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Original article

## Prevalence and Factors Associated with High Blood Pressure among Pregnant Women Attending Antenatal Care in Iringa Municipality, Tanzania

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### ABSTRACT:

**Background:** High blood pressure during pregnancy affects 5% to 10% of pregnancies worldwide, significantly impacting maternal and neonatal health, and is a troubling issue in Tanzania due to its contribution to high maternal mortality rates. This study examines the prevalence of high blood pressure in pregnant women attending antenatal care in Iringa Municipality, providing insight into the socio-demographic factors related to these conditions.

**Methods:** This study employed a quantitative cross-sectional design from June 12 to July 15, 2024. The research included 545 participants selected from 12 public healthcare facilities. Data were collected from antenatal clinic cards and analyzed using the Statistical Package for the Social Sciences (SPSS) to determine frequencies, percentages, statistical relationships, and predictors of high blood pressure.

**Results:** The study found a moderate-high prevalence of high blood pressure at 13.6% among pregnant women. Significant factors included age and occupation; women below 20 years had adjusted odds ratios (aOR) of 0.251 (95% CI: 0.066-0.958,  $p = 0.043$ ), and between 20-35 years had an aOR of 0.306 (95% CI: 0.135-0.694,  $p = 0.005$ ), indicating lower odds of high blood pressure. Homemakers showed an aOR of 5.02 (95% CI: 1.516-16.617,  $p = 0.008$ ), while petty business had an aOR of 2.975 (95% CI: 1.006-8.801,  $p = 0.049$ ). Marital status, education level, income, trimester, and parity were not associated with high blood pressure during pregnancy.

**Conclusions:** High blood pressure is prevalent among pregnant women, with age and occupation as associated factors, indicating a need for targeted interventions for better maternal health.

**Keywords:** Prevalence; High Blood Pressure; Hypertension; Pregnant Women; Antenatal Care.

### INTRODUCTION

High blood pressure during pregnancy, encompassing conditions such as gestational hypertension and preeclampsia, remains a significant public health concern, affecting approximately 5% to 10% of pregnancies globally [1]. The prevalence of hypertensive disorders in pregnancy has been documented to vary across different regions. For instance, a study in Saudi Arabia reported that high blood pressure comprised 2.16% of preeclampsia cases and 0.29% of persistent

hypertension among pregnant women [2]. This aligns with findings from a systematic review indicating that hypertensive disorders are prevalent in Sub-Saharan Africa, with significant implications for maternal and neonatal health [3]. The increasing incidence of chronic hypertension among pregnant women, particularly in the context of rising obesity rates and advanced maternal age, has been a focal point of research [4].

Several studies have explored the impact of lifestyle interventions on managing hypertension in

pregnancy. For instance, Ma et al. demonstrated that stress reduction techniques, such as progressive muscle relaxation, could effectively lower blood pressure in prehypertensive pregnant women [5]. Additionally, the consumption of potassium-rich foods, such as Ambon bananas, has been shown to significantly reduce blood pressure levels among hypertensive pregnant women [6]. Exercise during pregnancy has also been associated with lower blood pressure increases, with findings indicating that physically active pregnant women exhibit a reduced risk of developing hypertension compared to their sedentary counterparts [7,8].

Management strategies for hypertensive disorders in pregnancy have evolved, with recent guidelines emphasizing the importance of individualized treatment plans. A systematic review of international clinical practice guidelines highlighted the need for standardized approaches to diagnosing and managing pregnancy-related hypertension [9]. Recent clinical trials have compared the efficacy of different antihypertensive medications, such as labetalol and nifedipine, in improving maternal and fetal outcomes [10]. Furthermore, a study on the use of nicardipine for severe antepartum hypertension indicated favorable outcomes in terms of maternal safety and treatment success [11].

The implications of hypertensive disorders extend beyond immediate maternal health, affecting fetal development and long-term outcomes. Research has indicated that maternal hypertension can lead to adverse neonatal outcomes, including low birth weight and preterm delivery [12]. Moreover, there is growing evidence linking maternal hypertensive disorders to neurodevelopmental issues in offspring, suggesting that the effects of maternal health during pregnancy can have lasting impacts on child development [13,14].

The prevalence of hypertensive disorders of pregnancy (HDP) in Tanzania is concerning. A systematic review indicated that approximately 5.1% of pregnancies in Tanzania are complicated by HDP, which includes gestational hypertension and preeclampsia [15]. This aligns with findings from a study that reported high blood pressure as a contributing factor to maternal mortality, accounting for up to 34% of maternal deaths in the country, which is a public health concern [16]. The burden of these disorders is exacerbated by factors such as inadequate antenatal care, with recommendations emphasizing the importance of early booking for

antenatal services to improve maternal health outcomes [17,18].

This study aimed to investigate the prevalence of high blood pressure among pregnant women attending antenatal care in Iringa Municipality, Tanzania. To achieve this aim, the study determined the prevalence of high blood pressure in this population and identified the socio-demographic factors associated with the condition.

## METHODS

The study area of focus is Iringa Municipality, situated in the Iringa region of Tanzania. Iringa Municipal Council is one of the five councils within the Iringa region, which serves as the administrative capital and exhibits an urban character. The other councils in the region are the Iringa District Council, Kilolo District Council, Mufindi District Council, and Mafinga Town Council. The municipality is bordered by the Iringa Rural and Kilolo district councils, situated between latitudes 7.7° to 7.875° south of the Equator and longitudes 35.620° to 35.765° east of the Greenwich Meridian. According to the 2022 census, the municipality has a population of 202,490 residents [19,20].

### *Study design*

The study, conducted from June 12 to July 15, 2024, employed a quantitative cross-sectional analytical approach to thoroughly examine the prevalence and factors associated with high blood pressure among pregnant women attending antenatal care in Iringa Municipality, Tanzania. This approach allowed for the collection and analysis of data at a specific point in time, facilitating a comprehensive understanding of the phenomenon under investigation.

The study focused on pregnant women who attended antenatal care services in Iringa Municipality, Tanzania. The inclusion criteria for participants required that they were currently pregnant, had resided in Iringa Municipality for at least the past six months, had no history of hypertension, and were willing to provide informed consent for participation in the study. Conversely, individuals who were excluded from the study included those unable to provide informed consent due to cognitive or psychological impairments, and pregnant women who temporarily visited the antenatal clinic without having been residents of the municipality for a minimum of six months.

### *Sampling and sample size*

Given the limited number of public hospitals and health centers, a purposeful selection was made to involve all two hospitals and four health centers available in the municipality, complemented by a random selection of six public dispensaries. This approach resulted in a total of twelve public healthcare facilities participating in the study. Pregnant women were then randomly selected from each facility. To ascertain the requisite sample size for the study, Cochran's formula was employed.

$$\text{Cochran formula: } N = \frac{Z^2 P(1-P)}{d^2}$$

Where;

N = Minimum sample size

Z = Constant, standard normal deviation (1.96 for 95% Confidence level)

P = Estimated proportion of the population (50% or 0.5) to maximize sample size in the absence of precise prevalence data

d = Acceptable margin of error (4.2% or 0.042)

$$\text{Sample size (N)} = \frac{1.96^2 \times 0.5 \times (1-0.5)}{0.042^2} = 545 \text{ Pregnant women}$$

Therefore, the total sample size for the study in Iringa Municipality was determined to be 545 pregnant women.

### **Data analysis**

All socio-demographic characteristics and blood pressure data were recorded from the antenatal clinic cards of pregnant women of their current visits.

Data analysis utilized version 26 of the Statistical Package for Social Sciences (SPSS), emphasizing frequencies and percentages to establish a foundational understanding of the dataset. Chi-square tests revealed significant associations between predictor variables and high blood pressure, while binary logistic regression provided a detailed analysis of these predictors' impacts on the outcomes. In this study, high blood pressure (hypertension) was defined as blood pressure  $\geq 140/90$  mmHg among assessed pregnant women.

## **RESULTS**

### **Socio-demographic characteristics of pregnant women**

The majority of the women, 440 (80.7%), were aged between 20 and 35 years, which is considered the biologically optimal age. Meanwhile, 67 (12.3%) are below 20 years (adolescent pregnancies), and 38 (7%) are above 35 years

(advanced maternal age). Regarding marital status, most participants, 415 (76.1%), were married, and 130 (23.9%) were unmarried. Concerning educational level, 376 (69%) of pregnant women completed secondary education, followed by 89 (16.3%) with primary education. Income levels reflect financial challenges, as 378 (69.4%) women are classified as low-income earners, and 160 (29.4%) fall into the middle-income category. Occupationally, the largest group comprises petty business workers, 284 (52.1%), followed by homemakers, 95 (17.4%). In the pregnancy stage, 202 (37.1%) women were in their first trimester, followed by 277 (50.8%) in the second, as shown in **Table 1**. The data highlights the demographic diversity and various socio-economic factors influencing this population of pregnant women.

### **Prevalence of high blood pressure among pregnant women**

The **Figure** presents the prevalence of high blood pressure among pregnant women, indicating that 13.6% of participants had high blood pressure, which is classified as moderate-high, while the majority, 86.4%, had no high blood pressure to maintain normal levels.

### **Bivariate analysis of factors associated with high blood pressure among pregnant women**

In the bivariate analysis of factors associated with high blood pressure among pregnant women, age showed a significant association with a P-value of 0.003, while occupation was also significant with a P-value of 0.048. In contrast, marital status, education level, income, trimester, and parity were not significantly associated with high blood pressure among the study participants, as described in **Table 2**.

### **Binary logistic regression of factors associated with high blood pressure among pregnant women**

In the univariate analysis of factors associated with high blood pressure among pregnant women, significant variables included age and occupation. Specifically, women under 20 years of age and those between 20 and 35 years demonstrated a lower likelihood of having high blood pressure compared to those over 35 years, with crude odds ratios (cOR) of 0.253 (95% C.I: 0.089-0.715,  $p = 0.01$ ) and 0.31 (95% C.I: 0.148-0.649,  $p = 0.002$ ) respectively. This indicates that as age increases, the risk of high blood pressure increases among these groups, suggesting a potential intervention among older pregnant women. Furthermore, occupation was

significant, with homemakers, formal employment, and petty business showing increased odds for high blood pressure, particularly for those among homemakers with cOR = 4.442 (95% C.I: 1.436-13.733,  $p = 0.01$ ) and formal employment, cOR = 3.694 (95% C.I: 1.162-11.75,  $p = 0.027$ ). This suggests nature of occupation may contribute to stress levels or access to healthcare, further influencing the likelihood of developing high blood pressure.

In the multivariate analysis, age and occupation remained significant predictors of high blood pressure. Specifically, women below 20 and 20-35 years continued to show decreased odds of high blood pressure compared to those above 35 years, with adjusted odds ratios (aOR) of 0.251 (95% C.I: 0.066-0.958,  $p = 0.043$ ) and 0.306 (95% C.I:

0.135-0.694,  $p = 0.005$ ) respectively, also suggesting interventions to higher age. Additionally, homemakers retained its significant association aOR = 5.02 (95% C.I: 1.516-16.617,  $p = 0.008$ ), indicating that women in this category are more likely to experience high blood pressure compared to farmers. Similarly, doing petty business also remained significant with an aOR of 2.975 (95% C.I: 1.006-8.801,  $p = 0.049$ ), suggesting occupational factors can profoundly influence health outcomes, including blood pressure during pregnancy. Most predictor variables, including marital status, education level, income per month, trimester, and parity, were not significant in both univariate and multivariate analyses, indicating that they are not associated with high blood pressure among pregnant women, as detailed in **Table 3**.

**Table 1:** Socio-demographic characteristics of pregnant women (N = 545)

Variables	Frequency (n)	Percent (%)
<b>Age (Years)</b>		
Below 20	67	12.3
20-35	440	80.7
Above 35	38	7
<b>Marital status</b>		
Married	415	76.1
Unmarried	130	23.9
<b>Education level</b>		
No formal education	8	1.5
Primary	89	16.3
Secondary	376	69
College or university	72	13.2
<b>Income per month (Tsh)</b>		
Low (Less than 300,000)	378	69.4
Middle (300,000 – 1,000,000)	160	29.4
High (More than 1,000,000)	7	1.3
<b>Occupation</b>		
Homemaker	95	17.4
Formal employment	86	15.8
Petty business	284	52.1
Farmer	80	14.7
<b>Trimester</b>		
One	202	37.1
Two	277	50.8
Three	66	12.1
<b>Parity</b>		

Variables	Frequency (n)	Percent (%)
One	238	43.7
Over one	307	56.3
<b>First pregnancy's age (years)</b>		
Below 20	150	27.5
20-35	393	72.1
Above 35	2	0.4

**Table 2:** Bivariate analysis of factors associated with high blood pressure among pregnant women (N = 545)

	High blood pressure			
	YES	No	Chi-square	P-value
	n (%)	n (%)		
<b>Age (Years)</b>				
Below 20	7 (1.3)	60 (11.0)		
20-35	55 (10.1)	385 (70.6)	11.489	<b>0.003*</b>
Above 35	12 (2.2)	26 (4.8)		
<b>Marital status</b>				
Married	56 (10.3)	359 (65.9)	0.010	0.919
Unmarried	18 (3.3)	112 (20.6)		
<b>Education level</b>				
No formal education	2 (0.4)	6 (1.1)		
Primary	7 (1.3)	82 (15.0)	3.739	0.291
Secondary	54 (9.9)	322 (59.1)		
College or university	11 (2.0)	61 (11.2)		
<b>Income per month (Tsh)</b>				
Low (Less than 300,000)	51 (9.4)	327 (60.0)		
Middle (300,000 – 1,000,000)	22 (4.0)	138 (25.3)	0.009	0.995
High (More than 1,000,000)	1 (0.2)	6 (1.1)		
<b>Occupation</b>				
Homemaker	18 (3.3)	77 (14.1)		
Formal employment	14 (2.6)	72 (13.2)	7.895	<b>0.048*</b>
Petty business	38 (7.0)	246 (45.1)		
Farmer	4 (0.7)	76 (13.9)		
<b>Trimester</b>				
One	29 (5.3)	173 (31.7)		
Two	39 (7.2)	238 (43.7)	1.296	0.523
Three	6 (1.1)	60 (11.0)		
<b>Parity</b>				
One	28 (5.1)	210 (38.5)	1.184	0.277
Over one	46 (8.4)	261 (47.9)		
<b>First pregnancy's age (years)</b>				
Below 20	21 (3.9)	129 (23.7)		
20-35	53 (9.7)	340 (62.4)	0.340	0.844
Above 35	0 (0.0)	2 (0.4)		

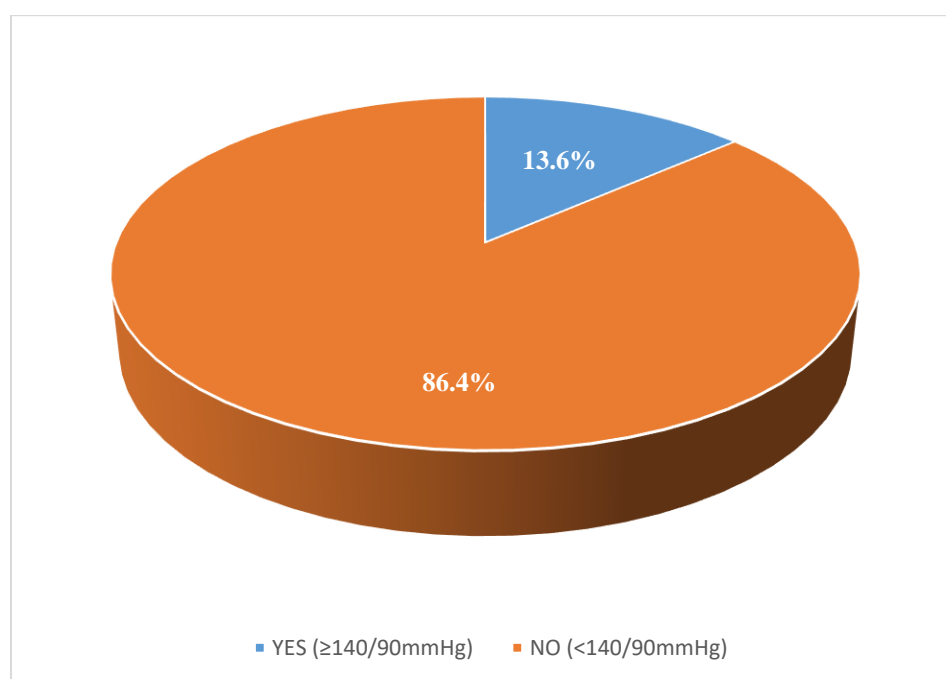
\* P<0.05 is statistically significant

**Table 3:** Binary logistic regression for factors associated with high blood pressure among pregnant women (N = 545)

Predictor variables	Univariate Analysis		Multivariate Analysis	
	cOR (95% C.I)	P-value	aOR (95% C.I)	P-value
<b>Age (Years)</b>				
Below 20	0.253 (0.089-0.715)	<b>0.01*</b>	0.251 (0.066-0.958)	<b>0.043*</b>
20-35	0.31 (0.148-0.649)	<b>0.002*</b>	0.306 (0.135-0.694)	<b>0.005*</b>
Above 35	Reference		Reference	
<b>Marital status</b>				
Married	0.971 (0.548-1.719)	0.919	1.042 (0.526-2.065)	0.906
Unmarried	Reference		Reference	
<b>Education level</b>				
No formal education	1.848 (0.33-10.367)	0.485	1.575 (0.211-11.742)	0.658
Primary	0.473 (0.173-1.292)	0.144	0.672 (0.182-2.487)	0.552
Secondary	0.93 (0.46-1.88)	0.84	1.2 (0.434-3.318)	0.725
College or university	Reference		Reference	
<b>Income per month (Tsh)</b>				
Low (Less than 300,000)	0.936 (0.11-7.933)	0.951	1.037 (0.105-10.197)	0.975
Middle (300,000 – 1,000,000)	0.957 (0.11-8.33)	0.968	0.738 (0.079-6.924)	0.79
High (More than 1,000,000)	Reference		Reference	
<b>Occupation</b>				
Homemaker	4.442 (1.436-13.733)	<b>0.01*</b>	5.02 (1.516-16.617)	<b>0.008*</b>
Formal employment	3.694 (1.162-11.75)	<b>0.027*</b>	3.866 (0.907-16.477)	0.068
Petty business	2.935 (1.015-8.487)	<b>0.047*</b>	2.975 (1.006-8.801)	<b>0.049*</b>
Farmer	Reference		Reference	
<b>Trimester</b>				
One	1.676 (0.664-4.235)	0.275	1.662 (0.635-4.349)	0.301
Two	1.639 (0.663-4.05)	0.285	1.548 (0.61-3.93)	0.358
Three	Reference		Reference	
<b>Parity</b>				
One	0.757 (0.457-1.252)	0.278	0.805 (0.438-1.479)	0.484
Over one	Reference		Reference	
<b>First pregnancy's age (years)</b>				
Below 20	-	-	-	-
20-35	-	-	-	-
Above 35	Reference		Reference	

\* P<0.05 is statistically significant, cOR=Crude Odds Ratio, aOR=Adjusted Odds Ratio, C.I = Confidence Interval





**Figure: Prevalence of high blood pressure among pregnant women**

## DISCUSSION

This study indicated that the prevalence of high blood pressure (hypertension) among pregnant women evaluated in healthcare facilities within Iringa Municipality, Tanzania, is 13.6%. This level of prevalence is considered moderate-high and raises significant public health concerns as it approaches a high prevalence threshold. In Tanzania, several studies have reported varying prevalence rates of hypertension and complications among pregnant women. For instance, a study conducted at Muhimbili National Hospital in Tanzania from September 2017 to January 2018 found that among pregnant women with hypertensive disorders, 62.2% had severe preeclampsia and 37.8% had eclampsia. The study reported 22.1% with severe maternal outcomes, including 63 near-misses and 8 maternal deaths, indicating a significant health concern [21]. Another study highlighted that the incidence of preeclampsia and eclampsia was found to be 1.7%, while the Tanzania Demographic Health Survey indicated that hypertensive disorders are the second leading cause of maternal mortality, accounting for 19% of deaths [22]. These findings underscore the critical need for improved antenatal care and blood pressure monitoring among pregnant women.

Comparatively, studies outside Tanzania have reported similar prevalence rates. For example, a

study in Benin found that the prevalence of hypertension during pregnancy was 13.3%, which closely mirrors the findings of this current study [23]. Similarly, research from Pakistan indicated that chronic hypertension significantly increases the risk of developing preeclampsia and eclampsia, with a prevalence of 28.57% among women with chronic hypertension [24]. This suggests that chronic conditions are a common risk factor for hypertensive disorders across different populations.

However, there are also notable differences in prevalence rates reported in other countries. For instance, a study in Sudan reported a prevalence of hypertension among pregnant women at 7.5%, which is considerably lower than the rates observed in this study [25]. This discrepancy may be attributed to differences in healthcare access, socioeconomic factors, and public health initiatives to manage hypertension in pregnancy. Additionally, a meta-analysis indicated that women with hypertension during pregnancy have a higher risk of stillbirth, a finding consistent across studies in Ethiopia, Cameroon, and Tanzania [26]. This highlights the severe consequences of untreated hypertension on maternal and fetal health.

This study utilized bivariate and binary logistic regression analyses to assess the factors associated with high blood pressure among pregnant women. The results indicated significant correlations between age

and occupation with high blood pressure, with P-values demonstrating statistical significance below 0.05. In contrast, the other variables examined were found to be insignificant. The study specifically analyzed the biological optimal period for childbirth (20 to 35 years) and compared it with adolescent pregnancies (below 20 years) and those of advanced maternal age (over 35 years). The findings indicated that older pregnant women, categorized as having advanced maternal age, were more likely to experience high blood pressure relative to the younger cohorts. The findings corroborated by another Tanzanian study that reported a higher prevalence of hypertension among women aged 20-34 years, suggesting that age-related physiological changes may contribute to increased blood pressure during pregnancy [16].

Similar trends have been observed outside Tanzania; for instance, a study conducted in Indonesia found that women aged 35 years and older were more likely to experience hypertensive disorders compared to younger women [27]. A study in Ghana found that older pregnant women were at a higher risk of developing hypertension, with obesity being a significant contributing factor [28]. The studies align with findings from a study in Saudi Arabia, where age was also identified as a significant predictor of high blood pressure among pregnant women [2]. However, the study from Benin contrasts with this study and many other studies, which revealed that younger pregnant women had a higher prevalence of hypertension compared to older women, challenging the common notion of age as a risk factor [23]. This discrepancy may be attributed to regional differences in lifestyle, healthcare access, and genetic factors that influence blood pressure regulation.

Moreover, occupation has been identified as a significant variable associated with health outcomes, particularly with women engaged in petty business and homemakers exhibiting increased odds of experiencing high blood pressure. The study conducted by Haroun et al. indicated that physically demanding occupations are associated with a higher prevalence of high blood pressure, potentially attributable to the stress and lifestyle factors linked to such work environments [25]. These findings align with a study undertaken in Saudi Arabia, which similarly recognized occupation as a prominent predictor of high blood pressure among pregnant women [2]. However, a contrasting study from Burkina Faso by Garanet et al. did not find a

significant association between occupation and hypertension, suggesting that cultural and environmental factors may influence these relationships differently across regions [29].

In addition to age and occupation, a study in Ethiopia found that women with lower educational levels and those engaged in manual labor were more likely to experience hypertension during pregnancy [30]. This is consistent with findings in Tanzania, where women in lower socioeconomic positions, often engaged in informal labor, exhibited higher blood pressure levels [16]. Understanding these factors is crucial for developing targeted interventions to manage hypertension in pregnant women effectively.

### **LIMITATIONS OF THE STUDY**

The cross-sectional study approach limits the ability to establish causality between high blood pressure and the various socio-demographic factors, as it does not account for changes over time or temporal relationships. The study's findings are specific to Iringa Municipality, which may not be generalizable to other regions in Tanzania or different cultural contexts. While the study analyzes socio-demographic factors, other unmeasured confounding variables related to lifestyle, healthcare access, or environmental factors may influence the prevalence and management of high blood pressure. Future researchers should collaborate to address highlighted limitations and enhance understanding in this field.

### **CONCLUSION**

The study underscores the prevalence of high blood pressure among pregnant women, identifying significant associations with age and occupation. With 13.6% of participants exhibiting high blood pressure ( $\geq 140/90$  mmHg), the findings highlight a meaningful public health concern, particularly regarding the risk of complications such as preeclampsia. Binary logistic regression analysis showed that pregnant women over 35 years old have a higher risk of high blood pressure. The influence of occupation further emphasizes an essential determinant of health; higher odds of high blood pressure were observed among homemakers and petty business pregnant women, suggesting that job-related stress or limited access to healthcare may play critical roles in maternal health outcomes. Interestingly, demographic factors such as marital status, education level, income, trimester, and parity did not show significant associations with high blood



pressure, indicating that these variables may not be as influential in this context.

### RECOMMENDATIONS

The study's findings advocate for targeted interventions focusing on advanced maternal age populations and those in specific occupational categories to mitigate the risks associated with high blood pressure. Enhanced screening, educational programs, and stress management resources for at-risk groups may contribute to better maternal and fetal health outcomes. Future research should explore the underlying mechanisms driving these associations and evaluate the effectiveness of tailored interventions to address the identified risk factors.

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### Ethical considerations

Ruaha Catholic University (RUCU) granted ethical approval for this research, referenced as RU/RPC/RP/2024/12. The office of the director of the Iringa Municipal Council authorized the collection of data through the district medical officer's office and the medical officer in charge at the facility level. Informed consent was obtained from all participants involved in the study. All data collected were managed with the highest regard for confidentiality, ensuring that no personal information was disclosed.

**Conflict of interest:** The authors declare that they have no competing interest.

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