

Analysis of Risk Factors for Hypertension in Productive Age Communities in the Working Area of the North Sangatta Health Center

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ABSTRACT

Hypertension is one of the health problems whose prevalence continues to increase in society, especially among the productive age. This study aims to determine the risk factors for hypertension in the productive age community in the work area of the North Sangatta Health Center. The research method used in this study is obsevely analytical with a case control design. Data were obtained from demographic data questionnaires and observation sheets for blood pressure calculations with a sample of 138 people. The variables analyzed included demographic factors (age, gender, education, occupation, ethnicity), lifestyle (smoking), and medical factors (family history of hypertension and diabetes). The results of the analysis showed that there was a significant relationship between age ($P = < 0.05$), occupation ($P = > 0.008$), diabetes mellitus ($P < 0.001$), hereditary history of hypertension ($P > 0.009$) and the incidence of hypertension, while sex ($P = > 0.85$), education ($P > 0.069$), ethnicity ($P > 0.067$), and smoking habits ($P > 0.170$) did not have a significant relationship with the incidence of hypertension in the productive age community. It is proven that age, occupation, diabetes mellitus, and a history of hypertension are risk factors for the increase in hypertension cases in the work area of the North Sangatta Health Center.

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1. INTRODUCTION

Hypertension, or high blood pressure, is a condition in which blood pressure in the blood vessels reaches or exceeds 140/90 mmHg, which can be serious if left untreated (who.int, 2024). According to WHO data, about 1.28 billion adults aged 30-79 years worldwide suffer from hypertension, with a higher prevalence in low- and middle-income countries. In Indonesia, the prevalence of hypertension reached 34.1% in 2018, up from 25.8% in 2013, with many sufferers going undiagnosed. In East Kalimantan,

hypertension is the most widely suffered non-communicable disease, with the number of sufferers increasing every year (kaltimpemprov.go.id, 2023).

Complications of hypertension can cause serious damage to the heart and brain, contributing to heart disease and stroke. Primary hypertension has no clear cause, while secondary hypertension is caused by other medical conditions such as kidney abnormalities or thyroid disorders (siloamhospitals.com, 2024). Risk factors that can affect hypertension include age, gender, hereditary history, obesity, a diet high in salt and fat, smoking, and stress levels. Previous research has shown a significant relationship between these factors and the incidence of hypertension.

Previous research on hypertension has been conducted. (Santoso, 2020) found that obesity, smoking habits, and stress are factors causing hypertension in West Passi District, Bolaang Mongondow. (Suwarni et al., 2023) showed a significant relationship between salty food consumption and smoking habits and the incidence of hypertension in Sungai Itik Village. (Nadir, 2019) identify the influence of genetic history, smoking, obesity, alcohol consumption, salt, and stress levels on the incidence of hypertension in Salatiga City. (Sinaga et al., 2022) found that smoking behavior and food consumption are at risk related to hypertension in Medan Tenggara Village. (Almahmoud et al., 2022) shows that knowledge about hypertension is influenced by age, education level, family history, and information related to hypertension in Arab countries. (Gebreziher et al., 2024) found that uncontrolled hypertension in Ethiopia was linked to a lack of awareness of hypertension complications, overweight, and age.

Previous studies on hypertension risk factors have some shortcomings. (Santoso, 2020) Only one sub-district with a small sample was involved, so the results may not be representative. (Suwarni et al., 2023) involving 64 samples from one village that may not reflect conditions in other areas. (Nadir, 2019) using a limited case control design in identifying causal relationships. (Sinaga et al., 2022) limited to one village with data collection methods that may be biased. (Almahmoud et al., 2022) are descriptive and do not identify causal relationships between variables. (Gebreziher et al., 2024) using a cross-sectional design in one region so that it cannot determine temporal relationships between variables.

This study offers novelty by exploring the risk factors for hypertension in the productive age community in the working area of the North Sangatta Health Center more comprehensively. Not only did the study focus on common risk factors such as obesity, smoking, and salty food consumption, the study also included other variables such as education, occupation, ethnicity, and history of diabetes mellitus. With a larger and more diverse sample, the study is expected to provide a more holistic picture of the causes of hypertension in the region and provide more generalizable data.

This research is important because hypertension is a major health problem in Indonesia, with the prevalence increasing from 25.8% in 2013 to 34.1% in 2018. Hypertension is a leading cause of premature death and serious complications such as heart disease and stroke, with many cases going undiagnosed and untreated, especially in low- and middle-income countries. The focus on the productive age community at the North Sangatta Health Center is relevant because this group is important for the economy and social development. This study aims to identify specific risk factors that affect hypertension, such as education, occupation, ethnicity, and history of diabetes mellitus. The results are expected to provide a deeper understanding of the causes of hypertension and provide data for more effective health policies and intervention programs, thereby improving public health and reducing the burden of hypertension-related diseases in Indonesia.

2. METHOD

This study is an analytical observational study with a case control design conducted to analyze the relationship between risk factors and the incidence of hypertension in the productive age community in the working area of the North Sangatta Health Center (Adiputra et al, 2021). The research was carried out from September 2023 to February 2024. The study population includes the entire productive age population suffering from hypertension in the region, with a total population of 13,681 people. The research sample consisted of 68 people in the case group (hypertension patients) and 68 people in the control group (not hypertension patients), taken using the purposive sampling technique.

The research data was collected through questionnaires that included variables such as age, gender, education, occupation, ethnicity, diabetes mellitus, hereditary history, and smoking habits. In addition, blood pressure measurements were taken to determine the respondent's hypertensive status. The data was analyzed using SPSS version 23 software with univariate, bivariate, and multivariate approaches. Univariate analysis was performed to describe the characteristics of each variable, while bivariate analysis used the Chi-Square statistical test to test the relationship between two variables. Multivariate analysis was performed by logistic regression test to determine the most dominant risk factors associated with hypertension events. The study also considers the ethical aspects of the research, including the principles of anonymity and confidentiality of respondent data.

In this study, the research variables are divided into two main categories, namely independent variables and dependent variables. Independent variables are characteristics of the research subject whose existence can cause changes in other variables. The independent variables in this study included age, gender, education, occupation, ethnicity, diabetes mellitus, hereditary history, and smoking habits. Meanwhile, bound variables are variables that change due to the influence or change that occurs in independent variables. In the context of this study, the bound variable is the incidence of hypertension.

The research hypothesis is formulated in two forms, namely the zero hypothesis (H0) and the alternative hypothesis (H1). The null hypothesis (H0) states that there is no relationship between the independent variable and the bound variable, while the alternative hypothesis (H1) states that there is a relationship between the independent variable and the bound variable. The hypothesis in this study is as follows:

1. H0: There is no relationship between age and hypertension in the productive age community.
H1: There is a relationship between age and hypertension in people of productive age.
2. H0: There is no relationship between sex and hypertension in the productive age community.
H1: There is a relationship between sex and hypertension in people of productive age.
3. H0: There is no relationship between education and hypertension in the productive age community.
H1: There is a relationship between education and hypertension in people of productive age.
4. H0: There is no association between work and hypertension in the productive age community.
H1: There is a relationship between work and hypertension in people of productive age.
5. H0: There is no relationship between ethnicity and hypertension in the productive age community.
H1: There is a relationship between ethnicity and hypertension in people of productive age.
6. H0: There is no association between diabetes mellitus and hypertension in people of productive age.
H1: There is a relationship between diabetes mellitus and hypertension in people of productive age.
7. H0: There is no association between hereditary history and hypertension in the productive age community.
H1: There is a relationship between hereditary history and hypertension in the productive age community.
8. H0: There is no association between smoking habits and hypertension in the productive age community.
H1: There is a relationship between smoking habits and hypertension in people of productive age.

Using this approach, the study is expected to identify the main risk factors that contribute to the incidence of hypertension in the productive age community in the working area of the North Sangatta Health Center.

3. RESULT AND DISCUSSION

Characteristics of Respondents

Related to the results of the research conducted at the BLUD Puskesmas Sangatta Utara, data on the characteristics of respondents can be seen in detail in the table below:

Table 1. Characteristics of Respondents in the Research at the North Sangatta Health Center in 2024

Variable	Quantity(n=136)	
	Frequency (n)	Percentage (%)
Age		
21-44	74	54.4
45-58	62	45.6
Gender		
Man	50	36.8
Woman	86	63.2
Education		
No School	4	2.9
Elementary School Graduation	11	8.1
Graduated from junior high school	14	10.3
High School Graduation	59	43.3
Graduated from College	48	35.3
Work		
Private Employees	38	27.9
ASN/TNI/POLRI	30	22.1
Self employed	12	8.8
Farmer	1	0.7
Laborer	3	2.2
IRT	35	25.7
Pensioner	3	2.2
Not working	14	10.3
Tribe		
Javanese	50	36.8
Bugis	49	36
Dayak	4	2.9
Banjar	9	6.6
Kutai	5	3.7
Other	19	14

Based on table 1. It is known that the frequency distribution of respondent characteristics, as many as 74 respondents (54.4%) have an age category of 21 to 44 years. Based on gender, 86 respondents (63.2%) were female. When viewed in terms of education variables, as many as 59 respondents (43.3%) have high school graduation education. Furthermore, from work, as many as 38 respondents (27.9%) work as private employees. Furthermore, it was found that as many as 50 respondents (36.8%) were of Javanese ethnicity.

A. Univariate Analysis

Education Category Variables

In the table below, data related to the education category of the respondents in the study conducted at the BLUD Sangatta North Health Center

Table 2. Education Category Variables in Respondents at the North Sangatta Health Center 2024

Variable	Quantity(n=136)	
	Frequency (n)	Percentage (%)
Categories Education		
Low	15	11
Intermediate	73	53.7
Tall	48	35.5

Based on table 2, it is known that all 73 respondents (53.7%) have a secondary education level.

Job Category Variable

Related to the job categories of the research respondents conducted at BLUD Sangatta Utara are illustrated in the table below:

Table 3. Variables of Job Category in Respondents at the North Sangatta Health Center 2024

Variable	Quantity(n=136)	
	Frequency (n)	Percentage (%)
Job Category		
Work	84	61.8
Not Working	52	38.2

Based on table 3, it is known that all respondents as many as 84 respondents (61.8%) have a work category.

Variable of Suffering from Diabetes Mellitus

In the table below, variable data of people with Diabetes Mellitus who are research respondents at the BLUD Sangatta North Health Center are displayed.

Table 4. Variables of Suffering from Diabetes Mellitus in Respondents at the North Sangatta Health Center in 2024

Variable	Quantity(n=136)	
	Frequency (n)	Percentage (%)
Having diabetes mellitus		
Exist	21	15.4
None	115	84.6

Based on table 4, it is known that a total of 115 respondents (84.6%) do not suffer from diabetes mellitus.

Variables: Hereditary history with hypertension

In the table below, data related to the history of hypertension from visitors to the BLUD service of the North Sangatta Health Center who were research respondents.

Table 5. Variables of Ancestry with Hypertension in Respondents at the North Sangatta Health Center in 2024

Variable	Quantity(n=136)	
	Frequency (n)	Percentage (%)
Hereditary history with hypertension		
Exist	54	39.7
None	82	60.3

Based on table 5, it is known that all respondents with a history of descent with hypertension were obtained, 82 respondents (60.3%) did not have a history of descent with hypertension.

Variables of Smoking Habits with Hypertension

In the table below, it is listed related to the smoking habits of research respondents at the BLUD Sangatta North Health Center.

Table 6. Variables of Smoking Habits with Hypertension in Respondents at the North Sangatta Health Center 2024

Variable	Quantity(n=136)	
	Frequency (n)	Percentage (%)
Smoking habits		
Yes	23	16.9
Not	113	83.1

Based on table 6, it is known that all respondents with smoking habits were obtained, 113 respondents (83.1%) did not have smoking habits.

Variables of Habit of Taking Hypertension Medication with Hypertension

In the table below, data on hypertension drug consumption habits in respondents with hypertension at the BLUD Sangatta Utara Health Center are listed.

Table 7. Variables of Hypertension Drug Consumption Habits With Hypertension in Respondents at the North Sangatta Health Center 2024

Variable	Quantity(n=136)	
	Frequency (n)	Percentage (%)
Habits of taking hypertension medication		
Not	96	70.6
Yes	40	29.4

Based on table 7. It is known that all respondents have a habit of taking hypertension drugs, as many as 96 respondents (70.6%) do not take hypertension OBA.

Hypertension Incidence Variables

In the table below, the variables of hypertension incidence in visitors to BLUD Sangatta Utara Health Center who were research respondents are listed.

Table 4.8. Variables of Hypertension Incidence in Respondents at the North Sangatta Health Center 2024

Variable	Number (n=136)	
	Frequency (n)	Percentage (%)
Hypertension		
Yes	68	50
Not	68	50

Based on table 4.8, it is known that all respondents have hypertension events, it can be seen that 68 respondents (50%) experienced hypertension events, and 68 respondents (50%) did not experience hypertension events.

B. Bivariate Analysis

Age Relationship with Hypertension

In the table below, the data from the research results at the BLUD Sangatta Utara Health Center are listed which contain related to the relationship between age and hypertension.

Table 9. Relationship between Age and Hypertension in Respondents at the North Sangatta Health Center 2024

Variable	Age	Hypertension
Age		
Correlation Coefficient	1.000	0.395
P value	.	<0.001
Hypertension		
Correlation Coefficient	0.395	1.000
P value	<0.001	.

Based on the table, it is known that the P value < 0.001 (P value < 0.05) which shows that there is a significant relationship between age and the incidence of hypertension.

Sex Relationship with Hypertension

In the table below, data related to the relationship between sex and hypertension in respondents at the BLUD Sangatta Utara Health Center are listed.

Table 10. Sex Relationship with Hypertension in Respondents at the North Sangatta Health Center 2024

Gender	Hypertension						P value	OR
	Yes		Not		Total			
	(n)	(%)	(n)	(%)	n	%		
Man	26	52	24	48	50	100		
Woman	42	48.8	44	51.2	86	100	0.859	1.135

Based on table 10, it is known that among respondents with male gender, the highest proportion is found in respondents who experience hypertension (52%), then among respondents with female gender, the highest proportion is found in respondents who do not experience hypertension (51.2%). The results of the chi-square analysis showed a p value of 0.859 ($p > 0.05$) which meant that there was no significant relationship between sex and the incidence of hypertension. The odds ratio showed 1,135,

which means that respondents with a male gender are 1,135 times more likely to develop hypertension compared to respondents with a female gender.

The Relationship Between Education and Hypertension

In the table below, the results of the study related to the relationship between education and hypertension are listed.

Table 11. The Relationship between Education and Hypertension in Respondents at the North Sangatta Health Center 2024

Education	Hypertension						P value
	Yes		Not		Total		
	(n)	(%)	(n)	(%)	n	%	
Low	10	66.7	5	33.3	15	100	0.069
Intermediate	40	54.8	33	45.2	73	100	
Tall	18	37.5	30	62.5	48	100	

Based on table 11, it is known that among respondents who have low education, the highest proportion is found in respondents who experience hypertension (14.7%), then among respondents who have secondary education, the highest proportion is found in respondents who experience hypertension (58.8%). In respondents who have higher education, the highest proportion is found in respondents who do not experience hypertension (44.1%). The results of the chi-square analysis showed a p value of 0.069 ($p > 0.05$) which meant that there was no significant relationship between education and the incidence of hypertension.

The relationship between work and hypertension

The table below displays data information related to the relationship between work and hypertension from research respondents at the BLUD Sangatta Utara Health Center

Table 12. The Relationship Between Work and Hypertension in Respondents at the North Sangatta Health Center 2024

Work	Hypertension						P value	OR
	Yes		Not		Total			
	(n)	(%)	(n)	(%)	n	%		
Work	34	40.5	50	59.5	84	100	0.008	0.360
Not working	34	65.4	18	34.6	52	100		

Based on table 12, it is known that among respondents and those who work, the highest proportion is found in respondents who do not experience hypertension (59.5%), then among non-working respondents, the highest proportion is found in respondents who experience hypertension (65.4%). The results of the chi-square analysis showed a p value of 0.008 ($p < 0.05$) which means that there was a significant relationship between work and the incidence of hypertension. The odds ratio showed a 0.360, which indicates the direction of a negative relationship which means that non-working respondents are 0.360 times more likely to develop hypertension compared to working respondents.

The Relationship Between Tribes and Hypertension

The table below displays information related to the relationship between ethnicity and hypertension in research respondents at the North Sangatta National Health Center.

Table 13. Relationship between Ethnicity and Hypertension in Respondents at the North Sangatta Health Center 2024

Tribe	Hypertension						P value
	Yes		Not		Total		
	(n)	(%)	(n)	(%)	n	%	
Javanese	22	44	28	56	50	100	0.067
Bugis	28	57.1	21	42.9	49	100	
Banjar	1	11.1	8	88.9	9	100	
Kutai	4	80	1	20	5	100	
Dayak	2	50	2	50	4	100	
Other	11	57.9	8	42.1	19	100	

Based on table 13, it is known that among respondents who have Javanese ethnicity, the highest proportion is found in respondents who do not experience hypertension (56%), then among respondents who have Bugis ethnicity, the highest proportion is found in respondents who have hypertension (57.1%). In Banjar respondents, the highest proportion was found in respondents who did not experience hypertension (88.9%). In Kutai respondents, the highest proportion was found in respondents who experienced hypertension (80%). In Dayak respondents, the highest proportion was found in respondents who did not experience hypertension and experienced hypertension events had the same proportion (50%). Furthermore, in respondents with other tribes, the highest proportion was found in respondents who experienced hypertension (57.9%). The results of the chi-square analysis showed a p value of 0.067 ($p > 0.05$) which meant that there was no significant relationship between the tribe and the incidence of hypertension.

The Relationship Between Diabetes Mellitus and Hypertension

In the table below, data information related to the relationship between diaphtheria melchitus and hypertension in research respondents at the North Sangatta Health Center is displayed.

Table 14. The Relationship between Diabetes Mellitus and Hypertension in Respondents at the North Sangatta Health Center 2024

Diabetes Mellitus	Hypertension						P value	OR
	Yes		Not		Total			
	(n)	(%)	(n)	(%)	n	%		
Exist	18	85.7	3	14.3	21	100	0.001	7.800
None	50	43.5	65	56.5	115	100		

Based on table 14, it is known that among respondents who have diabetes mellitus, the highest proportion is found in respondents who experience hypertension (85.7%), then among respondents who do not have diabetes mellitus, the highest proportion is found in respondents who do not experience hypertension (56.5%). The results of the chi-square analysis showed a p value of 0.001 ($p < 0.05$) which means that there is a significant relationship between diabetes mellitus and the incidence of hypertension. The odds ratio showed 7,800, which means that respondents who had diabetes

mellitus had a 7,800 times greater risk of developing hypertension compared to respondents who did not have diabetes mellitus.

The Relationship Between Hypertension and Hypertension

In the table below, information related to the relationship between the hereditary history of hypertension and hypertension in research respondents at the North Sangatta Health Center is displayed

Table 15. Relationship between Hypertension and Hypertension in Respondents at the North Sangatta Health Center 2024

Genetic History of Hypertensio n	Hypertension						P value	OR
	Yes		Not		Total			
	(n)	(%)	(n)	(%)	n	%		
Exist	35	64.8	19	35.2	54	100	0.009	2.735
None	33	40.2	49	59.8	82	100		

Based on table 15, it is known that among respondents who have a history of hypertension, the highest proportion is found in respondents who have experienced hypertension (64.8%), then among respondents who do not have a history of hypertension, the highest proportion is found in respondents who do not experience hypertension (59.8). The results of the chi-square analysis showed a p value of 0.009 ($p < 0.05$) which means that there is a significant relationship between the hereditary history of hypertension and the incidence of hypertension. The odds ratio showed 2,735, which means that respondents who had a history of hypertension were 2,735 times more likely to develop hypertension compared to respondents who did not have a history of hypertension.

The Relationship Between Smoking and Hypertension

In the table below, information related to the relationship between smoking and hypertension from research respondents at the North Sangatta Health Center is included.

Table 4.16. The Relationship Between Smoking and Hypertension in Respondents at the North Sangatta Health Center 2024

Smoke	Hypertension						P value	OR
	Yes		Not		Total			
	(n)	(%)	(n)	(%)	n	%		
Yes	15	65.2	8	34.8	23	100	0.170	2.123
Not	53	46.9	60	53.1	113	100		

Based on table 16, it is known that among respondents who have a smoking habit, the highest proportion is found in respondents who experience hypertension (65.2%), then among respondents who do not have a smoking habit, the highest proportion is found in respondents who do not experience hypertension (53.1%). The results of the chi-square analysis showed a p value of 0.170 ($p > 0.05$) which meant that there was no significant relationship between smoking habits and the incidence of hypertension. The odds ratio showed 2,123, which means that respondents who had a smoking habit

had a 2,123 times greater risk of developing hypertension compared to respondents who did not have a smoking habit.

C. Multivariate Analysis

Variable Independence Test

The table below displays data information related to the independence test of research variables from respondents at the BLUD Sangatta Utara Health Center

Table 17. Variable Independence Test			
It	Variable	P value	Information
1	Age	<0.001	Model Entry
2	Gender	0.859	Not included in the model
3	Education	0.069	Model Entry
4	Work	0.008	Model Entry
5	Tribe	0.067	Model Entry
6	Diabetes Mellitus	0.001	Model Entry
7	History of Hypertension	0.009	Model Entry
8	Smoke	0.170	Model Entry

Simultaneous Parameter Significance Test (Step 1)

The table below displays data information related to the simultaneous parameter significance test on respondents at the North Sangatta Health Center

Table 18. Simultaneous Parameter Significance Test (Step 1)		
Chi-Square	Df	p-value
(1)	(2)	(3)
50.852	7	<0.001

The table shows the chi square value of 50,852 > the value of the chi square table (df = 7, $\alpha = 0.05$) which is 14,017 so it was decided that H0 was rejected. This means that there is at least one variable that affects the incidence of hypertension. After simultaneous testing, it is followed by partial testing.

Partial Parameter Significance Test (Step 1)

In the table below, data information related to the simultaneous parameter significance test (step 1) in research respondents at BLUD Sangatta Utara Health Center is displayed

Table 19. Simultaneous Parameter Significance Test (Step 1)					
Variable	B	S.E.	Wald	p-value	Exp(β)
(1)	(2)	(3)	(4)	(5)	(6)
Age	0.091	0.024	14.485	<0.001	1.095
Education	-0.184	0.392	0.220	0.639	0.832
Work	-1.078	0.499	4.667	0.031	0.340
Tribe	-0.125	0.128	0.951	0.329	0.883
Diabetes Mellitus	1.018	0.734	1.928	0.165	2.769
Genetic	0.940	0.456	4.251	0.039	2.560
History of Hypertension	0.929	0.611	2.316	0.128	2.533
Smoke	-3.244	1.175	4.929	0.006	0.039
Consant					

The table shows that step 1 results of the wald test of all the variables that have been included in the modeling.

Simultaneous Parameter Significance Test (Step 2)

In the table below, data information related to the simultaneous parameter significance test (step 2) in research respondents at BLUD Sangatta Utara Health Center is displayed

Table 20. Simultaneous Parameter Significance Test (Step 2)		
<i>Chi-Square</i>	<i>Df</i>	<i>p-value</i>
(1)	(2)	(3)
50.631	6	<0.001

The table shows a chi square value of 50,631 > the value of the chi square table (df = 6, $\alpha = 0.05$) which is 12,592 so it was decided that H0 was rejected, meaning that at least one of the variables that affects the incidence of hypertension is there. After simultaneous testing, it is followed by partial testing.

Partial Parameter Significance Test (Step 2)

In the table below, data information related to the Partial Parameter Significance Test (Step 2) on research respondents at BLUD Puskesmas Utara Sangatta is displayed.

Table 21. Partial Parameter Significance Test (Step 2)					
Variable	B	S.E.	Wald	p-value	Exp(β)
(1)	(2)	(3)	(4)	(5)	(6)
Age	0.088	0.023	14.767	<0.001	1.092
Work	-1.008	0.475	4.508	0.034	0.365
Tribe	-0.136	0.125	1.175	0.278	0.873
Diabetes Mellitus	0.968	0.724	1.790	0.181	2.633
Genetic History of Hypertension	0.941	0.455	4.287	0.038	2.563
Smoke	0.882	0.598	2.178	0.140	2.416
Consant	-3.256	1.164	7.823	0.005	0.039

In the table, it was found that the results of the wald test from all variables were obtained one (1) variable that had no effect on the incidence of hypertension, namely education.

Simultaneous Parameter Significance Test (Step 3)

In the table below, data information related to the Simultaneous Parameter Significance Test (Step3) in research respondents at BLUD Puskesmas Utara Sangatta is displayed.

Table 22. Simultaneous Parameter Significance Test (Step 3)		
<i>Chi-Square</i>	<i>Df</i>	<i>p-value</i>
(1)	(2)	(3)
49.441	5	<0.001

The table shows the value of chi square worth 49,441 > the value of the chi square table (df = 5, $\alpha = 0.05$) which is 11,070 so it was decided that H0 was rejected, meaning that at least there is one variable that affects the incidence of hypertension. After simultaneous testing, it is followed by partial testing.

Partial Parameter Significance Test (Step 3)

In the table below, data information related to the Partial Parameter Significance Test (Step3) in research respondents at BLUD Puskesmas Utara Sangatta is displayed

Table 4.23. Partial Parameter Significance Test (Step 3)

Variable	B	S.E.	Wald	p-value	Exp(β)
(1)	(2)	(3)	(4)	(5)	(6)
Age	0.087	0.023	14.629	<0.001	1.092
Work	-0.954	0.468	4.153	0.042	0.385
Diabetes Mellitus	1.000	0.721	1.925	0.165	2.718
Genetic History of Hypertension	0.947	0.453	4.376	0.036	2.579
Smoke	0.786	0.583	1.822	0.177	2.196
Consant	-3.738	1.087	11.823	0.001	0.024

In the table, it was found that the results of the wald test from all variables were obtained one (1) variable that had no effect on the incidence of hypertension, namely tribe. In this step, all variables that have no effect will be eliminated and the best model is obtained by the backward method that stops at the last iteration, namely step 4.

Simultaneous Parameter Significance Test (Step 4)

In the table below, data information related to the Simultaneous Parameter Significance Test (Step 4) in research respondents at BLUD Sangatta Utara Health Center is displayed.

Table 4.24. Simultaneous Parameter Significance Test (Step 4)

Chi-Square	Df	p-value
(1)	(2)	(3)
47.594	4	<0.001

The table shows a chi square value of 47,594 > the value of the chi square table (df = 4, $\alpha = 0.05$) which is 9,488 so it was decided that H0 was rejected, meaning that at least one of the variables that affects the incidence of hypertension is there. After simultaneous testing, it is followed by partial testing.

Partial Parameter Significance Test (Step 4)

In the table below, data information related to the Simultaneous Parameter Significance Test (Step 4) in research respondents at BLUD Sangatta Utara Health Center is displayed

Table 25. Partial Parameter Significance Test (Step 4)

Variable	B	S.E.	Wald	p-value	Exp(β)
(1)	(2)	(3)	(4)	(5)	(6)
Age	0.090	0.023	15.905	<0.001	1.094
Work	-0.758	0.444	2.921	0.087	0.462
Diabetes Mellitus	1.217	0.709	2.950	0.086	3.377
Genetic History of Hypertension	0.915	0.446	4.220	0.040	2.498
Consant	-3.844	1.082	12.618	<0.001	0.021

In the table, it was found that the variables of age, occupation, diabetes mellitus, and hereditary history of hypertension had an effect on the incidence of hypertension.

Interpretation of the Multiple Logistic Regression Model

The logit model formed based on the 2nd step test is as follows: $g(x) = -3.844 + 0.090 (\text{age}) - 0.758 (\text{occupation}) + 1.217 (\text{diabetes mellitus}) + 0.915 (\text{hereditary history of hypertension})$.

The resulting model will be applied in predicting how much the incidence of hypertension affects by using the factors that affect it. The following is a simulation of the implementation prediction model:

Table 26. Interpretation of the Multiple Logistic Regression Model

Variable	Respondents 18	Respondents 89
(1)	(2)	(3)
Age	28	44
Work	Not working (0)	Work (1)
Diabetes Mellitus	None (0)	There are (1)
Genetic History of Hypertension	There are (1)	None (0)
Prediction Value	0.399	0.639

The results in the table can be interpreted as follows:

a) Respondents' prediction value 18

$$\pi_1 = \frac{\exp^{-3.844+0.090(28)-0.758(0)+1.217(0)+0.915(1)}}{1+\exp^{-3.844+0.090(28)-0.758(0)+1.217(0)+0.915(1)}}$$

$$\pi_1 = \frac{0.664}{1+0.664}$$

$$\pi_1 = \frac{0.664}{1.664}$$

$$\pi_1 = 0.399$$

Based on the results above, it shows that the probability of the respondent experiencing hypertension is 39.9 percent. Meanwhile, the chance of respondents not experiencing hypertension was 60.1 percent.

b) Respondents' prediction value 89

$$\pi_1 = \frac{\exp^{-3.844+0.090(44)-0.758(1)+1.217(1)+0.915(0)}}{1+\exp^{-3.844+0.090(44)-0.758(1)+1.217(1)+0.915(0)}}$$

$$\pi_1 = \frac{1.777}{1+1.777}$$

$$\pi_1 = \frac{1.777}{2.777}$$

$$\pi_1 = 0.639$$

Based on the results above, it shows that the probability of respondents experiencing hypertension is 63.9 percent. Meanwhile, the chance of respondents not experiencing hypertension was 36.1 percent.

Coefficient of Determination

In the table below, data information related to the Simultaneous Parameter Significance Test (Step3) in research respondents at BLUD Puskesmas Utara Sangatta is displayed

Table 27. Coefficient of Determination

<i>Nagelkerke R Square</i>
0.394

The table shows a Nagelkerke R Square value of 0.394, meaning that the predictor variables that are included in the model can explain the diversity by 39.4 percent, while the rest (60.6%) is explained by other variables that are not included in the model.

Interpretation of Parameter Coefficients

Odds Ratio is the value of the tendency between one category and another on a qualitative explanatory variable. The value of the tendency ratio can be seen in the following table.

Table 28. Interpretation of Parameter Coefficients

Variable	Odds Ratio Exp(β)
(1)	(2)
Age	1.094
Work	0.462
Diabetes Mellitus	3.377
Genetic History of Hypertension	2.498
Consant	0.021

The table can be interpreted as follows:

- Every 1-year increase in the age of respondents tends to experience an incidence of hypertension of 1,094
- Respondents who did not work tended to experience hypertension events by 0.462 times compared to respondents who worked.
- Respondents who had diabetes mellitus were 3,377 times more likely to experience hypertension than respondents who did not have diabetes mellitus
- Respondents who had a history of hypertension tended to experience hypertension events 2,498 times compared to respondents who did not have a history of hypertension
- A constant value of 0.021 means that if there are no independent variables that affect it, the hypertension incidence value is 0.021.

Age Relationship with Hypertension

Age has a significant effect on the incidence of hypertension, with the prevalence increasing with age (Kim & Thiruvengadam, 2024). Structural changes in blood vessels, such as increased stiffness and narrowing of the lumen, as well as disruptions to neurohormonal mechanisms such as the renin-angiotensin-aldosterone system, contribute to increased blood pressure, especially systolic pressure in old age. Systolic blood pressure continues to increase until the age of 80, while diastolic pressure tends to increase until the age of 55-60, then decreases or stabilizes.

The study showed a significant link between age and hypertension, supporting previous findings that age is a major risk factor for hypertension. Decreased vascular elasticity, decreased number of renal nephrons, and increased peripheral vascular resistance are some of the mechanisms that explain the increase in blood pressure in old age. This conclusion is in line with other epidemiological studies that highlight the importance of blood pressure monitoring in older people and the need for public health interventions that focus on the prevention and management of hypertension in this age group. By understanding this relationship, health programs can be more effective in targeting vulnerable age groups to reduce the risk of cardiovascular complications associated with hypertension (Taylor et al., 2024).

Gender Relationship with Hypertension

Sex did not show a significant association with the incidence of hypertension in this study (Taiso et al., 2021). Although the common theory states that women are protected from premenopausal hypertension by the hormone estrogen, which increases High Density Lipoprotein (HDL) levels and prevents atherosclerosis, data from the North Sangatta Health Center show an almost balanced prevalence of hypertension between men and women. These results challenge the hypothesis that gender is an independent risk factor for hypertension, suggesting that other factors may be more influential in determining the risk of hypertension in this population.

Previous studies have often shown that men are more prone to hypertension in their youth to middle age, while women tend to experience an increased risk after menopause. However, findings from the North Sangatta Health Center indicate that in the local context, lifestyle factors such as diet, physical activity levels, and smoking habits may play a more dominant role in the incidence of hypertension compared to gender factors. This highlights the need for a more holistic and contextual

approach to understanding and managing hypertension, which considers a range of health determinants beyond just gender (Connelly et al., 2021).

The Relationship between Education and Hypertension

No significant association was found between education level and the incidence of hypertension in this study. Although some previous studies have shown that individuals with higher levels of education tend to have a lower risk of hypertension, as they generally have better access to health information, better nutrition, and a healthy lifestyle, the results of the study at the North Sangatta Health Center challenge this assumption. The data show that educational status is not a major risk factor for hypertension, suggesting that even those with higher education do not necessarily have better blood pressure (Anshari, 2020).

Other factors such as lifestyle and diet seem to have a greater role in influencing the incidence of hypertension in this population (Goddard et al., 2023). Many respondents had low education but were able to keep their blood pressure within normal limits through healthy habits and an active lifestyle. In contrast, some individuals with higher education continue to experience hypertension due to poor diet and lack of physical activity. This highlights the importance of a more comprehensive approach to hypertension prevention and management, which focuses not only on education but also on the promotion of healthy lifestyles and community-based interventions (Ying et al., 2024).

Occupational Relationship with Hypertension

Employment showed a significant association with the incidence of hypertension, with individuals who did not work having a higher risk of developing hypertension (Rosadi, 2021). The study revealed that those who do not have a permanent job or are unemployed tend to experience higher levels of stress, which directly contributes to an increase in blood pressure. Economic uncertainty and a lack of regular physical activity are also factors that can exacerbate this condition. In addition, a stable job provides a daily routine that can help regulate diet, sleep, and physical activity, all factors that contribute to better cardiovascular health (Syed, 2020).

The results of this study support the importance of policy interventions that support job stability and healthy working conditions. Workplace wellness programs designed to reduce stress, provide a positive work environment, and promote healthy lifestyles can significantly reduce the prevalence of hypertension among workers. Additionally, government policies that increase job opportunities and provide support for the unemployed can have a positive impact not only on economic well-being but also on overall public health. The study confirms that efforts to address hypertension should include a more holistic approach, which takes into account economic and social factors in addition to traditional medical interventions (Sya'diyah et al., 2023).

The Relationship of Tribes with Hypertension

The study did not find a significant association between ethnicity and the incidence of hypertension, although several previous studies have shown differences in the prevalence of hypertension between ethnic groups (Pakpahan et al., 2024). The results of the study at the North Sangatta Health Center indicated that genetic factors may play a role in the incidence of hypertension, but the influence was not dominant in the context of this population. Variations in the prevalence of hypertension between tribes may be more influenced by other, more fundamental factors.

Other factors such as diet and lifestyle seem to play a greater role in determining the incidence of hypertension than genetic factors. For example, tribes that have diets high in salt and fat are more prone to hypertension, regardless of their genetic background. In addition, lifestyle such as physical activity, stress levels, and smoking habits also contribute significantly. Therefore, although genetic factors cannot be ignored, health interventions that focus on dietary and lifestyle changes may be more effective in controlling hypertension in different ethnic groups (Gerungan & Lainsamputti, 2022).

The Relationship between Diabetes Mellitus and Hypertension

Diabetes mellitus showed a significant association with the incidence of hypertension, with people with diabetes having a seven-fold greater risk of developing hypertension compared to individuals without diabetes. This is due to various interrelated pathophysiological mechanisms between the two conditions, such as insulin resistance and endothelial dysfunction. The results of the study at the North Sangatta Health Center reinforce the evidence that diabetes mellitus is a major risk factor for hypertension, in line with the findings of many previous studies. High blood glucose levels in people with diabetes can lead to increased blood volume and blood vessel stiffness, which ultimately increases blood pressure (Fuchs & Whelton, 2020).

The findings emphasize the importance of integrated management of diabetes mellitus and hypertension to prevent serious cardiovascular complications, such as heart disease and stroke. A holistic approach that includes strict blood sugar control, blood pressure management, as well as lifestyle changes such as a healthy diet and regular physical activity is necessary. Health intervention programs that combine patient education, regular monitoring, and support for lifestyle changes can help reduce the risk of hypertension in people with diabetes, improve their quality of life, and reduce the overall public health burden (Mano et al., 2023).

Relationship between Hereditary History and Hypertension

A hereditary history of hypertension showed a significant association with the incidence of hypertension, with individuals with a family history of hypertension at twice the risk of developing hypertension compared to those without a family history of hypertension (Sari & Majid, 2019). The results of this study at the North Sangatta Health Center are consistent with many previous studies that show that genetic factors play an important role in a person's predisposition to hypertension. Genes inherited from parents can influence blood pressure regulation through a variety of mechanisms, including the renin-angiotensin-aldosterone system and sensitivity to salt (OKTAVIARINI et al., 2019). Therefore, individuals with a family history of hypertension need to be more vigilant and proactive in monitoring their blood pressure.

This finding confirms the importance of taking into account genetic factors in the risk assessment and management of hypertension (Simanjuntak, 2021). In clinical practice, information about a family history of hypertension should be collected systematically and used to identify high-risk individuals. Appropriate prevention strategies, such as education about a healthy lifestyle, a low-salt diet, and regular physical activity, should be implemented, especially for those with a family history of hypertension. In addition, regular blood pressure checks and early detection are essential for managing and reducing the risk of complications associated with hypertension in vulnerable individuals (Handelsman et al., 2024). Thus, a well-rounded and evidence-based approach to treating hypertension can help reduce the burden of this disease in the population.

The Relationship between Smoking and Hypertension

The study did not find a significant association between smoking habits and the incidence of hypertension, although data suggest that smokers have twice as much risk of developing hypertension compared to non-smokers. These results may be due to other factors that affect blood pressure in the sample of this study, such as diet, physical activity, and genetic factors. Nonetheless, many previous studies have shown that smoking can damage artery walls, increase blood pressure, and worsen hypertensive conditions. Therefore, although these results do not show a significant association, smoking habits are still considered an important risk factor in the context of hypertension (Aswin et al., 2024).

Although the results of this study do not show a significant relationship between smoking and hypertension (Indrawan et al., 2020), the importance of education and intervention to encourage smoking cessation cannot be ignored. Smoking has many negative impacts on overall cardiovascular health, including an increased risk of heart disease and stroke. Health education programs that

emphasize the dangers of smoking and the benefits of quitting smoking can help reduce the prevalence of hypertension and related complications. In addition, health policies that support a smoke-free environment and provide assistance for those who want to quit smoking can contribute to improving public health and preventing cardiovascular disease (Gallucci et al., 2020).

4. CONCLUSION

The study concluded that age, occupation, diabetes mellitus, and hereditary history of hypertension had a significant relationship with the incidence of hypertension, while gender, education, ethnicity, and smoking habits did not show a significant relationship. The strength of this study lies in the identification of significant factors that contribute to hypertension in the productive age community in the working area of the North Sangatta Health Center. However, the limitations of this study include a limited range of variables and population expansion that can affect the results. Therefore, the suggestion for further research is to expand the sources of information and research variables to obtain a more comprehensive and accurate analysis.

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