

# Trends in Hypertension Control and Management Disparities in U.S. Adults: A NHANES Analysis from 1999-2020

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# Introduction: Background

## Background

- Hypertension is a leading risk factor for cardiovascular diseases, affecting public health worldwide and prominently in the U.S.

## Problem

- Following an initial improvement in blood pressure control among U.S. adults with hypertension from 1999-2000 to 2007-2008, there was a stagnation and subsequent decrease post-2013 (Muntner P, et al., 2020).

# Introduction

## Motivation

- This study aims to explore the reasons behind recent declines in hypertension control.

## Study Objective

- Examining the trends, awareness, and medication use among U.S. adults with hypertension in 1999-2020.
- Assessing the impact of demographic factors and comorbid conditions on blood pressure control.
- This study used 1999-2020 National Health and Nutrition Examination Survey (NHANES) dataset.

# Definition & Study Outcomes

- **Study population:** U.S. adults (older than 18 years old) with hypertension defined by the JNC7 guideline
- **Uncontrolled Blood Pressure:** Systolic blood pressure  $\geq 140$  mm Hg or diastolic blood pressure  $\geq 90$  mm Hg
- **Awareness:** Self-report of a prior diagnosis of antihypertensive medication.
- **Medication Use:** Self-reported use of antihypertensive medication

# Statistical Analysis

- ① Weighting and multiple year adjustment
- ② Multiple Imputation to address missing data
- ③ Logistic Regression Models account for complex survey design  
(Heeringa, S., West, B.T. and Berglund, P.A., 2017):

The model can be expressed as:

$$\log\left(\frac{\pi}{1 - \pi}\right) = X\beta = \beta_0 + \beta_1X_1 + \dots + \beta_nX_n$$

- Variance is estimated using the linearization method
- Using Rubin's multiple imputation combining rule to combine both between and within imputation variance (Little, R.A. and Rubin, D.B., 2019)

# Results

- Gap in high blood pressure treatment!
  - **Blood Pressure control:** Among U.S. adults with hypertension, 52% are uncontrolled.
  - **Awareness:** Among those with hypertension, 80% of them are aware of their condition.
  - **Medication Use:** Among those who are aware, 71% of them are taking medication.
- $0.80 \times 0.71 \approx 56.8\%$  of those with hypertension are being medicated.

# Results

Table 1: Characteristics for U.S. Adults with Hypertension, Uncontrolled Blood Pressure, Awareness of Hypertension, and Medication Use, 1999-2020

Characteristic	Hypertension N = 20,409 <sup>1</sup>	Uncontrolled N = 11,082 <sup>2</sup>	Awareness N = 16,297 <sup>3</sup>	Medication Use N = 14,690 <sup>4</sup>
Age	61 (50, 71)	60 (49, 72)	61 (51, 72)	62 (53, 72)
Race/Ethnicity				
Non-Hispanic White	9,056 (70%)	4,692 (67%)	7,240 (70%)	6,616 (71%)
Hispanic/Asian/Other	5,716 (16%)	3,278 (17%)	4,368 (15%)	3,863 (14%)
Non-Hispanic Black	5,637 (14%)	3,112 (15%)	4,689 (15%)	4,221 (15%)
Gender				
Male	10,064 (48%)	5,590 (49%)	7,665 (46%)	6,751 (45%)
Female	10,435 (52%)	5,492 (51%)	8,632 (54%)	7,939 (55%)
BMI				
<25	4,045 (19%)	2,645 (24%)	2,856 (17%)	2,497 (16%)
25 to 30	6,525 (33%)	3,651 (33%)	5,098 (32%)	4,591 (32%)
30+	9,147 (48%)	4,447 (43%)	7,778 (51%)	7,079 (52%)
Unknown	692	339	565	523
Diabetes	5,376 (22%)	2,450 (18%)	4,817 (25%)	4,611 (26%)
Chronic Kidney Disease	6,542 (26%)	3,726 (28%)	5,560 (28%)	5,127 (29%)
History of CVD	4,241 (18%)	1,949 (15%)	3,900 (21%)	3,704 (22%)

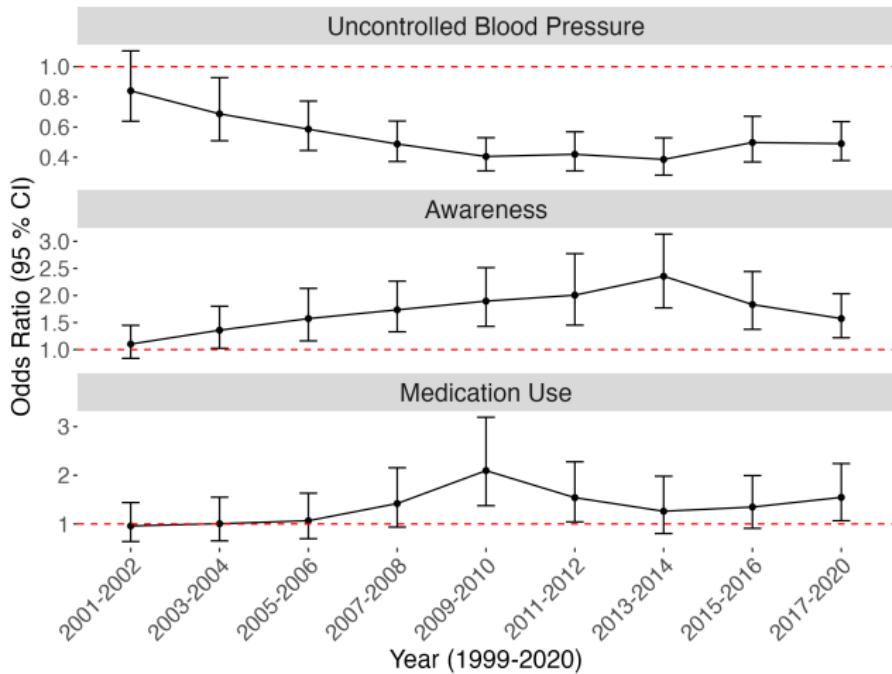
<sup>1</sup> Hypertension: There are 20,409 participants with hypertension in the dataset.

<sup>2</sup> Uncontrolled: Among those with hypertension, 52% of them are uncontrolled (represented by 11,082 participants in the dataset).

<sup>3</sup> Awareness: Among those with hypertension, 80% of them are aware of their condition (represented by 16,297 participants in the dataset).

<sup>4</sup> Medication Use: Among those who are aware, 71% of them are taking medication (represented by 14,690 participants in the dataset).

# Results



**Figure 1:** Odds Ratios and 95% CI of Uncontrolled Blood Pressure, Awareness, and Self-reported Antihypertensive Medication Use in U.S. Adults with Hypertension by Year

# Results

Table 2: Odds Ratios and 95% CI of Uncontrolled Blood Pressure, Awareness, and Medication Use in U.S. Adults with Hypertension, 1999-2020

Characteristic	Uncontrolled Blood Pressure N = 20,409	Awareness N = 20,409	Medication Use N = 16,297
Age	0.99 (0.99, 1.01)	1.02 (1.01, 1.02)	1.05 (1.04, 1.05)
Race/Ethnicity			
Non-Hispanic White	Ref	Ref	Ref
Hispanic/Asian/Other	1.43 (1.29, 1.59)	0.79 (0.70, 0.89)	0.71 (0.60, 0.84)
Non-Hispanic Black	1.44 (1.31, 1.58)	1.12 (0.99, 1.26)	0.86 (0.74, 1.01)
Gender			
Male	Ref	Ref	Ref
Female	0.84 (0.77, 0.91)	1.38 (1.24, 1.54)	1.59 (1.39, 1.81)
BMI			
< 25	Ref	Ref	Ref
25 to 30	0.62 (0.55, 0.71)	1.70 (1.47, 1.96)	1.48 (1.22, 1.79)
30+	0.50 (0.44, 0.57)	2.73 (2.41, 3.10)	1.70 (1.37, 2.12)
Diabetes	0.68 (0.60, 0.76)	2.03 (1.73, 2.38)	2.32 (1.83, 2.95)
Chronic Kidney Disease	1.43 (1.31, 1.57)	1.22 (1.09, 1.36)	0.77 (0.64, 0.93)
History of CVD	0.65 (0.59, 0.72)	3.14 (2.68, 3.68)	1.72 (1.34, 2.19)

# Discussion

## Findings

- A gap in high blood pressure treatment: 56.8% of those with hypertension are being medicated.
- Overall increase in awareness since 1999, but a notable decline in recent years.
- Level of medication use has not shown significant improvement.
- Women and people with diabetes or history of CVD tend to pay more attention to blood pressure management.

## Limitations

- Potential inaccuracies in self-reported data and the exclusion of certain variables that might influence the outcomes.

# References

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# Thank you!

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