristics by barrier to care score and blood pressure control status

Table 1 shows that participants with >= 2 of barriers to care were more likely to have uncontrolled blood pressure (53.82%) compared with participants without any reported barriers to care (39.46%; p<0.001). Participants with higher barrier scores had higher mean SBP and DBP values (P< 0.001). Higher barrier to care scores were associated with low level of education, lower annual income, being a current smoker and not taking anti-HTN medicine (P< 0.001, respectively). Medicine adherence was not significantly associated with score of barrier to care (P = 0.456), suggesting it may not be a significant mediator in the association between barrier to care scores and uncontrolled blood pressure.

Table 2 shows participants having no health insurance pressure (P =0.005), those without regular health resources (P<0.001), those not seeking for care for the past two years because of price (P =0.075), and those having payment difficulty for medical care (P = 0.002) are more likely to have of uncontrolled blood pressure. Participants who were non-Hispanic black(P<0.001), had a lower level of education(P=0.027), lower level of family income(P=0.036), not using anti-HTN medicine(P<0.001), being a current smokers(P=0.044), and being diabetic(P<0.001) were more likely to have uncontrolled blood pressure. There was no significant association between medication adherence and uncontrolled blood pressure.

3.3 logistic regression

3.3.1 Analysis of overall samples

As shown in ***Table 3***, the correlation coefficients among the four access to care variables were relatively small. The payment difficulty variable was most highly correlated with barrier to care score compared with the other three predictors (Rho=0.824, P<0.001). The medication use is negatively correlated with the score of barrier to care and four individual predictors, suggesting that people taking anti- HTN medicine can be less likely to have barrier to care issues.

Table 4 shows that in the unadjusted model, the association between barrier access score and uncontrolled hypertension was marginally significant for those with one reported barrier (OR = 1.29, .95%CI: 0.99-1.68), but significantly associated with uncontrolled hypertension among those with 2+ reported barriers (OR = 1.79, 95%CI :1.34-2.39). After adjusting for demographic factor and risk factors in model 2&3, the relationship was attenuated for those with one barrier, but remained significant for those with 2+ barriers to care (OR1.6895% CI 1.05-2.69).

3.3.2 stratified analysis

Because we found a significant interaction term between barrier to care score and anti-HTN medication use in the logistic model (report the value), we stratified the analyses by anti-HTN medication use. A total of 869 participants were using anti-HTN medicine and 408 people not using anti-HTN medicine. There were 3 anti-HTN medicine use missing values in this study, so the sample was 1277 for these analyses. As shown in ***Table 5***, in unadjusted analyses, participants with one barrier to care, and 2+ barriers to care were more likely to have uncontrolled blood pressure (OR = 1.63,95%CI: 1.17-2.27; OR = 1.98, 95%CI: 1.33-2.96

separately). After adjusting for covariables, the relationship was attenuated for one barrier (OR = 1.43 95%CI = 0.99-2.07), but remained significant for participants with 2+ barriers to care (OR = 1.66 95%CI: 1.03-2.64). This finding suggest that even among participants taking anti-HTN medicine, an increased number of barrier to care is associated with poor blood pressure control.

Among the patients who were not taking anti-hypertensive medications, those who reported barriers to care had an increased, but non-significant association with uncontrolled hypertension. The similar direction of findings, but lack of statistical significance may be due to an inadequate sample size to detect significance in this group N= 408).

4. Discussion

In this study of 1,280 CARDIA participants with hypertension, we found that having an increased number of self-reported barriers to care was significantly associated with poor blood pressure control. Medication adherence was not found to be a significant mediator for this relationship. Even among participants with hypertension who were taking anti-hypertensive medications, those that reported two or more barriers to care had poorer blood pressure control.

Prior studies exploring the relationship between access barrier to healthcare and control of blood pressure have shown mixed results. Our findings are consistent with studies that show regular health care resources is significantly associated with better odds of blood pressure control[15-16] and that an increased number of barriers to care is related to a higher prevalence of hypertension.[7] Moreover, the association of blood pressure control with other variables such as diabetes, tobacco use, BMI, race and social economic status were consistent with prior studies[17-18]. Few studies have stratified analyses by anti-hypertension medication use. A study, which regarded HTN-medication as an explanatory predictor, claimed that among people on

medication, not having health insurance significantly increase the risk of poor blood pressure control among hypertensive patients, which in some way was consistent with our finding that barriers to care do raise the odds of poor blood pressure among people on medication. [8].

We also found that use of medication maybe more correlated with poor blood pressure control compared to our score of barriers to care. Among people with poor blood pressure control, only one third are using medication while among people with good blood pressure control, more than two thirds are on medication. According to the distribution of medication use by barrier to care, more than 70% of hypertensive participants with no or moderate barrier to care taking medicine while only 50% of people with huge barrier to care taking medicine, suggesting that medication use is also highly correlated with barrier to care. Another finding is that we found a moderated effect of barriers to care among people not using medication. One possible explanation would be that people not taking medicine are more likely to have less sever condition of elevated blood pressure and hence decrease the difference in odds of poor blood pressure control.

Our study has several limitations. This is a cross-sectional study and we are unable to establish casualality of our association. Since we used data from one collection point (year 2010), we did not evaluate whether loss to follow up in CARDIA may have contributed to potential selection bias in our study. Most of the information including diagnose of hypertension was collected from self-report, which may cause information bias that make the results bias towards null. Moreover, in the full model including medication adherence, a relatively large proportion(33.75%) of participants were ruled out because of missing values which may cause lack of precision of the results in model4. We kept the participants with missing values in covariables such as demographic factors and social economic factors and we made those missing values as an individual level to handle the missing data. When we conducted stratified analysis, we failed to detect

several significance likely due to the lack of statistical power for the reduced sample.

Future studies focus on longitudinal analysis of CARDIA cohort from year 7-year 25 should be conducted and more observational studies should be done on other datasets to further explore the association of access to healthcare and blood pressure control among hypertensive participants.

Figure 1 **| Characteristics of Patients with Hypertension (N=1280)**

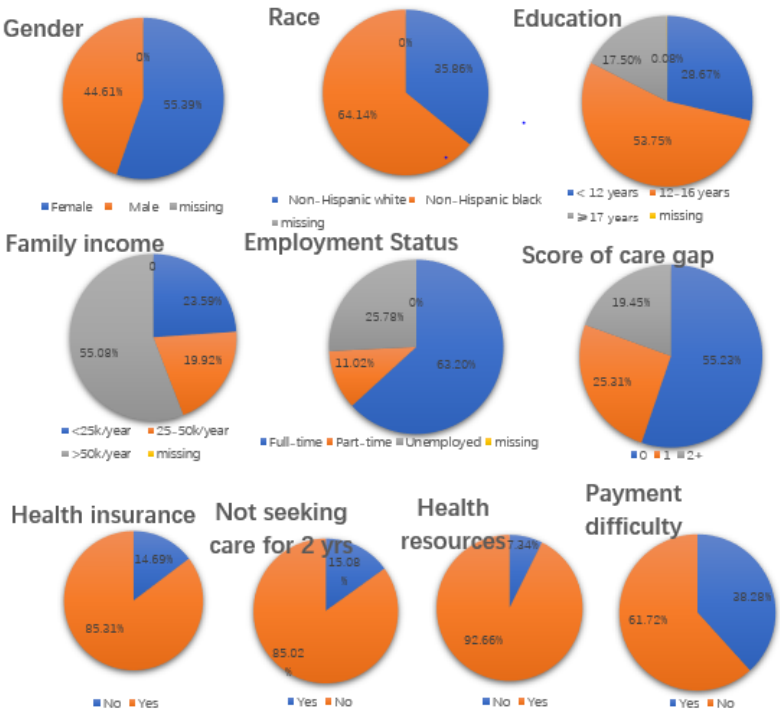

***Figure 2* | Distribution of access variables by barrier to care score**

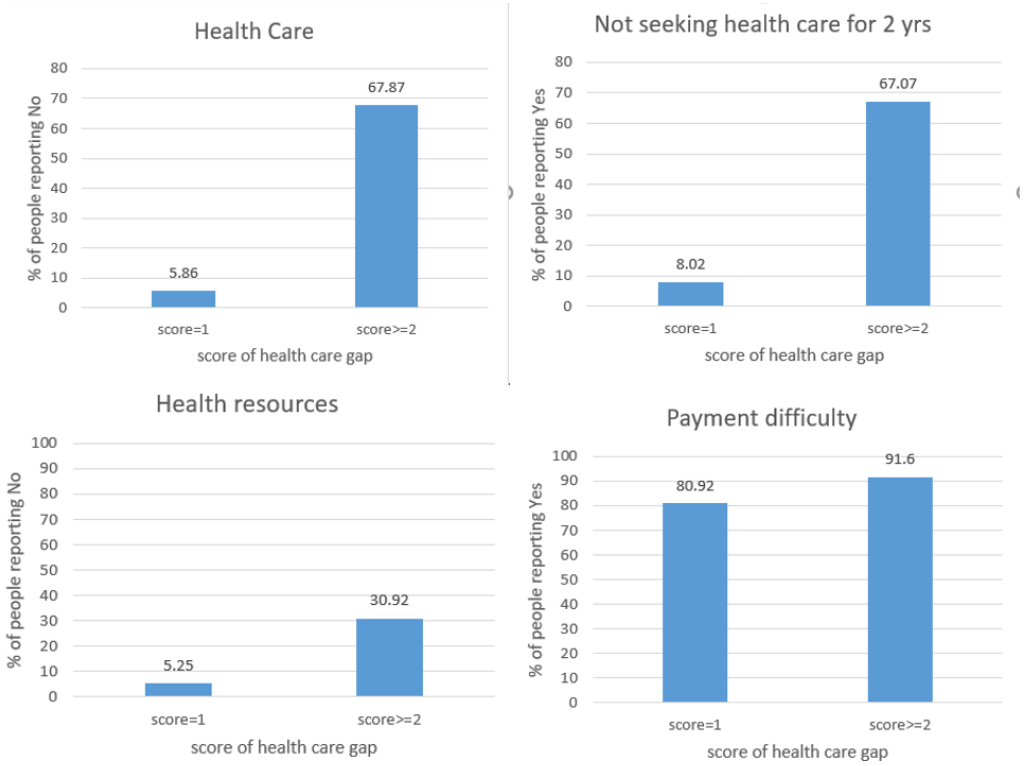

Table 1 | *Participant characteristics by barrier to care score (N=1280)*

	Score =0 (N=707)	**Score = 1 (N = 324)**	**Score⩾2 (N = 249)**	
Factor	**%**[a]	**%**	**%**	***p***[b]
Age(SD)	50.61(3.51)	50.50(3.54)	50.14(3.55)	0.205
Sex				0.872
Female	56.01	54.32	55.02	
Male	43.99	45.68	44.98	
Race				0.325
Non-Hispanic black	62.38	65.74	67.07	
Non-Hispanic white	37.62	34.26	32.93	
Controlled blood pressure				<0.001***
No	39.46	45.68	53.82	
Yes	60.54	54.32	46.18	
Education				<0.001***
<12 years	22.07	34.49	38.55	
12-16 years	56.58	50	50.60	
≥17 years	21.36	14.51	10.44	
missing	0.00	0.00	0.40	

Employment Status				<0.001***
Full-time	74.26	57.72	38.96	
Part-time	6.36	12.35	22.49	
Unemployed	19.38	29.94	38.55	
Family Income				<0.001***
<25k/year	13.86	27.47	46.18	
25-50k/year	13.01	29.01	27.71	
>50k/year	72.28	42.28	22.89	
missing	0.85	1.23	3.21	
Family History				0.909
yes	62.52	57.72	58.23	
No	23.20	22.84	21.29	
missing	14.29	19.44	20.48	
Tobacco Use				<0.001***
yes	16.41	25.62	27.71	
No	83.59	74.38	72.29	
Diabetes				0.074
yes	17.26	23.15	17.67	
No	82.18	76.23	79.92	
missing	0.57	0.62	2.41	
Anti-HTN medical use				<0.001***
yes	71.85	71.30	52.21	
No	28.15	28.40	46.99	
missing	0.00	0.31	0.80	
Medical adherence				0.456
0	25.88	19.44	17.67	
1	29.00	27.16	20.48	
2	10.89	11.73	9.24	
3	4.38	5.56	5.22	
4	0.85	1.85	0.80	
missing	29.00	34.26	46.59	
SBP(SD)	128.64(17.08)	129.69(17.14)	134.69(20.46)	<0.001***
DBP(SD)	81.25(11.25)	81.41(11.29)	84.96(12.77)	<0.001***
BMI(SD)	33.17(8.00)	33.22(7.80)	32.92(7.27)	0.889

[a]

Table values are mean(SD) for continuous variables and column% for categorical variables. [b] P value is for analysis of variance for continuous variables or chi-square test/ Fischer exact test for categorical variables(calculated without the row of missing) [c] Percentages may not sum to 100% due to rounding. *: P value < 0.05, **:P value < 0.01, ***:P value < 0.001

Table 2 | *Prevalence of factors by blood pressure control status (N=1280)*

	BP uncontrolled(N=561)	**BP controlled(N=719)**	
Factor	**%**[a]	**%**	***p***[c]
Score of barrier to care			<0.001***

0(n = 707)	30.46[b]	60.54	
1(n = 324)	45.68	54.32	
2+(n = 249)	53.82	46.18	
Health insurance			0.005**
No(n = 188)	53.19	46.81	
Yes(n = 1092)	42.22	57.78	
Health resources			<0.001***
No(n = 94)	67.02	32.98	
Yes(n = 1186)	41.99	59.01	
Not seeking care for 2 yrs			0.075
Yes(n = 193)	51.3	48.7	
No(n = 1087)	42.49	57.51	
Payment difficulty			0.002**
Yes(n = 490)	49.18	50.82	
No(n = 790)	40.51	59.49	
Age(SD)	50.42(3.53)	50.55(3.52)	0.510
Sex			0.672
Female(n = 709)	44.48	55.52	
Male(n = 571)	43.30	56.70	
Race			<0.001***
Non-Hispanic black(n = 821)	47.26	52.74	
Non-hispanic white(n = 459)	37.69	62.31	
Education			0.027*
<12 years(n = 367)	46.05	53.95	
12-16 years(n = 688)	45.2	54.8	
≥17 years(n = 224)	35.71	64.29	
Employment Status			0.280
Full-time(n = 809)	42.15	57.85	
Part-time(n = 141)	46.10	53.90	
Unemployed(n = 330)	46.97	53.03	
Family Income			0.036*
<25k/year(n = 302)	49.34	50.66	
25-50k/year(n = 255)	45.10	54.90	
>50k/year(n = 705)	40.71	59.29	
Family History			0.626
Yes(n = 291)	43.93	56.07	
No(n =774)	42.27	57.73	
Tobacco Use			0.044*
Yes(n = 268)	49.25	50.75	
No(n = 1012)	42.39	57.61	
Diabetes			<0.001***
Yes(n = 241)	56.85	43.15	
No(n = 1027)	40.80	59.20	

Anti-HTN medical use			<0.001***
Yes(n = 408)	31.42	68.58	
No(n = 869)	69.85	30.15	
Medical adherence			0.794
0(n = 290)	35.52	64.48	
1(n = 344)	38.08	61.92	
2(n = 138)	37.68	62.32	
3(n = 62)	40.32	59.68	
4(n = 14)	50.00	50.00	
SBP(SD)	144.50(14.75)	118.80(10.64)	<0.001***
DBP(SD)	91.25(8.86)	74.81(7.85)	<0.001***
BMI(SD)	32.70(7.79)	32,68(7.79)	0.994

[a] Table values are mean (SD) for continuous variables and row% for categorical variables. [b] P value is for student's test for continuous variables or chi-square test/ Fischer exact test for categorical variables (calculated without the row of missing) [c] Percentages may not sum to 100% due to rounding. *: P value < 0.05, **:P value < 0.01, ***:P value < 0.001

Table 3|Correlation Coefficient of the Primary Predictors

	Score of barrier to care	**anti-HTN medication use**	**Health insurance**	**regular source of care**	**not seeking care for 2 yrs**	**Payment difficulty**
Score of barrier to care	1	-0.137(P<0.001)	0.664(P<0.001)	0.420(P<0.001	0.566(P<0.001)	0.824(P<0.001)
anti-HTN medication use	0.137(P<0.001)	1	-0.148(<0.001)	-0.203(P<0.001	-0.086(P<0.001)	-0.065(P<0.001)
Health insurance	0.664(P<0.001)	-0.148(<0.001)	1	0.364(P<0.001)	0.335(P<0.001)	0.335(P<0.001)
regular source of care	0.420(P<0.001	-0.203(P<0.001	0.364(P<0.001)	1	0.225（P<0.001)	0.197(P<0.001)
not seeking care for 2 yrs	0.566(P<0.001)	-0.086(P<0.001)	0.335(P<0.001)	0.225（P<0.001)	1	0.266(P<0.001)
Payment difficulty	0.824(P<0.001)	-0.065(P<0.001)	0.335(P<0.001)	0.197(P<0.001)	0.266(P<0.001)	1

Table 4| Associations between score of barrier to care and having uncontrolled vs. controlled blood pressure N =1280

	Model 1[a]		**Model 2[b]**		**Model 3[c]**		**Model 4[d]**	
factor	**OR(95% CI)**	**P**	**OR(95%CI)**	**P**	**OR(95%CI)**	**P**	**OR(95%CI)**	**P**
Access to health care								
0	Ref		Ref		Ref		Ref	
1	1.29(0.99-1.68)	0.060	1.27(0.96-1.68)	0.093	1.23(0.93-1.64)	0.145	1.20(0.90-1.60)	0.221
2+	1.79(1.34-2.39)	<0.001***	1.71(1.24-2.37)	0.001**	1.75(1.26-2.43)	<0.001***	1.60(1.15-2.24)	0.006**

[a]unadjusted model; [b] model 1 adjusted for demographic factors: age, sex, race, education, income, employment status; [c] model 2 with risk factors: family history, diabetes, BMI, tobacco use; [d] model 3 with medication adherence. *: P value < 0.05, **:P value < 0.01, ***:P value < 0.001

Table 5| Stratified analysis of associations between score of barrier to care and having uncontrolled vs. controlled blood pressure (among people using and not using HTN medicine) N=1277

	Model 1[a]		**Model 2[b]**		**Model 3[c]**		**Model 4[d]**	
factor	**OR(95% CI)**	**P**	**OR(95%CI)**	**P**	**OR(95%CI)**	**P**	**OR(95%CI)**	**P**
Score of barrier to care[e](N = 869)								
0	Ref		Ref		Ref		Ref	
1	1.63(1.17-2.27)	0.004	1.48(1.04-2.11)	0.029	1.44(1.00-2.09)	0.049	1.43(0.99-2.07)	0.058
2+	1.98(1.33-2.96)	<0.001	1.60(1.02-2.51)	0.041	1.68(1.05-2.69)	0.030	1.66(1.03-2.64)	0.036
Score of barrier to care[f] (N = 408)								
0	Ref		Ref		Ref		Ref	
1	0.85(0.37-2.00)	0.717	1.09(0.44-2.70)	0.855	1.13(0.43-3.01)	0.279	1.09(0.39-3.06)	0.868
2+	0.81(0.37-1.80)	0.605	1.13(0.47-2.72)	0.793	1.37(0.48-3.94)	0.555	1.43(0.48-4.28)	0.527

[a]unadjusted model; [b] model 1 adjusted for demographic factors: age, sex, race, education, income, employment status; [c] model 2 with risk factors:
family history, diabetes, BMI, tobacco use, anti-HTN medicine (for form **e** only); [d] model 3 with medication adherence·[e]samples are those who using anti-HTN medication [f]Samples are those who are not using medication **:P value < 0.01, ***:P value < 0.001

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