

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

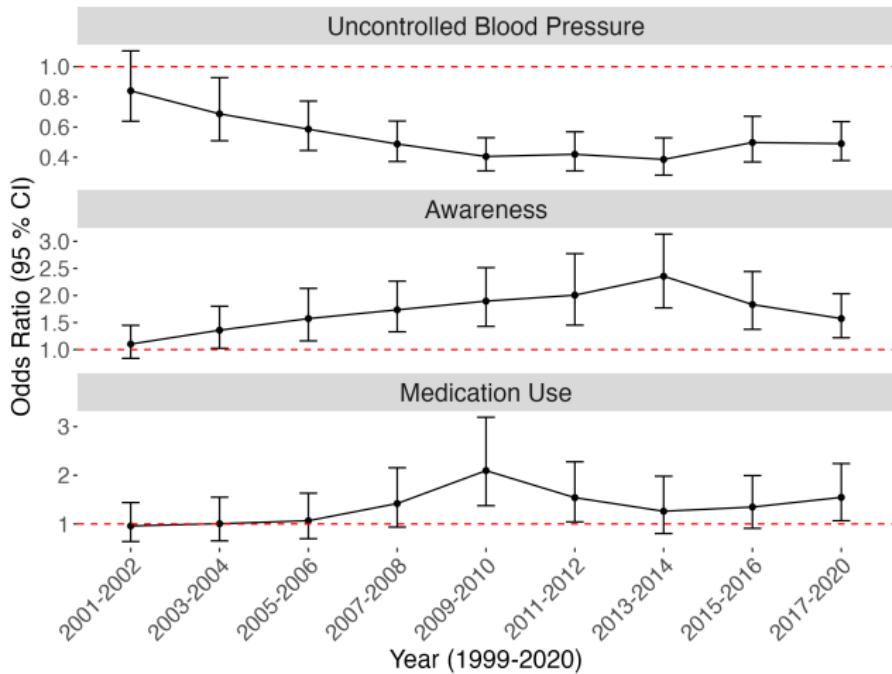


Figure 1: Odds Ratios and 95% CI of Uncontrolled Blood Pressure, Awareness, and Self-reported Antihypertensive Medication Use in U.S. Adults with Hypertension by Year

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: higher awareness and medication → better blood pressure control
- **Impact of other chronic diseases**
 - Diabetes/history of CVD: higher awareness and medication → better blood pressure control
 - CKD: struggle with control despite high awareness and medication use
- **Trends**
 - Uncontrolled decreased
 - Awareness peak in 2013-2014 then decline
 - Medication use no significant improvement

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

- ① Centers for Disease Control and Prevention. Facts about Hypertension. URL <http://www.cdc.gov/bloodpressure/facts.htm/> [Accessed 22 Dec. 2023.]
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- ⑥ Little, R.A. and Rubin, D.B. (2019). Statistical Analysis with Missing Data, Third Edition. John Wiley & Sons.

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Thank you!

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