

# 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).

## Motivation

- This study is motivated by the need to investigate the reasons behind this decline and to identify factors contributing to the diminishing control of hypertension in recent years.

## Study Objective

- Examining the trends, awareness, and medication use in stage 2 hypertension among U.S. adults.
- Assessing the impact of demographic factors and comorbid conditions on hypertension control.

# Methodology

- 1 Weighting and multiple year adjustment
- 2 Multiple Imputation to address missing data
- 3 Logistic Regression Models (Dobson, 2008):

Suppose there are  $n$  covariates  $X_i, i = 1, \dots, n$ , the model can be expressed as:

$$\log\left(\frac{\pi}{1-\pi}\right) = X\beta = \beta_0 + \beta_1 X_1 + \dots + \beta_n X_n$$

- $\pi$  is the risk
- $\frac{\pi}{1-\pi}$  is the odds
- $\beta_0$  is the log odds for  $X_i' s = 0$
- $\beta_i$  is the log odds ratio per unit change of  $X_i$ , holding all other covariates fixed

# Results

Table 1: Participant Characteristics and Comorbidity Status of Uncontrolled Stage 2 Hypertension, Awareness, and Medication Use in US Adults, 1999-2020

Characteristic	Stage 2 Hypertension N = 56,017 <sup>1</sup>	Awareness N = 10,923 <sup>2</sup>	Medication Use N = 6,891 <sup>3</sup>
Age	64 (52, 74)	65 (54, 75)	68 (59, 77)
Race/Ethnicity			
Non-Hispanic White	4,627 (42%)	2,841 (41%)	2,223 (42%)
Hispanic/Asian/Other	3,221 (29%)	1,909 (28%)	1,406 (27%)
Non-Hispanic Black	3,075 (28%)	2,141 (31%)	1,664 (31%)
Gender			
Male	5,510 (50%)	3,249 (47%)	2,338 (44%)
Female	5,413 (50%)	3,642 (53%)	2,955 (56%)
BMI			
<25	2,584 (24%)	1,423 (21%)	1,067 (21%)
25 to 30	3,604 (34%)	2,202 (33%)	1,700 (33%)
30+	4,408 (42%)	3,057 (46%)	2,359 (46%)
Unknown	327	209	167
Diabetes	2,410 (22%)	1,867 (27%)	1,661 (31%)
Chronic Kidney Disease	3,653 (33%)	2,702 (39%)	2,272 (43%)
History of CVD	1,920 (18%)	1,588 (23%)	1,395 (26%)

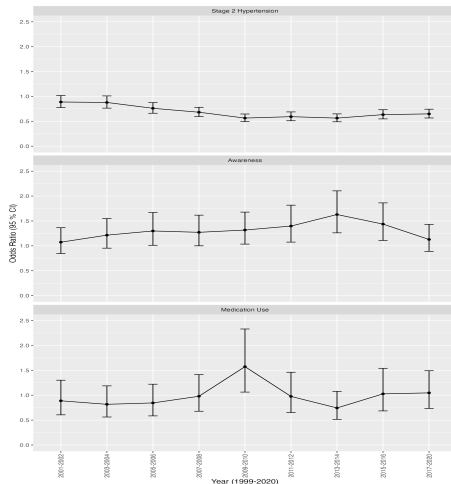
<sup>1</sup> Stage 2 Hypertension Prevalence: Among the 56,017 participants, 10,923 (19%) have stage 2 hypertension.

<sup>2</sup> Awareness Among Those with Stage 2 Hypertension: 6,891 (63%) of them are aware of their condition.

<sup>3</sup> Medication Usage Among Aware Participants: 5,293 (77%) of them are taking medication .



# Results



**Figure 1:** Odds Ratios and 95% CI of Uncontrolled Stage 2 Hypertension, Awareness, and Self-reported Antihypertensive Medication Use in US Adults by Year

Table 2: Odds Ratios and 95% CI of Uncontrolled Stage 2 Hypertension, Awareness, and Medication Use in US Adults, 1999-2020

Characteristic	Model 1: Stage 2 Hypertension N = 56,017		Model 2: Awareness N = 10,923		Model 3: Medication Use N = 6,891	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Age	1.06 (1.06, 1.06)	< 0.0001	1.02 (1.01, 1.02)	< 0.0001	1.06 (1.05, 1.07)	< 0.0001
Race/Ethnicity						
Non-Hispanic White	Ref	Ref	Ref	Ref		
Hispanic/Asian/Other	1.23 (1.14, 1.33)	< 0.0001	0.98 (0.86, 1.13)	< 0.0001	0.93 (0.76, 1.15)	0.0517
Non-Hispanic Black	2.09 (1.94, 2.24)	< 0.0001	1.49 (1.32, 1.70)	< 0.0001	1.38 (1.15, 1.66)	< 0.0001
Gender						
Male	Ref	Ref	Ref	Ref		
Female	0.83 (0.78, 0.89)	< 0.0001	1.24 (1.10, 1.40)	< 0.0001	1.39 (1.17, 1.65)	< 0.0001
BMI						
< 25	Ref	Ref	Ref	Ref		
25 to 30	1.16 (1.06, 1.26)	< 0.0001	1.41 (1.21, 1.64)	< 0.0001	1.26 (1.00, 1.65)	0.0050
30+	1.57 (1.44, 1.70)	< 0.0001	2.26 (1.93, 2.64)	< 0.0001	1.62 (1.28, 2.03)	< 0.0001
Diabetes	1.02 (0.93, 1.12)	0.0652	1.68 (1.42, 1.98)	< 0.0001	2.10 (1.63, 2.70)	< 0.0001
Chronic Kidney Disease	1.72 (1.59, 1.87)	< 0.0001	1.56 (1.36, 1.77)	< 0.0001	1.10 (0.91, 1.34)	0.0335
History of CVD	0.84 (0.76, 0.92)	< 0.0001	2.79 (2.33, 3.36)	< 0.0001	1.61 (1.26, 2.05)	< 0.0001

SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure.

Stage 1 Hypertension: SBP ≥ 130 mm Hg or DBP ≥ 80 mm Hg.

Stage 2 Hypertension: SBP ≥ 140 mm Hg or DBP ≥ 90 mm Hg.

# Discussion

# Discussion

## Data source

- NHANES data (1999-2020).

## Method

- Descriptive statistics and logistic regression

## Findings

- Significant gap in high blood pressure treatment
- Overall increase in awareness and treatment since 1999, but a notable decline in recent years.
- Age, race, BMI, and additional health conditions, particularly diabetes, have a considerable impact on high blood pressure management.

## Limitations

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

# References

- ① Dobson, A.J. (2008) An introduction to generalized linear models, Third Edition. Chapman & Hall.
- ② “Facts about Hypertension.” Centers for Disease Control and Prevention, 6 July 2023. URL <http://www.cdc.gov/bloodpressure/facts.htm/> [Accessed 22 Dec. 2023.]
- ③ Muntner P, et al. (2020) Trends in Blood Pressure Control Among US Adults With Hypertension, 1999-2000 to 2017-2018. JAMA 324(12):1190–1200. <https://doi.org/10.1001/jama.2020.14545>
- ④ “Nhanes tutorials - Variance Estimation module”. Centers for Disease Control and Prevention, URL <https://wwwn.cdc.gov/nchs/nhanes/tutorials/VarianceEstimation.aspx> [Accessed 22 Dec. 2023.]

# References

- ⑤ “Nhanes tutorials - weighting module”. Centers for Disease Control and Prevention, URL <https://wwwn.cdc.gov/nchs/nhanes/tutorials/Weighting.aspx> [Accessed 22 Dec. 2023.]
- ⑥ Rubin, D.B. (2018). Flexible Imputation of Missing Data, Second Edition. Chapman and Hall/CRC.