Assessment of Prevalence and Determinants Associated with Hypertension Among the Adult Population in Hawtat Bani Tamim Province

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Article

Assessment of Prevalence and Determinants Associated with Hypertension Among the Adult Population in Hawtat Bani Tamim Province

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Abstract

Hypertension is a major public health concern globally, with varying prevalence and risk factors across different populations. This study aimed to assess the prevalence of hypertension and identify its associated determinants among adults in Hawtat Bani Tamim Province. A cross-sectional study was conducted among 384 adult participants. Data on sociodemographic characteristics, lifestyle factors, and clinical measurements were collected. Hypertension was diagnosed based on standard criteria. Logistic regression analysis was used to identify factors associated with hypertension, and odds ratios (OR) with 95% confidence intervals (CI) were calculated. The overall prevalence of hypertension among the participants was 25.5%, with a higher rate observed in urban areas (15%) compared to rural areas (10.4%). Multivariate analysis revealed that age was significantly associated with hypertension, with participants aged 20–30 years (OR=0.181, 95% CI: 0.067–0.485), 31–40 years (OR=0.235, 95% CI: 0.092–0.599), 41–50 years (OR=0.184, 95% CI: 0.067–0.510), and 51–60 years (OR=0.268, 95% CI: 0.104–0.690) having lower odds compared to those over 60 years. Males had a lower risk than females (OR=0.423, 95% CI: 0.192–0.932). Lower educational attainment was also associated with reduced odds of hypertension (secondary or less: OR=0.315, 95% CI: 0.118–0.844; bachelor's degree: OR=0.294, 95% CI: 0.127–0.679) compared to postgraduates. Regarding BMI, normal weight (OR=0.262, 95% CI: 0.126–0.544) and overweight (OR=0.421, 95% CI: 0.220–0.805) individuals had lower odds of hypertension compared to obese participants. Marital status was a significant determinant, with married individuals having higher odds of hypertension (OR=3.222, 95% CI: 1.807–6.110). Smoking was associated with a lower risk of hypertension (OR=0.181, 95% CI: 0.067–0.485). Hypertension is prevalent among adults in Hawtat Bani Tamim Province, with significant associations observed for age, gender, education, BMI, marital status, and smoking. Targeted interventions addressing these risk factors are recommended to reduce the burden of hypertension in this population.

Keywords: prevalence; hypertension; risk factors; Saudi Arabia; non-communicable diseases

1. Introduction

According to the American Heart Association, Hypertension (HTN) is a medical condition classified by high blood pressure, which means the force of blood pushing against the walls of the arteries is regularly too high. This can lead to serious health difficulties such as heart disease, stroke, and kidney failure. [1]. According to the World Health Organization (WHO), 1.28 billion people have hypertension globally, and most of them (67%) are in countries that have lower and middle-income levels. [2]. In Asia, the percentage of people with hypertension was 27.2% overall. However, the prevalence varied widely by country, with the highest rates found in Central Asia and the lowest rates in South Asia. [3]. A 2023 study revealed that the hypertension prevalence in

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Saudi Arabia was 9.2% among people older than 15 years and 10% for women, compared to men 8.5% [4].

According to [5], the prevalence of HTN)was 6% among males compared to 4.2% for females. Overweight and obese were significantly associated with HTN. Studies revealed that HTN was positively related to weight, body mass index, and waist circumference. [6] . [7]disclosed that higher alcohol use, obesity, and older age were correlated with HTN [8]. Furthermore, it was observed that the prevalence of HTN was increasing with advancing age. It is also high among the rich and overweight/obese participants. [9]. The results from Ethiopia found that the prevalence of HTN was 44.91%. Hypertension was significantly associated with poor exercise, consuming cruddy oil, a family history of hypertension, and a history of diabetes. [10]. The study revealed a hypertension prevalence rate of 11.1%. Key factors linked to elevated hypertension risk included advancing age, unemployed status, insurance coverage, obesity, diabetes, cardiovascular conditions, and elevated cholesterol levels. [11]. Behavioral risk factors, such as alcohol consumption, being overweight, obesity, increased waist circumference, and high blood glucose levels, are positively associated with hypertension. [12]. It was found that the prevalence of hypertension was 40.8. There is no significant association between hypertension and education level, social status, and overweight. However, factors such as older age and obesity were positively related to hypertension. [13]. Many studies disclosed that older age, smoking, alcohol consumption, and being overweight were associated with hypertension. [7,14–16].

Previous studies revealed that factors such as Genetics, lifestyle factors, age, gender, and medical conditions were considered determinants of hypertension. [17–23], It is important to study the prevalence and determinants associated with hypertension because it helps to understand the burden of the disease in a population and identify the factors that contribute to its occurrence. This information can then be used to develop effective prevention and control strategies, as well as to target interventions for those who are at the highest risk. Additionally, understanding the determinants of hypertension can help to identify modifiable risk factors that individuals can address to reduce their risk of developing the condition. Subsequently, the study aims to assess the prevalence and its associated determinants of hypertension among the adult population in Hawtat Bani Tamim province.

2. Materials and Methods

2.1. Source of the Data

A cross-sectional study was carried out among adults in Hawtat Bani Tamim Province between November and December 2023. Researchers employed a multistage sampling approach to select participants. Initially, the province was divided into six residential neighborhoods—Birk, Al Hilwa, Elfara, El Hareeg, Al Hilah, and El Salamia—which served as geographic boundaries to ensure representation of diverse demographic and socioeconomic backgrounds. In the second stage, cluster sampling was used within each neighborhood to cover all residential areas. Finally, in the third stage, participants were selected from each cluster using simple random sampling.

2.2. Study Population and Sample Size

The study population consisted of adults from Hawtat Bani Tamim. The sample size was calculated using the formula. [24].

$$n=\frac{Z2*p*(1-p)}{E2}$$

where: Z = Z-score to the confidence level, which is 1.96 for 95% confidence

p: estimated proportion for the unknown; the researchers use 0.5 for maximum variability

E: margin of error, here was 0.05

By substituting the above values into the formula, the sample size was 384.

The researchers sent out 384 questionnaires via email to the selected participants, resulting in a sample size of 384 individuals. Data were collected using a questionnaire developed after a

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thorough review of relevant prior studies. The survey was created electronically using Google Forms and distributed to the chosen respondents. Ethical standards were maintained, with both verbal and written consent obtained from all participants.

2.3. Study Variables

The dependent variable in this analysis is hypertension status, a binary outcome coded as 1 if hypertension is present and 0 if not. The independent variables include age, gender, place of residence, marital status, education level, BMI, physical activity, stress, smoking status, and relative infection of hypertension. The selection of these covariates was guided by recommendations from numerous previous studies. [25–32]. The variable BMI is calculated using the formula. **[33].**

$$\text{BMI}=\frac{\text{weight (kg)}}{[\text{height (m)}]2}$$

The Body Mass Index (BMI) was categorized into four groups: underweight, normal weight, overweight, and obese.

2.4. Statistical Model

Binary logistic regression is a statistical method that models the relationship between a binary (dichotomous) dependent variable and one or more independent variables. It is commonly used when the dependent variable is categorical and has two possible outcomes. [34–38].

The logistic regression model is formulated as follows.

Let $P(Y=1)$ Denote the probability of the binary outcomes being 1.

$\boldsymbol{X}$ The vector of the independent variables.

$\beta_0, \beta_1, \ldots\ldots\ldots, \beta_k$ Represent the coefficients associated with the intercept and the independent variables, respectively.

The binary logistic regression model can be represented as follows:

$$P(Y=1)=\frac{1}{1+e^{-(\beta_0+\beta_1 x_1+\cdots\ldots+\beta_k x_k)}}$$

Where,

β_0 Is the intercept of the model.

$\beta_1, \beta_2, \ldots\ldots\ldots, \beta_k$ Are the coefficients associated with the response variable.

Maximum Likelihood Estimation (MLE) is used to estimate the unknown parameter of binary logistic regression. [39–43]. For more details about the theory and applications of logistic regression, see [42,44–50]

3. Results

Table 1 provides the characteristics of the participants. In this sample, hypertension affected 25.5% of the participants. The highest proportions were in the 31–40 and 20–30 age brackets, at 24.7% and 24.5%, respectively. Rural residents made up most of the sample (68.8%), and there was a higher proportion of females (59.6%) compared to males (40.4%).

Table 1. Characteristics of the participants.

Variable	Classification	n	%
Hypertension	Yes	98	25.5
	No	286	74.5
Age(in Years)	20-30	94	24.5
	31-40	95	24.7
	41-50	67	17.4
	51-60 years	87	22.7
	More than 60	41	10.7
Place of Residence	Urban	120	31.3
	Rural	264	68.8

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gender	Male	155	40.4
	Female	229	59.6
Education	Secondary and less	64	18.7
	University	273	71.1
	Postgraduates	47	12.2
BMI	Underweight	11	2.9
	Normal	125	32.6
	Overweight	137	35.7
	Obese	111	28.9
Occupation	student	34	8.9
	Public sector employee	185	48.2
	Private sector employee	56	14.6
	Free job	109	28.4
Marital status	Married	119	31.0
	Single	285	69.0
Physical status	Active	110	28.6
	Less active	62	16.1
	Moderate active	200	52.1.7
	More active	12	3.1
Relative infection	Yes	247	64.3
	No	137	35.7
Smoking	Yes	43	11.2
	No	341	88.8
Stress	Yes	168	43.8
	No	216	56.3

Regarding education, the majority had a university degree (71.1%), while only 12.2% held postgraduate qualifications. BMI classifications showed that the categories were the most common (35.7%), and the obese category (28.9%) was the most common.

Occupationally, public sector employees represented nearly half of the sample (48.2%), whereas students comprised only 8.9%. Most participants were single (69.0%).

Regarding physical activity, over half (52.1%) were moderately active, but only 3.1% reported being highly active. The majority (64.3%) had a relative with hypertension.

Most participants did not smoke (88.8%), and a little over half (56.3%) reported experiencing no stress

Table 2 presents the association between covariates and hypertension. Urban residents showed a higher prevalence of hypertension (58 cases, 15%) compared to those in rural areas (40 cases, 10.4%). Hypertension was more frequent in older age groups, with the highest rates observed in individuals over 60 years old (20 cases, 5.2%). Higher BMI was associated with an increased prevalence of hypertension, notably among overweight and obese individuals (32 and 42 cases, respectively).

Table 2. Distribution of the prevalence of hypertension among participants .

Characteristic		**Positive Hypertension N(%)**	**Negative Hypertension N(%)**	**p-Value**
Place of Residence	Urban	58(15%)	206(53.6%)	0.018
	Rural	40(10.4%)	80(20.8%)	
Age (in Years)	20-30	22(5.7%)	72(18.8%)	0.011
	31-40	22(5.7%)	73(19%)	
	41-50	15(3.9%)	52(13.5%	
	51-60	19(4.9%)	68(17.7%)	

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	More than 60	20(5.2%)	21(5.4%)	
BMI	underweight	7(1.8%)	14(3.6%)	0.001
	Normal	17(4.4%)	108(28.1%)	
	Overweight	32(8.3%)	105(27.3%)	
	Obese	42(10.9%)	69(17.9%)	
Occupation	Student	7(1.8%)	27(7.1%)	0.010
	Public sector employee	56(14.6%)	129(33.6%)	
	Private sector employee	19(4.9%)	37(96%)	
	Free job	16(4.2%)	93(24.2%)	
Education	Secondary and less	14(3.6%)	50(13.2%)	0.042
	Bachelors	65(16.9%)	208(54.2%)	
	postgraduates	19(4.9%)	28(7.2%)	
Marital status	Married	44(11.5%)	75(19.5%)	0.001
	Single	54(14.1%)	211(54.9%)	
Gender	Male	52(13.5%)	103(26.8%)	0.001
	Female	46(12%)	183(47.7%)	
Relative infection	Yes	69(17.9%)	178(46.3%)	0.145
	No	29(7.6%)	108(28.1%)	
physical activities	Yes	43(11.2%)	138(35.9%)	0.454
	No	55(14.3%)	148(38.5%)	
Smoking	Yes	13(3.4%)	30(7.8%)	0.452
	No	85(22.1%)	256(66.7%)	

Public sector employees (56 cases, 14.6%) and those with freelance jobs (16 cases, 4.2%) exhibited higher rates of hypertension compared to students (7 cases, 1.8%).

Educational attainment also appeared to play a role, with those holding a bachelor's degree showing the highest prevalence (65 cases, 16.9%).

Regarding marital status, single individuals had slightly higher rates of hypertension (54 cases, 14.1%) than their married counterparts (44 cases, 11.5%).

A slightly higher prevalence of hypertension was noted among males (52 cases, 13.5%) compared to females (46 cases, 12%).

No substantial pattern was observed about having a relative infected, engaging in physical activities, or smoking status.

Table 3 displays the findings from the multivariate logistic regression. Age is significantly linked to hypertension (p-value=0.007). Compared to those over 60, younger age groups have substantially lower odds of hypertension. For example, individuals aged 20–30 have 82% lower odds (OR=0.181, 95% CI: 0.067–0.485, p-value=0.001). Regarding gender, males have significantly reduced odds of hypertension relative to females (OR=0.423, 95% CI: 0.192–0.932, p-value=0.033). Education is also significantly associated (p=0.014). Individuals with secondary education or less (OR=0.315, 95% CI: 0.118–0.844, p-value=0.022) and those with a bachelor's degree (OR=0.294, 95% CI: 0.127–0.679, p-value=0.004) have lower odds of hypertension than those with postgraduate qualifications. In addition, BMI shows a strong association with hypertension (p-value=0.0001). Compared to obese individuals, those with normal BMI (OR=0.262, 95% CI: 0.126–0.544, p-value=0.0002) and those overweight (OR=0.421, 95% CI: 0.220–0.805, p-value=0.009) have significantly lower odds of hypertension. Furthermore, no significant difference in hypertension risk was observed between urban and rural residents (p-value=0.273). There is no significant association between having an infected relative and the risk of hypertension (p-value=0.104). Physical activity level does not show a significant relationship with hypertension (p-value=0.237). Married individuals are significantly more likely to have hypertension compared to singles (OR=3.222, 95% CI: 1.807–6.110, p-value=0.0001).

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Table 3. Logistic Regression Model Results.

Variable	Sig	OR	95% CI for OR	
Age				
20-30	0.001	0.181	0.067	0.485
31-40	0.002	0.235	0.092	0.599
41-50	0.006	0.184	0.067	0.510
51-60	0.001	0.268	0.104	0.690
More than60		Ref		
Gender				
Male	0.033	0.423	0.192	0.932
Female		Ref		
Education				
Secondary and less	0.022	0.315	0.118	0.844
Bachelors	0.004	0.294	0.127	0.679
postgraduates		Ref		
BMI				
Underweight	0.092	3.98	0.800	19.796
Normal	0.0002	0.262	0.126	0.544
Overweight	0.009	0.421	0.220	0.805
Obese		Ref		
Residence				
Urban	0.273	0.642	0.290	1.420
Rural		Ref		
Relative infected				
yes	0.104	0.608	0.783	3.457
No		Ref		
physical activities				
yes	0.237	1.403	0.407	1.632
No		Ref		
Marital Status				
Married	0.0001	3.222	1.807	6.110
Single		Ref		
Smoking				
Yes	0.001	0.181	0.067	0.485
No		Ref		

4. Discussion

This research investigated the prevalence of hypertension and its related factors among adults, with particular attention to demographic, socioeconomic, and lifestyle variables. The multivariate analysis identified several significant relationships, highlighting the intricate interactions between various risk factors that contribute to the development of hypertension.

Excessive hypertension remains a worldwide health concern. 10.2 million deaths and 208 million years of life with a disability were attributed to it each year. According to a Ministry of Health report from 2021, two out of every five adults in the Middle East have hypertension. Nevertheless, many previous studies conducted in Saudi Arabia revealed that the prevalence of HTN in adults was approximately 49%. It is imperative to eradicate this high rate of hypertension in both adults and adolescents. [51,52]. Furthermore, adult hypertension and other chronic diseases are caused by childhood hypertension that is not treated. Because of this, measuring blood

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pressure, identifying hypertension HTN, and preventing it in kids and teenagers have become international priorities.

The prevalence of hypertension in the current study (25.5%) was lower than the overall prevalence of hypertension in Asia (27.2%). However, when compared to the prevalence found in other studies, the prevalence of hypertension in this study was higher. [4,5,8,53]. Few studies have published findings that were consistent with this investigation.

In this study, no significant association was found between place of residence and hypertension, which is consistent with the results reported in several other studies. [54–57]. Hypertension was more common in urban areas (15%) compared to rural areas (10%). However, this difference indicates that urban or rural residence may not play a significant role in determining hypertension risk in this population, possibly because both groups share similar lifestyles or have comparable access to healthcare services.

Our research revealed a significant relationship between marital status and hypertension, a finding that is consistent with the results of numerous previous studies. [58,59]. Hypertension was found in 14.5% of single participants, compared to 11.2% among married individuals. This difference may be explained by a mix of social, psychological, and lifestyle influences. Studies have shown that unmarried people, particularly men, face a notably higher risk of developing hypertension, even when factors like age, body mass index, and smoking are taken into consideration.

Furthermore, there was a significant relationship observed between gender and hypertension, a result that aligns with the findings of numerous other studies. [5,18,19]. The overall prevalence was 13.5%, with rates of 12% among males and females, respectively. The occurrence of hypertension varies between males and females, influenced by a combination of biological and social factors. Typically, men exhibit a higher prevalence of hypertension than women during early and middle adulthood. However, as people age, this trend may shift, with older women sometimes experiencing rates of uncontrolled hypertension that are comparable to or even exceed those seen in men.

Our research identified a strong association between BMI and hypertension, a result that is consistent with the findings of numerous other studies. [10,25,30]. The highest prevalence rate was observed among participants who were obese, at 10%. Individuals with obesity are more likely to have hypertension because of various related physiological processes. Increased body fat, particularly around the abdomen, stimulates both the sympathetic nervous system and the renin-angiotensin-aldosterone system (RAAS), resulting in elevated blood pressure.

Furthermore, our study found a significant association between age and hypertension. Such a finding is consistent with many previous studies. [25,28,30].It is noteworthy because age is typically a strong predictor of hypertension. due to Smaller sample sizes, self-reported physical activity measures, or age categorization could explain weaker statistical power. The likelihood of developing hypertension increases with age due to a combination of physiological and lifestyle factors. As people get older, their arteries tend to become stiffer and less flexible, which raises blood pressure. This is mainly because the arterial walls thicken and lose elasticity over time, making it more difficult for blood vessels to handle changes in blood flow. Additionally, aging affects the body's ability to regulate blood pressure through changes in the nervous system, hormone levels, and kidney function. Reduced physical activity, weight gain, and the presence of other health conditions like diabetes or kidney disease are also more common in older adults, further increasing the risk of hypertension. Because of these factors, a large proportion of people over the age of 60 develop high blood pressure.

The study revealed that there was a significant association between education level and hypertension. Such a result agreed with many previous studies. [10,28,32]. The findings showed that participants with postgraduate education had a higher prevalence (19%)of hypertension compared to other education levels. This finding is contrary to the general expectation that higher

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education is protective, suggesting the need for further investigation into occupational stress or lifestyle factors among highly educated individuals in this population.

Interestingly, the study found that physical activity was not associated with hypertension; such results align with many studies. [10,30]. This may reflect limitations in how physical activity was measured or reported, or it may indicate that other factors, such as diet or genetic predisposition, play a more prominent role in this population.

The present study found no significant link between smoking and hypertension, which contrasts with the results of several previous studies. [10,28]. This counterintuitive result may be due to confounding factors, such as the "healthy smoker" effect, or underreporting of smoking status among hypertensive individuals.

4.1. Limitations of the Study

The study has several potential limitations. Firstly, the sample size may be relatively small, which could affect the ability to generalize the findings to the entire adult population in the province. Secondly, the data on hypertension prevalence and associated factors could be subject to recall bias or underreporting, especially if the study relies on self-reported information. Thirdly, there may be other important factors, such as lifestyle, diet, physical activity, or access to healthcare, that were not adequately captured or controlled for in the study and could influence the prevalence of hypertension. Fourthly, the findings may be specific to the Hawtat Bani Tamim province and may not be easily applicable to other regions or populations, particularly if there are significant differences in socioeconomic, cultural, or healthcare-related factors. Finally, the absence of longitudinal data could limit the ability to understand the dynamic changes in hypertension prevalence and the long-term impact of the identified determinants.

4.2. Future Direction of the Study

1. Increasing the sample size and ensuring better representation of the target population
2. Implementing more robust data collection methods to minimize bias and improve data quality.
3. Accounting for a wider range of potential confounding factors
4. Conducting a longitudinal study to better understand the temporal relationships between determinants and hypertension development.
5. Validating the findings in other geographic regions to assess the generalizability of the results.

5. Conclusion

The study identifies age, gender, education level, BMI, marital status, and smoking as key factors associated with hypertension in this population. Notably, some results, such as the reduced risk observed in males and smokers, and the increased risk among those with higher education and married individuals, differ from what is commonly reported in the literature and suggest the need for further research. These findings highlight the importance of considering local circumstances and possible confounding variables when analyzing epidemiological data on hypertension.

Author Contributions: MOMM designed the study concept, prepared the literature review, and prepared the paper draft. ASRA has guided the study design, analyzed the data, and critically reviewed the paper. All authors read and approved the final paper.

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Institutional Review Board Statement: The research adhered to the guidelines outlined in the Declaration of Helsinki. Ethical approval for this study was obtained from the deanship research of Prince Sattam University (SCBR-1942023). Informed consent was obtained from all participants before their inclusion in the study, ensuring they were fully aware of the study's purpose, procedures, risks, and benefits.

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Informed Consent Statement: Not applicable.

Data Availability Statement: Interested individuals can contact the corresponding author to inquire about accessing the data for further analysis or reference.

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Conflicts of Interest: The authors declare that they have no competing interests.

Abbreviations

Hypertension: HTN
Body Mass Index: BMI
Odds Ratio: OR
World Health Organization: WHO
Maximum Likelihood Estimation: MLE
Standard Error: SE
CI: Confidence Interval

References

1. AHA, "Understanding Blood Pressure Readings," National Center, 2023.
2. WHO, "Hypertension," World Health Organization, 2021.
3. B. Zhou, J. Bentham, M. D. Cesare, J. Z. Cisneros, H. Bixby, G. Danaei and M. J. Cowan, "Worldwide trends in blood pressure from 1975 to 2015 : a pooled analysis of 1479 population-based measurement studies with 19.1 million participants," The Lancet, vol. 389, no. 10064, pp. 37-55, 2017.
4. A. M. Alenazi and B. A. Alqahtani, "National and regional prevalence rates of hypertension in Saudi Arabia: A descriptive analysis using the national survey data," Front Public Health, vol. 4, no. 11, 2023.
5. A. Aldiab, M. M. Shubair, J. M. Al-Zahrani, K. K. A. S. Al-Ghamdi, M. Househ, H. A. Razzak, A. El-Metwally and H. Jradi, "Prevalence of hypertension and prehypertension and its associated cardioembolic risk factors; a population based cross-sectional study in Alkharj, Saudi Arabia," BMC public Health, vol. 18, no. 1327, 2018.
6. W. A. Mumena, S. A. Hammouda, R. M. Aljohani, A. M. Alzahrani, M. J. Bamagos, W. K. Alharbi, B. M. Mulla and H. Kutbi, "Prevalence and determinants of undiagnosed hypertension in the Western region of Saudi Arabia," PLOS ONE, vol. 18, no. 3, 2023.
7. N. M. Tapela, L. Clifton, G. Tshisimogo, M. Gaborone, T. Madidimalo, V. Letsatsi, T. Masupe, M. Mosepele, J. Makhema, S. Lockman and D. J. Hunter, "Prevalence and Determinants of Hypertension Awareness,Treatment, and Control in Botswana: A Nationally Representative Population-Based Survey," International Journal of Hypertension, pp. 1-8, 2020.
8. J. Kayima, J. Nankabirwa, I. Sinabulya, J. Nakibuuka, X. Zhu, M. Rahman, C. T. Longenecker, A. Katamba, H. Mayanja-Kizza and M. R. Kamya, "Determinants of hypertension in a young adult Ugandan population in epidemiological transition—the MEPI-CVD survey," BMC Public Health, vol. 15, no. 830, 2015.
9. M. Hasan, I. Sutradhar, T. Akter, R. D. Gupta, H. Joshi, M. R. Haider and M. Sarker, "Prevalence and determinants of hypertension among adult population in Nepal: Data from Nepal Demographic and Health Survey 2016," PLOS ONE, vol. 13, no. 5, 2018.
10. D. G. Belay, H. F. Wolde, M. D. Molla, H. Aragie, D. G. Adugna, E. B. Melese, G. E. Tarekegn, E. Gezahegn and A. A. Kibret, "Prevalence and associated factors of hypertension among adult patients attending the outpatient department at the primary hospitals of Wolkait tegedie zone, Northwest Ethiopia," Frontiers inNeurology, 2022.
11. S. M. Nasser, M. M. Shubair, F. Fatani, N. M. Alhawiti, B. Aleissa, A. I. S. Aldubikhi, K. Angawi, A. Alshahrani, S. A. Ali, S. Javed and A. El-Metwally, "Prevalence of hypertension and associated factors: a cross-sectional study in Riyadh, Saudi Arabia," BMC Health Services Research, 2025.

 doi:10.20944/preprints202507.0920.v1

12. R. Mohammad and D. W. Bansod, "Hypertension in India: a gender-based study of prevalence and associated risk factors," BMC Public Health, 2024.
13. S. M. Omar, I. R. Musa, O. E. Osman and I. Adam, "Prevalence and associated factors of hypertension among adults in Gadarif in eastern Sudan: a community-based study," BMC Public Health, vol. 20, no. 291, 2020.
14. S. K. Mistry, M. B. Hossain, M. Parvez, R. D. Gupta and A. Arora, "Prevalence and determinants of hypertension among urban slum dwellers in Bangladesh," BMC Public Health, vol. 22, no. 2063, 2022.
15. R. Ismail, N. H. Ismail, Z. M. Isa, A. M. Tamil, M. H. Ja'afar, N. M. Nasir, S. Abdul-Razak, N. Z. Abidin, N. H. A. Razak, P. Joseph and K. H. Yusof, "Prevalence and Factors Associated with Prehypertension and Hypertension Among Adults: Baseline Findings of PURE Malaysia Cohort Study," American Journal of Medicine Open, vol. 10, 2023.
16. M. Rahman, M. M. Zaman, J. Y. Islam, J. Chowdhury, H. N. Ahsan, R. Rahman, M. Hassan, Z. Hossain, B. Alam and R. Yasmin, "Prevalence, treatment patterns, and risk factors of hypertension and pre-hypertension among Bangladeshi adults," Journal of Human Hypertension, 2017.
17. D. Abdissa and K. Kene, "Prevalence and Determinants of Hypertension Among Diabetic Patients in Jimma University Medical Center, Southwest Ethiopia, 2019," Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, vol. 13, p. 2317–2325, 2020.
18. K. Peltzer and S. Pengpid, "The Prevalence and Social Determinants of Hypertension among Adults in Indonesia: A Cross-Sectional Population-Based National Survey," International Journal of Hypertension, 2018.
19. G. I. Wanghi, P. B. Mutombo and E. K. Sumaili, "Prevalence and determinants of hypertension among students of the University of Kinshasa, Democratic Republic of Congo: a cross-sectional study," Afri Health Sci, vol. 19, no. 4, pp. 2854-2862, 2019.
20. Z. D. Kifle, M. Adugna, G. S. Chanie and A. Mohammed, "Prevalence and associated factors of hypertension complications among hypertensive patients at University of Gondar Comprehensive Specialized Referral Hospital," Clinical Epidemiology and Global Health, vol. 13, 2022.
21. E. Tesfa and D. Demeke, "Prevalence of and risk factors for hypertension in Ethiopia: A systematic review and meta-analysis," Health Science Reports, 2021.
22. Z. Haung and S. A. Hongb, "Prevalence and factors associated with treatment and control of hypertension among adults with hypertension in Myanmar," International Health, vol. 15, pp. 207-215, 2023.
23. P. M. Mphekgwana, N. Malema, K. D. Monyeki, T. M. Mothiba, M. Makgahlela, N. Kgatla, I. Makgato and T. Sodi, "Hypertension Prevalence and Determinants among Black South African Adults in Semi-Urban and Rural Areas," International Jpurnal of Enviromental Research and Public Health, vol. 17, no. 7463, 2020.
24. W. G. COCHRAN, Sampling Techniques, New York: John Wiley & Sons,, 1977.
25. A. S. R. Abdallah and M. O. M. Mohammed, "MODELING FACTORS AFFECTING BLOOD PRESSURE AMONG SUDANESE REPRODUCTIVE WOMEN," JP Journal of Biostatistics, vol. 18, no. 1, pp. 135-147, 2021.
26. S. T. Shafi and T. Shafi, "A survey of hypertension prevalence, awareness, treatment, and control in health screening camps of rural central Punjab, Pakistan," Journal of Epidemiology and Global Health, pp. 135-140, 2017.
27. J. Kishore, N. Gupta, C. Kohli and N. Kumar, "Prevalence of Hypertension and Determination of Its Risk Factors in Rural Delhi," International Journal of Hypertension, pp. 1-6, 2016.
28. Y. E. Achhab, Laila Nazek, M. Maalej, M. Alami and C. Nejjari, "Prevalence, control and risk factors related to hypertension among Moroccan adults: a multicentre study," EMHJ, vol. 25, no. 8, pp. 447-456, 2019.
29. B. Olack, F. Wabwire-Mangen, L. Smeeth, J. M. Montgomery, N. Kiwanuka and R. F. Breiman, "Risk factors of hypertension among adults aged 35–64 years living in an urban slum Nairobi, Kenya," BMC Public Health , 2015.

 doi:10.20944/preprints202507.0920.v1

30. M. M. AsemuI, A. W. Yalew, N. D. Kabeta and D. Mekonnen, "Prevalence and risk factors of hypertension among adults: A community based study in Addis Ababa, Ethiopia," PLOS ONE , vol. 16, no. 4, 2021.
31. R. Mahapatra, A. Kaliyappan, P. Chinnakali, N. Hanumanthappa, R. Govindarajalou and C. Bammigatti, "Prevalence and Risk Factors for Resistant Hypertension: Cross-Sectional Study From a Tertiary Care Referral Hospital in South India," cureus, vol. 13, no. 10, pp. 1-8, 2021.
32. E. O. Anto, W. Owiredu, E. Adua, C. Obirikorang, L. A. Fondjo, M. E. Annani-Akollor, E. Acheampong, E. A. Asamoah, P. Roberts, W. Wang and S. Donkor, "Prevalence and lifestyle-related risk factors of obesity and unrecognized hypertension among bus drivers in Ghana," Heliyon, vol. 6, pp. 1-9, 2020.
33. WHO, "Obesity : preventing and managing the global epidemic : report of a WHO consultation," World Health Organization, Geneva, Switzerland, 1999.
34. S. Menard, Logistic Regression: From Introductory to Advanced Concepts and Applications, Thousand Oaks: SAGE Publications, 2010.
35. D. W. Hosmer and S. Lemeshow, Applied logistic Regression, New York: John Wiley & Sons, 2000.
36. P. Hyeoun-Ae, "An Introduction to Logistic Regression: From Basic Concepts to Interpretation with Particular Attention to Nursing Domain," J Korean Acad Nurs, vol. 43, no. 2, pp. 154-164, 2013.
37. S. Sperande, "Understanding logistic regression analysis," Biochemia Medica, vol. 24, no. 1, pp. 12-18, 2014.
38. S. Singh, R. Shankar and G. P. Singh, "Prevalence and Associated Risk Factors of Hypertension: A Cross-Sectional Study in Urban Varanasi," International Journal of Hypertension, 2017.
39. M. R. Abonazel and M. G. Ibrahim, "On Estimation Methods for Binary Logistic Regression Model with Missing Values," International Journal of Mathematics and Computational Science, vol. 4, no. 3, pp. 79-85, 2018.
40. R. LI, ZHOU and L. WANG, "ESTIMATION OF THE BINARY LOGISTIC REGRESSION MODEL PARAMETER USING BOOTSTRAP RE-SAMPLING," Latin American Applied Research, vol. 48, pp. 199-2014, 2018.
41. B. W. McDonald, "Estimating Logistic Regression Parameters for Bivariate Binary Data," Journal of the Royal Statistical Society Series B: Statistical Methodology, vol. 55, no. 2, pp. 391-397, 1993.
42. J. M. Hilbe, Practical Giued to Logistic Regression, New York: Taylor & Francis Group, 2015.
43. D. G. Kleinbaum and M. Klein, Logistic Regression, New York: Springer, 2010.
44. A. Agresti, An Introduction to Categorical Data Analysis, New York: John Wiley and Sons, 2007.
45. N. Srimaneekarn, A. Hayter, W. Liu and C. Tantipoj, "Binary Response Analysis Using Logistic Regression in Dentistry," International Journal of Dentistry, pp. 1-7, 2022.
46. A. Ekholm, P. W. F. Smith and J. W. McDonald, "Marginal Regression Analysis of a Multivariate Binary Response," Biometrika, vol. 82, no. 4, pp. 847-854, 1995.
47. P. Purhadi and M. Fathurahman, "A Logit Model for Bivariate Binary Responses," Symmetry , pp. 1-18, 2021.
48. M. Díaz-Pérez, Á. Carreño-Ortega, J.-A. Salinas-Andújar and Á.-J. Callejón-Ferre, "Application of Logistic Regression Models for theMarketability of Cucumber Cultivars," agronomy, pp. 1-18, 2019.
49. H. R. Talib, A. R. Abd and A. H. Ahmed, "Use of logistic regression to study the most important factors affecting the incidence of tuberculosis," Journal of AL-Qadisiyah for computer science and mathematics, vol. 10, no. 2, pp. 1-8, 2018.
50. D. W. Hosmer and S. Lemeshow, "The Importance of Assessing the Fit of Logistic Regression Models: A Case Study," American journal of public Health, vol. 81, no. 12, pp. 1630-1635, 1991.
51. N. Aljefree and F. Ahmed, "Prevalence of Cardiovascular Disease and Associated Risk Factors among Adult Population in the Gulf Region: A Systematic Review," Advances in Public Health, pp. 1-23, 2015.
52. P. P. Bassareo and G. Mercuro, "Pediatric hypertension: An update on a burning problem," World J Cardiol, vol. 6, no. 5, pp. 253-259, 2014.
53. M. O. M. Mohammed and A. S. R. Abdallah, "A predictive model for assessing hypertension associated factors in Hotat Bani Tamim Province," Advances and Applications in Statistics, vol. 77, no. 1, pp. 1-20, 2022.

 doi:10.20944/preprints202507.0920.v1

54. I. Sharma, M. K. Campbell, Y.-H. Choi, I. Luginaah, J. M. Were, J.-C. V.-. Gonzalea and S. Stranges, "Does the place of residence influence your risk of being hypertensive? A study-based on Nepal Demographic and Health Survey," Hypertension Research, vol. 46, p. 1363–1374, 2023.
55. A. S. Bhadoria, P. K. Kasar, N. A. Toppo, P. Bhadoria, S. Pradhan and V. Kabirpanthi, "Prevalence of hypertension and associated cardiovascular risk factors in Central India," Journal of Family and Community Medicine, vol. 21, no. 1, pp. 29-38, 2014.
56. P. Oktaviyani, Salman, M. H. N. Sari, M. Frisilia, Munazar, A. Satria and Maretalinia, "Prevalence and Risk Factors of Hypertension and Diabetes Mellitus among Indonesian Elderly," makara journal of health research, vol. 26, no. 1, pp. 7-13, 2022.
57. J. K. Soubeiga, T. Millogo, B. W. Bicaba, B. Doulougou and S. Kouanda, "Prevalence and factors associated with hypertension in Burkina Faso: a countrywide cross-sectional study," BMC Public Health, vol. 17, no. 64, pp. 1-8, 2017.
58. A. Ramezankhani, F. Aziz and F. Hadaegh, "Associations of marital status with diabetes, hypertension, cardiovascular disease and all-cause mortality: A long term follow-up study," PLOS ONE, vol. 14, no. 4, 2019.
59. K. Li, X. Ma, L. Yuan and J. Ma, "Age differences in the association between marital status and hypertension: a population-based study," Journal of Human Hypertension, vol. 36, p. 670–680, 2022.