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

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Junuary 16, 2024

Content

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 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

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 $X_i, i = 1, \ ... \ n$, the model can be expressed as:

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

- π is the risk
- $\frac{\pi}{1-\pi}$ is the odds
- β_0 is the log odds for $X_i's = 0$
- β_i is the log odds ratio per unit change of X_i, holding all other covariates fixed

Results

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 [1]	Awareness N = 10,923 [2]	Medication Use N = 6,891 [3]
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%)

[1] Stage 2 Hypertension Prevalence: Among the 56,017 participants, 10,923 (19%) have stage 2 hypertension.

[2] Awareness Among Those with Stage 2 Hypertension: 6,891 (63%) of them are aware of their condition.

[3] Medication Usage Among Aware Participants: 5,293 (77%) of them are taking medication .

Results

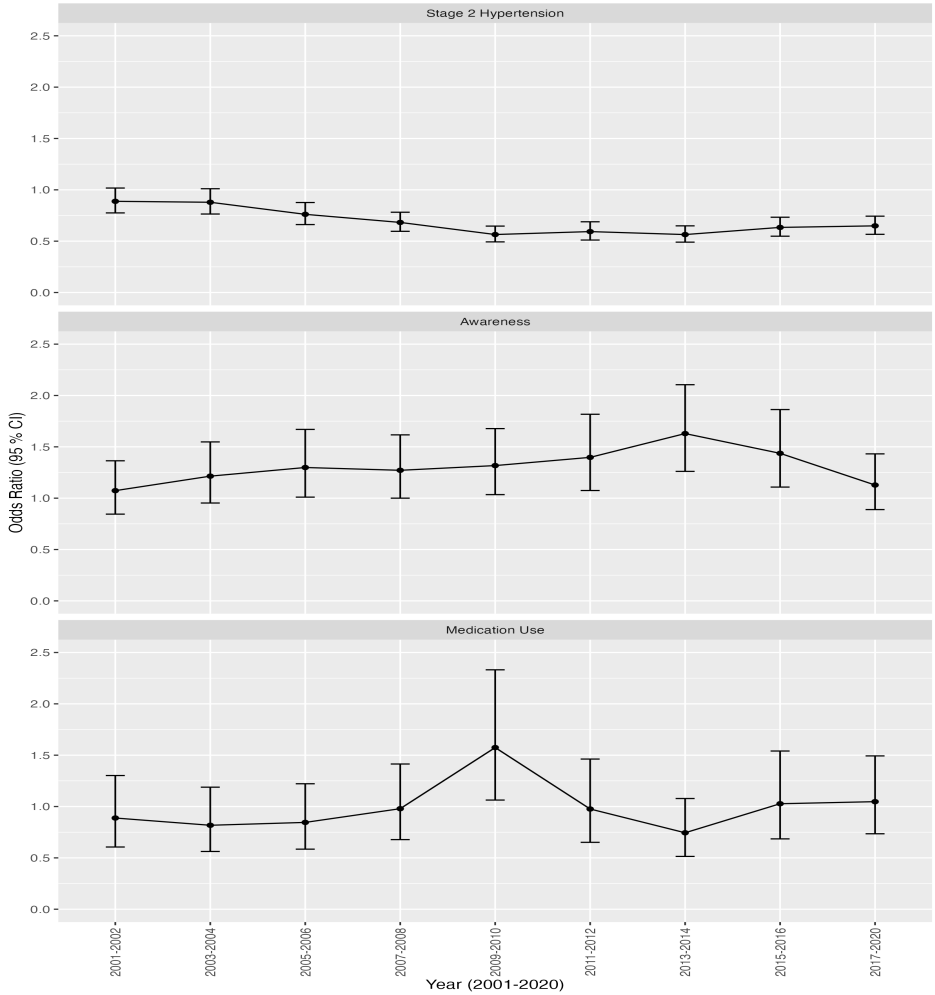

Figure 1: Odds Ratios and 95% CI of Uncontrolled Stage 2 Hypertension, Awareness, and Self-reported Antihypertensive Medication Use in US Adults by Year

Results

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

	Model 1: Stage 2 Hypertension N = 56,017		Model 2: Awareness N = 10,923		Model 3: Medication Use N = 6,891	
Characteristic	**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 $\geqslant$ 130 mm Hg or DBP $\geqslant$ 80 mm Hg.

Stage 2 Hypertension: SBP $\geqslant$ 140 mm Hg or DBP $\geqslant$ 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.