

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 in stage 2 hypertension among U.S. adults in 1999-2020.
- Assessing the impact of demographic factors and comorbid conditions on hypertension control.
- This study used 1999-2020 National Health and Nutrition Examination Survey (NHANES) data.

Statistical Analysis

- ① Weighting and multiple year adjustment
- ② Multiple Imputation to address missing data
- ③ Logistic Regression Models accounts 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 (Rubin, 2018)

Results

- Gap in high blood pressure treatment!
 - **Hypertension control:** Among the 20,409 participants with stage 2 hypertension, 54% are uncontrolled.
 - **Awareness:** Among those with hypertension, 80% of them are aware of their condition.
 - **Treatment:** Among those aware, 90% of them are taking medication.
- $0.80 \times 0.90 \approx 72\%$ of those with stage 2 hypertension are being medicated.

Results

Table 1: Participant Characteristics, Awareness, and Medication Use Among US Adults with Hypertension, 1999-2020

| Characteristic | Stage 2 Hypertension N = 20,409 ¹ | Awareness N = 16,297 ² | Medication Use N = 14,690 ³ |
|------------------------|---|--------------------------------------|---|
| Age | 64 (53, 74) | 64 (54, 74) | 65 (55, 74) |
| Race/Ethnicity | | | |
| Non-Hispanic White | 9,056 (44%) | 7,240 (44%) | 6,616 (45%) |
| Hispanic/Asian/Other | 5,716 (28%) | 4,368 (27%) | 3,863 (26%) |
| Non-Hispanic Black | 5,637 (28%) | 4,689 (29%) | 4,221 (29%) |
| Gender | | | |
| Male | 10,064 (49%) | 7,665 (47%) | 6,751 (46%) |
| Female | 10,435 (51%) | 8,632 (53%) | 7,939 (54%) |
| BMI | | | |
| <25 | 4,045 (21%) | 2,856 (18%) | 2,497 (18%) |
| 25 to 30 | 6,525 (33%) | 5,098 (32%) | 4,591 (32%) |
| 30+ | 9,147 (46%) | 7,778 (49%) | 7,079 (50%) |
| Unknown | 692 | 565 | 523 |
| Diabetes | 5,376 (26%) | 4,817 (30%) | 4,611 (31%) |
| Chronic Kidney Disease | 6,542 (32%) | 5,560 (34%) | 5,127 (35%) |
| History of CVD | 4,241 (21%) | 3,900 (24%) | 3,704 (25%) |

¹ Stage 2 Hypertension Prevalence: Among the 20,409 participants with hypertension, 9,417 (46%) are controlled.

² Awareness Among Those participants with hypertension: 16,297 (80%) of them are aware of their condition.

³ Medication Usage Among Aware Participants: 14,690 (90%) of them are taking medication.

Results

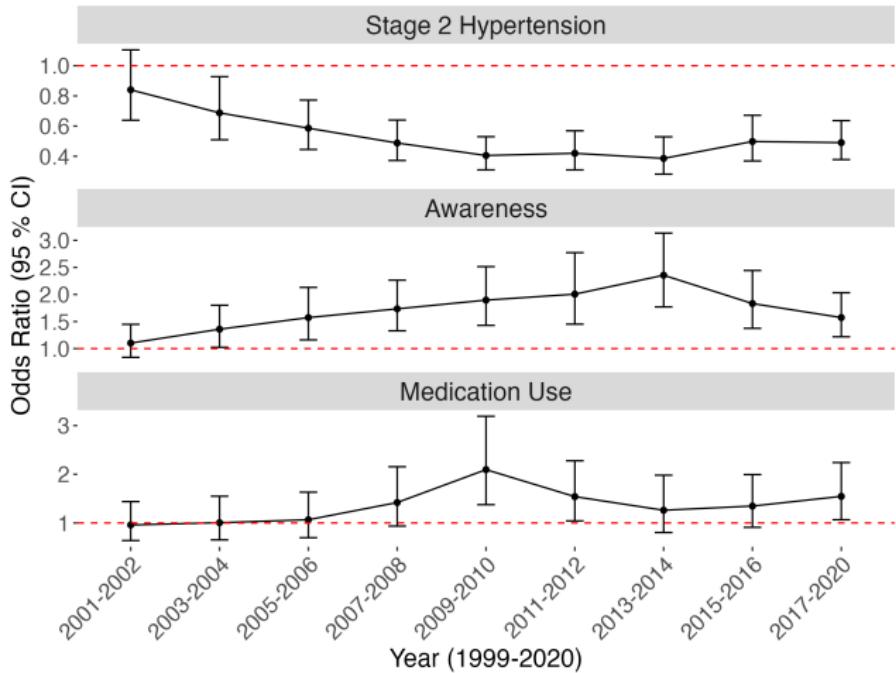


Figure 1: Odds Ratios and 95% CI of Uncontrolled Stage 2 Hypertension, Awareness, and Self-reported Antihypertensive Medication Use in US Adults by Year

Results

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 = 20,409 | Model 2: Awareness N = 16,297 | Model 3: Medication Use N = 14,690 |
|------------------------|---|----------------------------------|---------------------------------------|
| 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) |

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

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

Discussion

Findings

- A gap in high blood pressure treatment
- 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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- ⑥ Rubin, D.B. (2018). Flexible Imputation of Missing Data, Second Edition. Chapman and Hall/CRC.

Thank you!

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