

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.

Study Population & Outcomes

Study population

- U.S. adults (older than 18 years old) with hypertension defined by the JNC7 guideline

Study Outcomes

- **Uncontrolled Blood Pressure:** Systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 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 ¹	Uncontrolled N = 11,082 ²	Awareness N = 16,297 ³	Medication Use N = 14,690 ⁴
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%)

¹ Hypertension: There are 20,409 participants with hypertension in the dataset.

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

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

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

Results

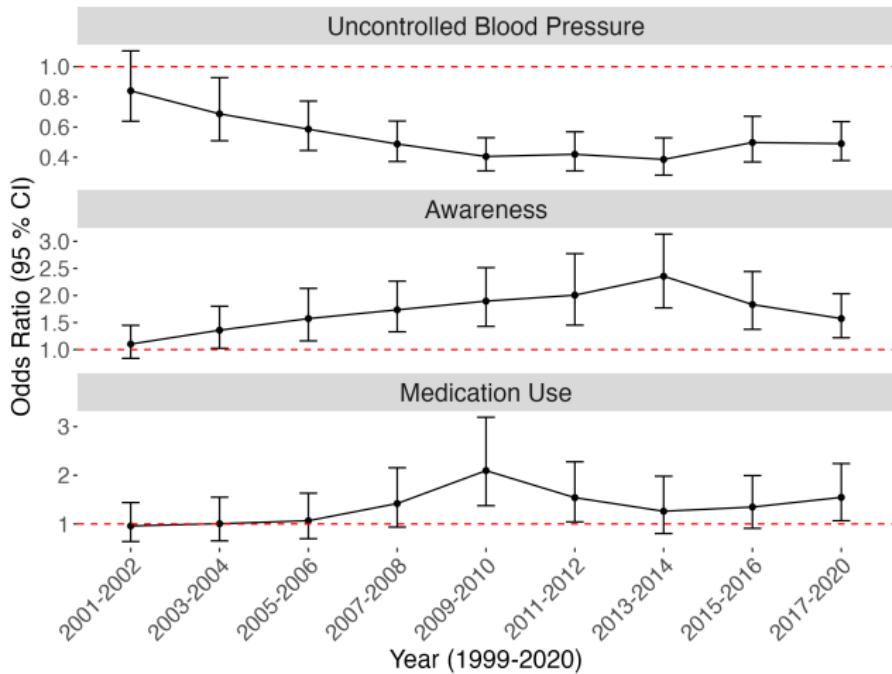


Figure 1: Odds Ratios and 95% CI of Uncontrolled Blood Pressure, Awareness, and Self-reported Antihypertensive Medication Use in U.S. Adults with Hypertension by Year

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

- **Significant treatment gap**
 - Uncontrolled blood pressure: 52%
 - Awareness level: 80%
 - Medication use: 56.8%
- **Gender differences:** Women, slightly more likely to have hypertension than men, show better blood pressure control due to higher awareness and medication adherence.
- **Impact of other chronic diseases:**
 - Diabetes or history of CVD: higher awareness, medication use, and better blood pressure control.
 - CKD: struggle with control despite high awareness and medication use.
- **Trends over time:** Uncontrolled high blood pressure has decreased since 1999, with a peak in awareness in 2013-2014, followed by a decline. Medication use has fluctuated without significant improvement in management over the past 20 years.

Discussion

Suggestions

- **Enhance Public Awareness Campaigns:** especially among men and individuals with chronic kidney disease (CKD), who may experience less effective treatment.
- **Improve Healthcare Accessibility:** help in early detection and continuous control of hypertension.
- **Personalize Treatment Approaches:** Considering the variances in response to medication, particularly among individuals with CKD

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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