

# Alcohol Use, Passive Smoking, and Hypertension among U.S. Adults

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# Background and Motivation

- Hypertension is a leading risk factor for cardiovascular disease, stroke, and premature mortality that is preventable.
- Lifestyle factors:
  - Cigarette smoking
  - Alcohol consumption
  - Passive (second-hand) smoking
- Prior NHANES studies link alcohol use and passive smoking to hypertension.
- How do these behaviors relate to hypertension, after adjusting for age, BMI, and sociodemographic factors?

## Primary objective

- Assess associations of alcohol use, active smoking, and passive smoking with hypertension among U.S. adults.

## Secondary objectives

- Describe the prevalence of hypertension in the sample.
- Compare characteristics of hypertensive vs. non-hypertensive adults.
- Fit a multivariable logistic regression model for hypertension.
- Evaluate model performance (accuracy, sensitivity, specificity, AUC).

# Data Source and Study Sample

- National Health and Nutrition Examination Survey (NHANES), 2015–2016 cycle.
- Adults aged 20–80 years.
- Required data on:
  - Blood pressure, smoking, alcohol use, passive smoking
  - Age, gender, BMI, education, marital status
- Excluded observations with missing values on these variables.
- **Final sample:** 4,003 adults.

## Outcome: Hypertension

- HTN = 1 if any SBP  $\geq 140$  mmHg or any DBP  $\geq 90$  mmHg.
- HTN = 0 otherwise.

## Main exposures

- Alcohol use:  $\geq 12$  drinks in the past year (Yes/No).
- Active smoking:  $\geq 100$  cigarettes in lifetime (Yes/No).
- Passive smoking: anyone smokes in the home (Yes/No).

## Covariates

- Age, Gender, BMI, education level, marital status.

## Exploratory analysis

- Descriptive statistics and plots.
- Bar plots for smoking and alcohol responses.
- Boxplots of age and BMI by smoking and alcohol status.

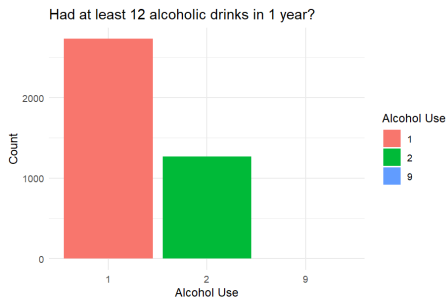
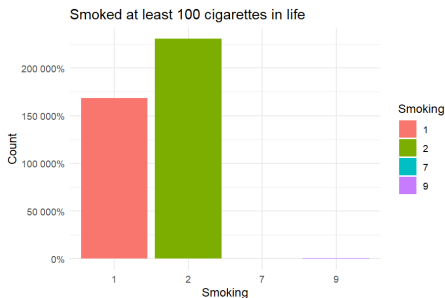
## Statistical tests

- Welch two-sample  $t$ -tests and Wilcoxon rank-sum tests.
- Chi-square tests for categorical variables.
- ANOVA and Kruskal–Wallis tests for age/BMI across behavior groups.

## Modeling

- Multivariable logistic regression for hypertension.
- Performance: confusion matrix, sensitivity, specificity, AUC.

# Exploratory Data Analysis: Smoking and Alcohol

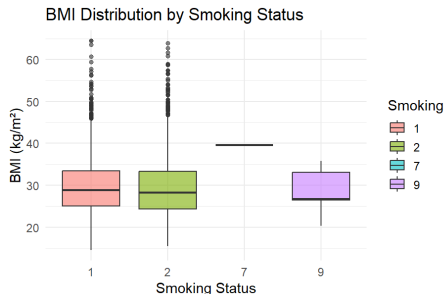
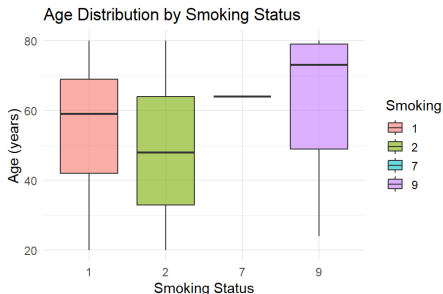


Distribution of lifetime smoking (100+ cigarettes)

Distribution of alcohol use (12+ drinks in past year)

- ~43% smokers; ~68% report drinking in past year.
- Very few “refused” / “don’t know” responses.

# Exploratory Data Analysis: Age and BMI by Smoking



Age distribution by smoking status

BMI distribution by smoking status

- Smokers tend to be older (median  $\approx$  5 years higher).
- BMI distributions are very similar for smokers vs. non-smokers.



# Prevalence and Key Differences

- **Hypertension prevalence:** 1,042 / 4,003 ( $\approx 26\%$ ).

Table: Age and BMI by Hypertension Status

	No HTN	HTN
Mean age (years)	48.2	62.5
Mean BMI ( $\text{kg}/\text{m}^2$ )	29.3	30.6

- Welch  $t$ -tests:  $p < 0.001$  for both age and BMI.
- Hypertensive adults are notably older and slightly heavier on average.

# Behavioral Factors and Hypertension

**Table:** Associations Between Behaviors and Hypertension

Test / Exposure	Statistic	df	p-value
<i>Chi-square tests</i>			
Smoking vs. HTN	$\chi^2 = 12.38$	3	0.006
Alcohol vs. HTN	$\chi^2 = 7.13$	2	0.028
Passive smoke vs. HTN	$\chi^2 = 18.78$	1	< 0.001
<i>ANOVA (age/BMI by behavior)</i>			
Age by smoking	$F = 66.93$	1	< 0.001
BMI by smoking	$F = 1.32$	1	0.25
Age by alcohol	$F = 44.16$	1	< 0.001
BMI by alcohol	$F = 3.71$	1	0.054

- All three behaviors show significant associations with hypertension.
- Age varies strongly across smoking/alcohol groups; BMI does not.
- Suggests possible confounding by age (and demographics).

# Age Cohort Analyses

- Participants were grouped into three age cohorts: 20–39, 40–59, and 60+ years.
- Chi-square tests could only be reliably performed for the 40–59 group due to sparse cells in the other age groups.
- For adults aged 40–59:
  - Smoking vs. hypertension:  $\chi^2 = 1.59$ ,  $p = 0.21$
  - Alcohol vs. hypertension:  $\chi^2 = 0.21$ ,  $p = 0.64$
- No significant association between smoking/alcohol and hypertension within the 40–59 age group.
- Overall, the relationship between lifestyle behaviors and hypertension is not consistent across age groups.

# Multivariable Logistic Regression Results

**Table:** Adjusted Logistic Regression for Hypertension

Predictor	Est.	SE	z	p
(Intercept)	-4.63	0.33	-13.88	< 0.001
Smoking	0.11	0.07	1.62	0.11
Alcohol (12-mo)	-0.00	0.08	-0.04	0.97
Passive smoke (No)	0.07	0.15	0.45	0.65
BMI	0.03	0.01	5.68	< 0.001
Age	0.05	0.00	19.55	< 0.001
Female	-0.19	0.08	-2.30	0.02
Education	-0.08	0.03	-2.67	0.007
Marital status	0.04	0.02	2.08	0.04

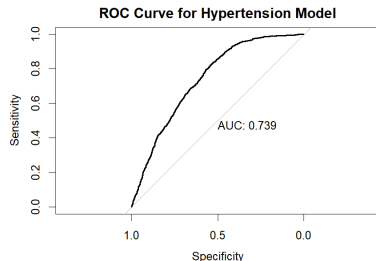
- Strong predictors: age, BMI; also gender, education, marital status.

# Model Performance

Table: Confusion Matrix (threshold 0.5)

	Pred. No HTN	Pred. HTN
Obs. No HTN	2756	205
Obs. HTN	829	213

- Accuracy: 0.742
- Sensitivity: 0.204
- Specificity: 0.931
- AUC: 0.739



ROC curve for hypertension model.

# Conclusion

- Age, BMI, and sociodemographic factors are strong predictors of hypertension among U.S. adults.
- Associations of alcohol use, smoking, and passive smoking with hypertension are largely attenuated after adjustment.
- Results highlight the multifactorial nature of hypertension risk and the importance of addressing both lifestyle behaviors and broader demographic and socioeconomic determinants.

# Thank you!