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PREVALENCE OF HYPERTENSION AMONG MEN AND WOMEN IN ANDHRA PRADESH

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Abstract

Hypertension is a major non-communicable disease and an important public health concern because of its association with cardiovascular disease, stroke, kidney disease and premature mortality. The present study examines the prevalence of hypertension among men and women in Andhra Pradesh and identifies the demographic, socioeconomic and lifestyle factors associated with hypertension. The study is based on secondary data obtained from the fourth round of the National Family Health Survey (NFHS-4), conducted during 2015–2016. The analysis includes 1,541 male respondents and 10,428 female respondents from Andhra Pradesh. Hypertension prevalence was estimated according to selected demographic, socioeconomic and behavioural characteristics. Chi-square tests were used to examine associations, while binary logistic regression was employed separately for men and women to identify significant predictors of hypertension. The findings indicate a higher prevalence of hypertension among men (18.5%) than women (11.5%). Age emerged as the strongest predictor of hypertension among both sexes, with the likelihood of hypertension increasing substantially with advancing age. Marital status, educational attainment and wealth status were also significantly associated with hypertension. Among men, tobacco use and alcohol consumption were significant behavioural risk factors, whereas these associations were not statistically significant among women. Place of residence was not a significant independent predictor after multivariate analysis. The study demonstrates clear gender differences in the prevalence and determinants of hypertension in Andhra Pradesh. The findings highlight the need for age-specific, gender-sensitive and district-focused hypertension screening, health education, lifestyle modification and preventive interventions, particularly among high-risk population groups.

Keywords: Hypertension, Prevalence, Men and Women, Gender Differences, Socioeconomic Determinants and Lifestyle Factors.

1.1 Concept of Hypertension

Blood pressure (BP) is the product of cardiac output multiplied by peripheral resistance. In normal circulation pressure is exerted by flow of blood through heart and blood vessels. High blood pressure known as hypertension can result from a change in cardiac output, a change in peripheral resistance or both. Hypertension is defined as a systolic blood pressure greater than 140 mm of Hg and diastolic blood pressure greater than 90mm of Hg based on the average of two or more correct blood pressure measurements taken during two or more contacts with a health care provider.

Our modern understanding of hypertension began with the work of physician William Harvey (1578-1657), who was the first to describe correctly the systemic circulation of blood being pumped in the body by the heart in his book 'De motu cordis'. The basis for measuring blood pressure was established by Stephen Hales in 1733. Initial description of hypertension as a disease came from Thomas Young in 1808 and specially Richard Bright in 1836. The first ever elevated blood pressure in a patient without kidney disease was reported by Frederick Mahomed (1849-1884). Studies in the 1920s demonstrated the public health impact of untreated high blood pressure as treatment options were limited at the time, deaths and complications of hypertension were common.

According to Smeltzer Suzanne and Bare G. Brenda (2004), the seventh report of Joint National Committee on Prevention, Detection, Evaluation and treatment of High blood pressure classifies hypertension into four categories namely, Normal, pre-hypertension, stage-1 hypertension and stage-2 hypertension. Normal is systolic blood pressure less than 120 and diastolic blood pressure less than 80 mm Hg. Pre-hypertension is systolic blood pressure between 120-139 and diastolic



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blood pressure 80-89 mm Hg. In Stage 1 hypertension systolic pressure is 140-159 and diastolic pressure is 90- 99 mm Hg. Stage-2 hypertension is systolic pressure above or equal to 160 and diastolic pressure above or equal to 100 mm Hg.

Table: 1.1 Classification of Blood Pressure

S. No.	Type of Blood Pressure	Range of Systolic and Diastolic pressure
1	Normal	<120 and <80 mm Hg
2	Pre-hypertension	120-139 and 80-89 mm Hg
3	Stage-1 hypertension	140-159 and 90-99 mm Hg
4	Stage-2 hypertension	Above or equal to 160 and above or equal to 100 mm Hg

Hypertension is one of the leading non-communicable diseases (NCDs) and a major contributor to cardiovascular diseases, stroke, chronic kidney disease and premature mortality worldwide. The increasing prevalence of hypertension in India has become a significant public health concern due to rapid urbanization, population ageing, unhealthy dietary habits, obesity, physical inactivity and increased stress. The National Family Health Survey-4 (NFHS-4, 2015–16) provides nationally representative data on blood pressure measurements among adults, making it an important source for studying hypertension and its determinants.

1.2. Global Evidence on Hypertension

According to the World Health Organization (WHO), approximately 1.28 billion adults aged 30–79 years suffer from hypertension globally, with nearly two-thirds living in low- and middle-income countries. Hypertension is often referred to as the "silent killer" because many individuals remain unaware of their condition until severe complications occur. Several international studies have identified age, obesity, alcohol consumption, tobacco use, sedentary lifestyle and family history as major determinants of hypertension.

1.3. Hypertension in India

India has experienced a rapid epidemiological transition from communicable to non-communicable diseases. National surveys indicate that hypertension prevalence has increased steadily over the last two decades. Urban populations generally exhibit higher prevalence than rural populations due to lifestyle changes, although recent evidence suggests that hypertension is increasing rapidly in rural areas as well. Studies consistently report that hypertension prevalence increases with age and varies according to gender, educational status, wealth, body mass index (BMI), tobacco use, alcohol consumption and place of residence.

1.4. Hypertension in Andhra Pradesh

The NFHS-4 State Fact Sheet for Andhra Pradesh reported that approximately **13% of women (15–49 years)** and **18% of men (15–49 years)** were hypertensive. The prevalence increased steadily with age among both sexes. Men consistently exhibited higher hypertension prevalence than women across most age groups. Earlier community-based studies conducted in Andhra Pradesh demonstrated that urban residents had higher blood pressure than rural populations. Age, alcohol consumption and urban residence were identified as significant determinants of hypertension, particularly among men. Recent evidence also indicates that hypertension prevalence in Andhra Pradesh has continued to increase because of rapid urbanization, sedentary lifestyles, dietary changes and population ageing.



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1.5 Review of Literature

A nationwide study by **Anand et al. (2021)¹** used NFHS-4 data to examine sex differences in hypertension among Indian adults. Using multiple logistic regression, the authors found that the overall prevalence of hypertension was **16.3% among men and 11.6% among women**. Age was the strongest predictor of hypertension for both sexes. Men had higher prevalence across most socioeconomic groups, whereas women showed a sharper increase in hypertension with advancing age. The study also reported significant associations with obesity, alcohol consumption, tobacco use, wealth status and urban residence. **Talukdar et al. (2021)²** analysed NFHS-4 data to investigate undiagnosed hypertension among women aged 15–49 years. Using logistic regression, they found that older age, obesity, urban residence, higher socioeconomic status and alcohol consumption significantly increased the likelihood of undiagnosed hypertension. Another NFHS-4-based study examining non-pregnant women of reproductive age reported an overall hypertension prevalence of approximately 10.9%. The study concluded that age, overweight/obesity, alcohol consumption and metabolic comorbidities were significant predictors of hypertension. These studies consistently show that age and BMI are the strongest predictors of hypertension, while lifestyle factors such as alcohol consumption and tobacco use further increase the risk. **Soumitra Ghosh and ManishKumar (2019)³** in this study provide estimates on the prevalence of hypertension at the state and district level, a prerequisite for designing effective interventions. Besides, the study aims to identify the risk factors of hypertension. They analysed cross-sectional survey data from the fourth round (2015–2016) of National Family Health Survey (NFHS). NFHS was conducted between January 2015 and December 2016, gathering information on a range of indicators including blood pressure. The age adjusted prevalence of hypertension was calculated for national and state level comparison was studied. **Kaushik Mukhopadhyay et al., (2019)⁴** they investigated hypertension awareness, treatment and control and its association with patient level socioeconomic factors are limited in India. The objectives of this study were to determine association of demographic variables like age, sex, habitat, wealth, religion and educational status with prevalence, awareness, treatment and control of hypertension among rural and urban subjects in different states and union territories of India from NFHS-4 data. Data of 803211 subjects were taken from NFHS survey in 36 states and union territories of India, in 2015- 2016. Prevalence of hypertension and its awareness, treatment and control status and their association risk factors were determined. **Vishal Vennuet. al., (2019)⁵** they studied overweight, obesity, hypertension and diabetes increase the risk of non-communicable diseases and all-cause mortality worldwide. Previous studies have not determined the prevalence of these conditions/diseases throughout India. **Harmeet Kaur and Bani Tamber Aeri (2017)⁶** investigated prevalence of non-communicable diseases is reaching epidemic proportions both in developed and developing nations. Non-communicable diseases (NCDs) kill 40 million people each year, equivalent to 70% of all deaths globally. The National Family Health Survey is a large –scale, multi –round survey conducted in a representative sample of households throughout India. For the very first time NFHS in its fourth series expanded the domain of clinical anthropometric and biochemical testing (CAB) and included blood glucose and hypertension measurements. According to the NFHS 4-National fact sheet, the prevalence of hypertension is more widespread in men (13.6%) than female (8.8%) population and also it is higher in case of urban subjects than the rural counterparts. **Manoj Kumar Singh et al. (2016)⁷** they studied on the prevalence of hypertension and its associate risk factors in a rural population. They focused on cross sectional study was conducted by the Department of community medicine in the rural field practice area of a medical college of Nellore from October 2013 to September 2015. The socio demographic variables and risk factors were obtained by interviewing the subjects in the study and collected in a predesigned questionnaire sheet. The sample size was calculated by prevalence of HTN in previous studies and 1025 subjects were included. The blood pressure was assessed and classified using recent JNC 7 and WHO criteria to grade hypertension.

1.5.1. Research Gap

Although several national studies have investigated hypertension using NFHS-4 data, relatively few studies have focused exclusively on Andhra Pradesh while comparing men and women using multivariable logistic regression. Most previous studies present national estimates or descriptive statistics without providing state-specific evidence. Therefore, there is a need to estimate the prevalence of hypertension among men and women in Andhra Pradesh and identify the independent socioeconomic, demographic and behavioural determinants using logistic regression analysis. Therefore, this study was aimed to address this limitation. Data on these conditions/diseases among men and women aged ≥ 18 years were



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obtained from the fourth National Family Health Survey conducted throughout India between January 2015 and December 2016. The prevalence and prevalence rate per 100,000 populations were calculated at the national level and by age group, sex and type of residence for each state and union territory.

1.6. Statement of the Problem

A study to assess the prevalence of hypertension in Andhra Pradesh is to identify the risk factors of hypertension. Hypertension is one of the dangerous diseases in both developed and developing countries as it mainly affects our vital organs such as heart, brain and kidney. Its public health significance is due to its high incidence rate, its association with heart diseases, brain stroke and kidney diseases.

Many life style practices such as smoking, alcoholism, lack of exercise, stress contribute to hypertension so; if we modify these practices then hypertension can be controlled. Lifestyle modification has important roles in hypertensive as well as non-hypertensive individuals. Lifestyle modifications can serve as initial treatment before the start of drug therapy in hypertension patients and as an adjunct to medication in persons already on drug therapy. In hypertensive individuals whose Blood Pressure is controlled by drugs, these therapies can facilitate drug reduction and drug withdrawal in highly motivated individuals who achieve and sustain lifestyle changes. In non-hypertension lifestyle modification has the potential to prevent hypertension and more broadly to reduce BP and there by lower the risk of BP related clinical complications in whole populations. A small reduction in BP, if applied to an entire population, could have a large beneficial effect on cardiovascular system and its events.

1.7. Need of the Study

Heart disease is amongst the nation 's leading causes of death and disability. It can affect anyone without regard to age, race and gender or income level. And as our population ages, these largely preventable conditions are projected to increase. The cause of cardiovascular disease can be reduced by choosing a healthy lifestyle. We have tools to reduce the disturbing impact of cardiovascular disease on individuals, their families and nation 's economy. We can take significant steps towards a heart healthy India through several actions. So early screening, prevention and control of cardiovascular disease is of very much importance. With growing problem of hypertension worldwide, there is a concern that hypertension according to NFHS-4 data shows that age group between 20-24 to 30-39 are young adults may also be on the rise and that cases are not identified because of inadequate screening at this age group. Repeated testing, blood pressure measurement & monitoring are required to distinguish this group from true hypertension. Such studies insight into the magnitude of the health problem in adults is important in determining the need for early blood pressure monitoring. It is never too early to start lifestyle modification and intervene to prevent hypertension, heart disease.

This disease has lifelong and life-threatening implications. People with high blood pressure are three times more likely to have a heart attack and eight times more likely to suffer a stroke, than people with normal blood pressure. Though essential hypertension remains somewhat mysterious, it has been linked to certain risk factors. High blood pressure tends to run in families and is more likely to affect men than women. Essential hypertension is also greatly influenced by diet and lifestyle. The link between salt and high blood pressure is especially compelling. Other factors that have been associated with essential hypertension include obesity; diabetes; stress; insufficient intake of potassium, calcium and magnesium; lack of physical activity; and chronic alcohol consumption. Some studies also suggest that identifying risk factors will help people to adopt lifestyle modifications and maintain blood pressure within normal limits. The literature also shows that there is rapid increase in number of lifestyle diseases like obesity, diabetes and heart problems. So that to identify prevalence and risk factors of hypertension in Andhra Pradesh.

NHFS survey is a periodically conducted survey, which delivers data on health and healthcare of a representative sample. In Andhra Pradesh total 11969 households, 1541 men and 10428 women were interviewed from numerous primary sampling units (PSU). It included rural areas and census enumeration blocks (CEB) in urban areas all over Andhra Pradesh (NFHS-4, 2015-16). In this study have made an effort to understand hypertension and its association with socioeconomic



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factors such as household age, sex, place of residence, wealth index, religion and educational status in all districts of Andhra Pradesh.

1.8. Objectives of the Study

- ✓ Estimation of hypertension among male and female respondents by demographic, socioeconomic and lifestyle characteristics in Andhra Pradesh.
- ✓ Test of Association between hypertension and sample characteristics among the male and female respondents in Andhra Pradesh.
- ✓ Prevalence of hypertension among male and female respondents by using the logistic regression analysis in Andhra Pradesh using the NFHS-4.

1.9. Data Source

In this study used the country's one of the important demographic and health database, the latest round of National Family Health Survey 2015–16 (NFHS-4). This multi-round large scale survey was conducted under the leadership of the Ministry of Health and Family Welfare (MoHFW) and coordinated by the International Institute of Population Sciences (IIPS), Mumbai. It provides essential information on household population and housing characteristics, basic demographic and socio-economic characteristics of respondents, fertility, family planning, infant and child mortality, maternal and child health, nutrition and anaemia, morbidity and health care, HIV/ AIDs including other adult health issues, women empowerment and domestic violence at the all India, state and the district levels. However, the NFHS-4 was first in the NFHS series to provide reliable information on emerging health-related issues like blood glucose levels and hypertension in the general population.

1.10. Methodology

This study is mainly based on secondary data obtained from the fourth wave of National Family Health Survey (NFHS), which is the Indian version of Demographic and Health Survey. NFHS-4 was conducted under the stewardship of the Ministry of Health and Family Welfare (MoHFW) government of India. By using two-stage stratified random sampling approach by selecting primary sampling units from villages in rural areas and census enumeration blocks in urban areas with probability proportional to population size at the first stage and subsequently, picking the same number of households from each of selected primary sampling units through systematic random sampling. The NFHS-4 was administered across Primary Sampling Units (PSU) in rural areas and Census Enumeration Blocks (CEB) in urban areas. The background characteristics of eligible survey participants were collected using two different structured questionnaires for female respondent ages between 15-49 years ($N=10428$) and male respondents ages between 15-54 years ($N=1541$) from all districts in Andhra Pradesh state. The study identifying the associated risk factors of the hypertension by using chi square test of association and logistic regression analysis separately for male and female respondents independently in Andhra Pradesh. The statistical analysis is performed using Statistical Package for the Social Sciences, version 26.0 and STATA version 14.

The survey protocol including the content of all survey questionnaires was approved by the IIPS Institutional Review Board and the ICF Institutional Review Board and reviewed by the U.S. Centres for Disease Control and Prevention (CDC). Further details of the sampling design used for the survey can be found in the national report of NFHS-4.

1.11. Logistic Regression Analysis

Regression methods are an integral component of any data analysis concerned with describing the relationship between a categorical response variable and one or more explanatory factors. It is often the case that the outcome variable is discrete, taking on two or more values. Logistic regression model can be used mainly for two reasons. The first is from a mathematical point of view, it is an extremely flexible and easily used function and the second is that it leads itself to meaningful interpretation.



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1.12. Binary Logistic Regression Model

The model can have an arbitrary number of parameters and terms in the model representing qualitative variables, quantitative variables and interaction terms in order to model dichotomous or categorical outcome variable. When explanatory variables are included to model probabilities, a problem is that probabilities are restricted to the domain between 0 and 1, whereas a linear effect for an explanatory variable could take the fitted value outside this interval. Instead of the probability of an event, one may consider the odds: the ratio of the probability of success to the probability of failure. When the probability of success is p , the odds are $\left(\frac{p}{1-p}\right)$. In contrast to probabilities, odds can assume any value from 0 to infinity and odds can be considered to constitute a ratio scale. The logarithm transforms a multiplicative scale to an additive scale. Indeed, one of the most widely used transformations of probabilities is the log odds, defined by

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right)$$

Where $\ln(x)$ denotes the natural logarithm of a positive number. The logit function is an increasing function assuming values between 0 and 1 and it is defined over the set of real numbers. The logistic regression model is a model where $\text{logit}(p)$ is a linear function of the explanatory variables. For a binary response variable, the logit transformation of success probability, p_i of the i^{th} individual can be modelled as a linear combination of k explanatory variables.

$$\text{logit}(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki}$$

Implies that

$$p_i = \frac{e^{\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki}}}{1 + e^{\beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki}}}$$

Where a model parameter β_i will be interpreted as the change in the log odds for a one unit increase in, X_i holding all the other predictor constant.

1.13. Dependent Variable

A dependent variable is the outcome or response due to effect of independent variable which researcher wants to predict or explain. It may reflect the effect associated with the manipulation of independent variable. The selection of an appropriate variable must be based on practical and theoretical considerations which are in turn determined by a consideration of the sensitivity, reliability and practicability of possible dependent variable. It is important that the observation within each treatment or combination of treatment must be normally distributed. In the present study the dependent is blood pressure i.e., respondent having hypertension is represented as 1 and respondent not having hypertension is represented as 0.

1.14. Independent Variable

Independent variables are variables that cause an impact on dependent variables. The selection of an appropriate independent variable should be based on concerned research literatures, the need for the type of impact and on research designing. In this study, we considered demographic, socio-economic and lifestyle characteristics as covariates in order to identify the important risk factors associated with hypertension among men and women. Age was categorized as 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49 for women and 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49 and 50-54 for men respectively. Other demographic and socio-economic information include place of residence (rural or urban), education



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level (no education, primary, secondary or higher), marital status (never married or married, widowed, divorced, separated), religion (Hindus, Muslims, Christian and others), caste (SC, ST, OBC or others), wealth quintile (poorest, poorer, middle, richer or richest) and state of residence. The lifestyle factors were frequency of drinking alcohol (yes or no), tobacco uses (yes or no) respectively.

The prevalence of hypertension and risks factors among respondents using the logistic regression model is aimed to estimating the prevalence of hypertension, testing for the association between the dependent variable and independent variables and to model hypertension in Andhra Pradesh state. In this study the male is more hypertensive compared to the female with (1541)18.5%and (10428) 11.5% respectively. It was discovered that increasing age, educational qualification and wealth index and tobacco use and alcohol consumption are the major risk factors of hypertension using multivariate logistic regression analysis.

Table:1 Odds ratios for hypertension among men by using demographic and Lifestyle characteristics

Hypertension	Odds Ratio	Std. Err.	z	p-value	95% Conf. Interval	
Age groups						
15-19	1					
20-24	1.269	0.555	0.550	0.585@	0.539	2.990
25-29	2.620	1.127	2.240	0.025*	1.128	6.087
30-34	3.166	1.490	2.450	0.004**	1.259	7.962
35-39	4.352	2.055	3.110	0.002**	1.725	10.982
40-44	5.785	2.751	3.690	0.000**	2.278	14.691
45-49	7.290	3.435	4.220	0.000**	2.895	18.356
of Residence						
Rural	1					
Urban	0.843	0.148	0.970	0.330@	0.598	1.189
Marital Status						
Never Married	1					
Married	1.071	0.328	0.220	0.001**	0.588	1.951
Widowed	1.592	1.262	0.590	0.000**	1.337	7.532
Divorced	5.585	1.649	0.820	0.000**	1.897	8.327
Social Category						
Schedule caste	1					
Schedule tribe	2.196	0.759	2.280	0.023*	1.116	4.322
OBC	0.798	0.183	0.980	0.326@	0.509	1.252
None of them	1.164	0.292	0.610	0.545@	0.712	1.904
Hypertension	Odds Ratio	Std. Err.	z	p-value	95% Conf. Interval	
Religion						
Hindu	1					
Muslim	1.076	0.271	0.290	0.770@	0.657	1.763
Christian	0.951	0.386	-0.120	0.901@	0.429	2.106
Education level						



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No education	1					
Primary	1.190	0.280	0.740	0.458@	0.751	1.887
Secondary	1.211	0.251	0.920	0.001**	0.807	1.817
Higher	1.146	0.311	0.500	0.000**	0.673	1.952
Wealth Index						
Poorest	1					
Poorer	0.897	0.417	2.630	0.015*	0.361	2.230
Middle	1.864	0.819	2.420	0.000**	1.788	4.412
Richer	2.201	0.987	3.760	0.001**	1.914	5.300
Richest	2.555	1.234	2.940	0.000**	1.991	6.585
Tobacco use						
No	1					
Yes	2.473	0.638	2.421	0.000**	3.416	14.684
Alcohol consumption						
No	1					
Yes	1.173	0.177	2.050	0.000**	2.872	4.578

** 1% Level of Significant ($p < 0.01$); * 5% Level of Significant ($p < 0.05$); @ Not Significant

From the above table age was found to be an important predictor of hypertension. The likelihood of being hypertensive increased significantly with age. ORs suggest that the risk of hypertension (OR=7.290; Std.Err.=3.435; 95% CI:2.895-18.356; $p < 0.000$) times higher in older to age group (45-49 years) than in younger age group (15-19 years), (OR=5.785; Std.Err.=2.751; 95% CI:2.278-14.691; $p < 0.000$) times higher in older to age group (40-45 years) than in younger age group (15-19 years), (OR=4.352; Std.Err.=2.055; 95% CI:1.725-10.982; $p < 0.000$) times higher in older to age group (35-39 years) than in younger age group (15-19 years), (OR=3.166; Std.Err.=1.490; 95% CI:1.259-7.962; $P < 0.004$) times higher in older to age group (30-34 years) than in younger age group (15-19 years), (OR=2.620; Std.Err.=1.127; 95% CI:1.128-6.087; $P < 0.025$) times higher in older to age group (25-29 years) the age group (20-24 years) are statistically not significant. Compared with those age groups 15-24 is people age being increased having considerably age group 25-49 are likely to have hypertension. Place of residence is not statistically significant so prevalence of hypertension was not much so there is no difference in the area.

The differences in prevalence probabilities between married, widowed and single were statistically significant. Those who were widowed, separated and divorced were more likely to have hypertension than their single counterparts (OR=1.071; Std.Err. =0.328; CI=0.588-1.951; $p < 0.001$) married men are more likely to have hypertension than never married men. (OR=1.592; Std.Err. =1.262; CI=1.337-7.532; $p < 0.030$) widowed men are more likely to have hypertension than never married men. (OR=5.585; Std.Err. =1.649; CI=1.897-8.327; $p < 0.001$) divorced men are more likely to have hypertension than never married men. Interestingly, married persons were also found to be at greater risk of hypertension than those who were never married or single.

Caste differences in prevalence of hypertension were not much. Religion differences in prevalence of hypertension were not much.

Educational attainment seems to be inversely related with prevalence, though the effect of education was not significant among those who studied only up to primary level. But persons with secondary (OR=1.211 Std.Err. =0.251; CI=0.807-1.817; $p < 0.001$) or higher education (OR=1.146; Std.Err. =0.311; CI=0.673-1.952 $p < 0.002$) were less likely to be hypertensive as compared with those with no formal education.



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The differences in prevalence probabilities between wealth index such as poorer, middle, richer and richest were statistically significant. Those who were middle, richer and richest were more likely to have hypertension than poorer (OR=0.897; Std.Err. =0.417; CI=0.361-2.230; $p<0.015$) poorer male respondent are more likely to have hypertension than poorest male respondent. (OR=1.864; Std.Err. =0.819; CI=1.788-4.412; $p<0.000$) middle wealth index male respondent is more likely to have hypertension than poorest male respondent. (OR=2.201; Std.Err. =0.987; CI=1.914-5.300; $p<0.001$) richer wealth index male respondent is more likely to have hypertension than poorest male respondent. (OR=2.555; Std.Err. =1.243; CI=1.991-6.585; $p<0.000$) richest wealth index male respondent is more likely to have hypertension than poorest male respondent. Compared with those in poorest quintile, people from richest quintile were having considerably higher likelihood of hypertension.

Tobacco use persons were significantly more likely to suffer from hypertension (OR=2.473, Std.Err. =0.638; CI=3.416-14.684; $p<0.000$) are statistically significant compared with those who are non-tobacco use persons; tobacco use persons were having the higher level of hypertension respectively. Alcohol consumption was found to be positively related with hypertension; however, those who drank alcohol almost (OR=1.173; Std.Err. =0.177; CI=2.872-4.578; $p<0.000$), are higher risk of hypertension than people without alcohol use habit.

Table:2 Odds ratios for hypertension among women by using demographic and Lifestyle characteristics

Hypertension	Odds Ratio	Std. Err.	z	p-value	95% Conf. Interval	
Age group						
15-19 years	1					
20-24 years	2.215	0.543	3.240	0.001**	1.370	3.582
25-29 years	3.790	0.989	5.270	0.000**	2.309	6.223
30-34 years	6.905	1.739	7.670	0.000**	4.215	11.311
35-39 years	9.935	2.483	9.190	0.000**	6.087	16.215
40-44 years	15.469	3.889	10.890	0.000**	9.451	25.319
45-49 years	23.167	5.795	12.560	0.000**	14.189	37.825
Place of Residence						
Rural	1					
Urban	1.000	0.078	0.000	1.000@	0.859	1.164
Marital Status						
Never Married	1					
Married	1.755	0.138	1.540	0.023*	0.528	1.079
Widowed	1.940	0.199	2.290	0.030*	0.621	1.423
Divorced	1.278	0.210	1.690	0.001**	0.630	1.225
Separated	1.729	0.224	1.030	0.003**	0.399	1.331
Social Category						
Schedule caste	1					
Schedule tribe	1.029	0.163	0.180	0.858@	0.754	1.404
OBC	0.907	0.084	1.050	0.292@	0.757	1.087
None of them	0.844	0.092	1.560	0.118@	0.682	1.044
Don't know	1.126	0.498	0.270	0.788@	0.473	2.680



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Religion						
Hindu	1					
Muslim	1.338	0.146	2.670	0.008**	1.080	1.658
Christian	1.259	0.164	1.770	0.077@	0.975	1.625
Education Level						
No education	1					
Primary	1.167	0.111	1.620	0.105@	0.969	1.405
Secondary	1.191	0.103	2.010	0.044*	1.005	1.412
Higher	0.868	0.129	1.950	0.002**	1.018	1.662
Hypertension	Odds Ratio	Std. Err.	z	p-value	95% Conf. Interval	
Wealth Index						
Poorest	1					
Poorer	0.875	0.165	1.710	0.003**	0.605	1.266
Middle	1.938	0.169	2.360	0.001**	0.658	1.335
Richer	1.185	0.218	3.920	0.000**	1.826	2.701
Richest	2.194	0.241	5.880	0.000**	1.934	3.773
Tobacco Use						
No	1					
Yes	2.914	0.525	0.983	0.537@	1.368	3.272
Alcohol Consumption						
No	1					
Yes	1.427	0.606	0.840	0.402@	0.621	3.280
_cons	0.021	0.006	14.440	0.128@	0.012	0.135

** 1% Level of Significant (p<0.01); * 5% Lever of Significant (p<0.05); @ Not Significant

From the above table age was found to be an important predictor of hypertension. The likelihood of being hypertensive increased significantly with age. ORs suggest that the risk of hypertension (OR=23.167; Std.Err.=5.795; 95% CI:14.189-37.825; p<0.000) times higher in older to age group (45-49 years) than in younger age group (15-19 years), (OR=15.469; Std.Err.=3.889; 95% CI:9.451-25.319; p<0.000) times higher in older to age group (40-45 years) than in younger age group (15-19 years), (OR=9.935; Std.Err.=2.483; 95% CI:6.087-16.215; p<0.000) times higher in older to age group (35.39 years) than in younger age group (15-19 years), (OR=6.905; Std.Err.=1.739; 95% CI:4.215-11.311; P<0.000) times higher in older to age group (30-34 years) than in younger age group (15-19 years), (OR=3.790; Std.Err.=0.989; 95% CI:2.309-6.223; P<0.000) times higher in older to age group (25-29 years) and (OR=2.215; Std.Err.=0.543; 95% CI:2.309-6.223; P<0.001) times higher in older to age group (20-24 years) than in younger age group (15-19 years) than in younger age group (15-19 years). Place of residence is not statistically significant so prevalence of hypertension were not much so there is no difference in the area.

The differences in prevalence probabilities between married, widowed and single were statistically significant. Those who were widowed, separated and divorced were more likely to have hypertension than their single counterparts (OR=1.755; Std.Err. =0.138; CI=0.258-1.079; p<0.001) married female respondent are more likely to have hypertension than never married female respondent. (OR=1.940; Std.Err. =0.199; CI=0.030-0.621; p<0.030) widowed female respondent are more likely to have hypertension than never married female respondent. (OR=1.278; Std.Err. =0.210; CI=0.630-1.225; p<0.001) divorced female respondent are more likely to have hypertension than never married female respondent.



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Interestingly, married persons were also found to be at greater risk of hypertension than those who were never married or single.

Caste differences in prevalence of hypertension were not much. Religion differences in prevalence of hypertension were not much, except that persons belonging to Muslim were likely to have the condition (OR=1.338; Std.Err. =0.146; CI=1.080-1.658; $p<0.001$) as compared with those from others.

Educational attainment seems to be inversely related with prevalence, though the effect of education was not significant among those who studied only up to primary level. But persons with secondary (OR=0.1191 Std.Err. =2.010; CI=1.005-1.412; $p<0.04$) or higher education (OR=0.868; Std.Err. =0.129; CI=1.018-1.662 $p<0.002$) were less likely to be hypertensive as compared with those with no formal education.

The differences in prevalence probabilities between wealth index such as poorer, middle, richer and richest were statistically significant. Those who were middle, richer and richest were more likely to have hypertension than poorer (OR=0.875; Std.Err. =0.165; CI=0.605-1.266; $p<0.003$) poorer female respondent are more likely to have hypertension than poorest female respondent. (OR=1.938; Std.Err. =0.169; CI=0.658-1.335; $p<0.001$) middle wealth index female respondent is more likely to have hypertension than poorest female respondent. (OR=1.185; Std.Err. =0.218; CI=1.826-2.701; $p<0.001$) richer wealth index female respondent is more likely to have hypertension than poorest female respondent. (OR=2.194; Std.Err. =0.241; CI=1.934-3.773; $p<0.000$) richest wealth index female respondent is more likely to have hypertension than poorest female respondent. Compared with those in poorest quintile, people from richest quintile were having considerably higher likelihood of hypertension.

Tobacco use persons were significantly more likely to suffer from hypertension (OR=2.914, Std.Err. =0.525; CI=1.368-3.272; $p>0.05$) are statistically not significant. Tobacco use in prevalence of hypertension was not much. Alcohol consumption in prevalence of hypertension was not much (OR=1.427; Std.Err. =0.606; CI=0.621-3.280; $p>0.05$).

This study is one of the novel attempts to assess the prevalence of hypertension and its sex-specific risk factors using the nationally representative data of NFHS 2015–2016. Additionally, the present study provides estimates on the prevalence of hypertension across all districts rural and urban areas in Andhra Pradesh. Findings of the present study highlighted that prevalence of hypertension by all selected background characteristics is much higher for male respondents compared to the female respondents in Andhra Pradesh. Besides this sex differences in the prevalence of hypertension we found that risk of hypertension between sexes differs by socio-economic, demographic and lifestyle factors.

One of our key findings is that 11.9% of the population aged 15-49 female respondents and 18.04% of the population aged 15-54 male respondents in Andhra Pradesh are hypertensive.

1.15. Findings

1. The prevalence of hypertension increased significantly with age among both men and women. Logistic regression results showed that older adults (particularly those aged 40–49 years) had substantially higher odds of hypertension compared with younger adults, making age the strongest predictor of hypertension.
2. Marital status was significantly associated with hypertension. Widowed, divorced, and married respondents exhibited a higher prevalence and greater likelihood of hypertension than never-married individuals, indicating that social and family circumstances may influence cardiovascular health.
3. Educational attainment showed an inverse relationship with hypertension. Respondents with secondary and higher education were generally less likely to be hypertensive than those with no formal education, suggesting that education contributes to improved health awareness and healthier lifestyles.



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4. Wealth status emerged as a significant determinant of hypertension. Individuals belonging to richer and richest wealth quintiles had higher odds of hypertension than those in poorer wealth groups, reflecting lifestyle and behavioural transitions associated with economic development.
5. Lifestyle behaviours influenced hypertension risk. Among men, tobacco use and alcohol consumption were significantly associated with hypertension, whereas these associations were weaker and statistically non-significant among women.
6. Urban residents showed slightly higher hypertension prevalence than rural residents; however, place of residence was not a strong independent predictor after statistical analysis.
7. District-level variation in hypertension prevalence was evident across Andhra Pradesh, indicating geographical disparities that require district-specific public health interventions.
8. The study demonstrates clear sex differences in hypertension risk factors, supporting the need for gender-sensitive prevention and management strategies.

1.16. Suggestions

1. Introduce routine hypertension screening for adults aged 30 years and above, with priority given to individuals aged 40 years and older.
2. Strengthen community-based awareness programmes on hypertension prevention, emphasizing healthy diets, reduced salt intake, regular physical activity, weight management, and stress reduction.
3. Expand behavioural interventions aimed at reducing tobacco use and harmful alcohol consumption, particularly among men.
4. Improve health literacy through educational campaigns targeting populations with low educational attainment to promote early diagnosis and treatment adherence.
5. Integrate hypertension screening and counselling into existing primary healthcare services, including Health and Wellness Centres under the National Health Mission.
6. Develop district-specific hypertension control programmes focusing on districts with relatively higher prevalence.
7. Encourage periodic blood pressure monitoring through Accredited Social Health Activists (ASHAs), Auxiliary Nurse Midwives (ANMs), and community health workers, especially in underserved rural and tribal populations.
8. Promote sex-specific prevention strategies recognizing the differing risk profiles of men and women.
9. Strengthen follow-up systems for diagnosed hypertensive patients to improve medication adherence and reduce complications.
10. Encourage further longitudinal studies using recent NFHS datasets (NFHS-5) to monitor temporal changes and evaluate intervention effectiveness.

1.17. Policy Implications

1. **Strengthening NCD Control:** The findings support expanding the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD) by prioritizing hypertension screening among high-risk population groups.
2. **Age-Specific Screening Policy:** Since age is the strongest predictor of hypertension, state health authorities should institutionalize routine blood pressure screening beginning at age 30, with intensified surveillance for adults aged 40 years and above.
3. **Gender-Sensitive Health Policy:** Different risk patterns among men and women justify gender-responsive prevention strategies, including tailored health education and behavioural interventions.
4. **District-Level Resource Allocation:** Geographic disparities in hypertension prevalence suggest that district health planning should allocate resources according to local disease burden rather than adopting a uniform statewide approach.



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5. **Lifestyle Modification Policies:** Government policies should encourage healthier food environments by reducing salt and trans-fat consumption, promoting physical activity, and strengthening tobacco and alcohol control measures.
6. **Health Education Integration:** Cardiovascular health education should be incorporated into school curricula, workplace wellness programmes, and community outreach activities to improve awareness from an early age.
7. **Strengthening Primary Healthcare:** Health and Wellness Centres should be equipped to provide regular hypertension screening, counselling, essential medicines, and long-term follow-up as part of comprehensive primary care.
8. **Evidence-Based Planning:** Logistic regression findings identifying age, marital status, education, wealth, and behavioural factors as significant predictors should guide the design of targeted interventions and efficient allocation of public health resources.

These findings indicate that hypertension in Andhra Pradesh is shaped by demographic, socioeconomic, and behavioural determinants. Population-wide prevention combined with targeted interventions for high-risk groups can substantially reduce the burden of hypertension and contribute to achieving Sustainable Development Goal (SDG) 3.4 on reducing premature mortality from non-communicable diseases.

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