International Journal of Science and Healthcare Research
Vol. 9; Issue: 2; April-June 2024
Website: ijshr.com
Original Research Article *ISSN: 2455-7587*

Magnitude and Determinants of Pregnancy Induced Hypertension in Selected General Hospitals in Lusaka, Zambia: A Cross-Sectional Study

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DOI: https://doi.org/10.52403/ijshr.20240240

ABSTRACT

Background: Hypertension in pregnancy continue to be among the major causes of maternal and perinatal morbidity and mortality, affecting 5-6% of pregnancies globally and contributing to a significant disease burden.
Aims and objectives: To assess prevalence and factors associated with pregnancy induced hypertension among pregnant women aged 15 to 49 years at three general hospitals of Lusaka District.
Methodology: Conducted cross sectional study with 413 systematically selected pregnant women attending antenatal clinics at Chawama, Chipata and Matero general hospitals from January 2019 to July 2020. The sample size for each hospital was determined proportionally based on twelve months of antenatal care visit data. Blood pressure, heights, weights, Body mass index and urinalysis were measured on all the study participants. A structured questionnaire collected data on social demographic and economic factors, reproductive and medical history. Data was analyzed using STATA version 13. Chi-square and fisher's exact tests identified association between PIH and various variables with multiple logistic regression used to control for confounders. Statistical significance was set at <0.05.
Results: The prevalence of Pregnancy induced hypertension was found to be 21%. Significant predictors of PIH included Stress during pregnancy (AOR = 2.28, 95% CI =1.35-3.85, p=0.002), lack of exercise (AOR = 0.48, 95% CI =0.28-0.81, p=0.007), high BMI (AOR = 1.57, 95% CI =1.12-2.19, p=0.007) and consuming alcohol (AOR = 2.29, 95% CI =1.03-5.09, p=0.042).
Conclusion: The prevalence of PIH was 21% with significant association observed between PIH and stress, alcohol consumption, lack of exercise and high BMI during pregnancy.

Keywords: *Pregnancy Induced hypertension; Prevalence; Associated factors, Antenatal mothers.*

INTRODUCTION

Background of the Study

Hypertension in pregnancy is a systolic blood pressure greater than or equal to 140

mmHg or diastolic blood pressure greater than or equal to 90 mmHg or both. Elevated systolic and diastolic blood pressure are both important in the identification of Pregnancy induced hypertension (1). Hypertensive blood pressure readings should be confirmed using the appropriate measurement technique with measurement after 10-15 minutes of rest.

Hypertension is the most common medical problem encountered during pregnancy and it complicates about 5-6% of pregnancies worldwide (2). There are different types of hypertensive disorders that occur during pregnancy and they are classified into four categories as recommended by the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. These include: chronic hypertension, preeclampsia-eclampsia, preeclampsia superimposed on chronic hypertension and gestational hypertension also known as transient hypertension or pregnancy induced hypertension (3).The diagnosis of PIH requires that the patient has systolic blood pressure ≥140 or diastolic blood pressure ≥90 mm Hg, with previously normal blood pressures in the client, no protein in the urine, and no manifestations of preeclampsia-eclampsia (4). Severe form of PIH is blood pressure levels of 160/100 and above, taken on two separate occasions, six hours apart after bed rest (5, 6).

The World Health Organization estimates that at least one woman dies every seven minutes from complications of pregnancy induced hypertension disorders (7). Any pregnancy that is complicated with hypertensive disorder has high risk of adverse fetal, neonatal and maternal outcome (8). In Africa and Asia, nearly one tenth of all maternal deaths are associated with hypertensive disorders of pregnancy such as pregnancy induced hypertension.

The risk factors for PIH include Nulli-parity, multiple pregnancies, history of chronic hypertension, gestational diabetes, fetal malformation, obesity, extreme maternal age (less than 20 or over 40 years), history of PIH in previous pregnancies and chronic diseases like renal disease, diabetes mellitus, cardiac disease, unrecognized chronic hypertension, positive family history of PIH which shows genetic susceptibility, psychological stress, alcohol use, rheumatic arthritis, extreme underweight and overweight, asthma and low level of socioeconomic status (9-11).

Although PIH is one of the major direct causes of maternal morbidity and mortality during pregnancy, there is a gap with limited evidence on prevalence and factors associated with hypertension among women attending antenatal care visits in Zambia specifically in the study areas sited, also there is a gap in information among women in the community on how they can prevent pregnancy induced hypertension by knowing the PIH disease burden and factors that are associated with this disease. Therefore, this study was undertaken to determine the prevalence of pregnancy induced hypertension and its associated factors among pregnant women attending antenatal clinics at three selected general hospitals of Lusaka, with the aim of assessing the associated factors of pregnancy related hypertension and providing preliminary information for intervention as well as for a more detailed future investigation.

MATERIALS & METHODS

Study design and Study setting

This study utilized a cross-sectional study design, employing a quantitative data collection approach to evaluate the prevalence of pregnancy-induced hypertension and its correlated factors among pregnant women of childbearing age (15 to 49) attending Antenatal Clinics at Chawama, Chipata, and Matero General Hospitals in Lusaka, Zambia. This study was conducted at Chawama, Chipata and Matero general hospitals in Lusaka District. The three General hospitals were purposively selected for this study based on the number of recorded cases of Pregnancy Induced Hypertension in the Health

Information Aggregate 2 (HIA 2) for Lusaka District in the year 2018.

The target population comprised all pregnant women who presented themselves at the maternal and child health department of Chawama, Chipata, and Matero General hospitals for routine antenatal visits. This encompasses all expectant mothers within these locations who are seeking prenatal care. On the other hand, the study population consisted of all pregnant women of 20 weeks' gestation and above aged 15 to 49 years who attend regular antenatal appointments at General hospitals within the Lusaka District. Those with chronic hypertension, with severe pre-eclampsia and other medical emergencies such as ante-partum hemorrhage, were excluded.

Sampling and selection of study participants

The sample size was calculated using the formula for prevalence of single population. Thereafter, proportion to size calculation was used to come up with the required sample size for each hospital using 2018 source population of each hospital taken from twelve months antenatal care visits records. The lists of patients in each clinic formed the frame(s) from which the sample was selected. After that, the participants attending antenatal clinic from each hospital were selected using systematic random sampling method until the required sample size was achieved. The total sample size was 427 and distributed as follows: Chawama **151**, chipata **161** and Matero **115.**

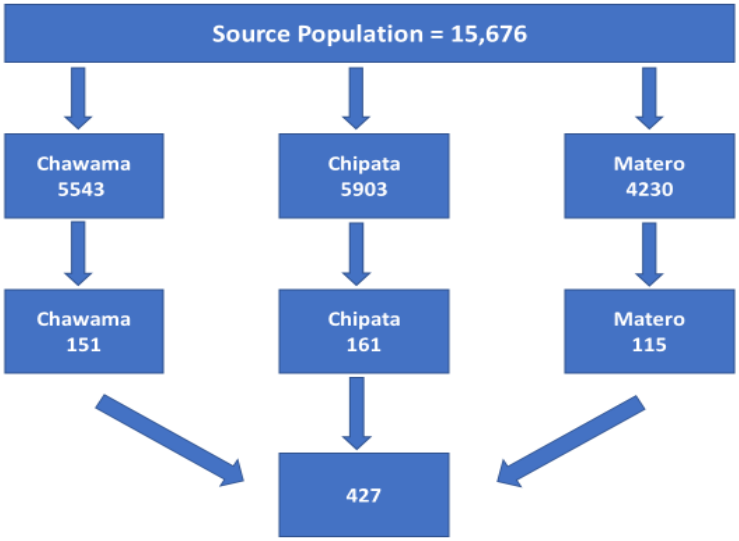

Figure 1: Schematic presentation of sampling procedure on proportion to size from three general hospitals.

Data collection

Data for this study was collected using structured questionnaire. A pre-test of the questionnaire was conducted at Chawama General Hospital to evaluate the appropriateness and sequence of questions. The insights gained from the pre-test were used to fine-tune the instrument prior to the commencement of data collection exercise.

The questionnaire included socio demographic data, socio economic factors, reproductive health and medical history. Next, Blood pressure, Height, weight and Body mass index were then taken. Thereafter, urine collection for the estimation of proteins to determine presence of pregnancy induced hypertension was done.

Hypertension was defined as 140/90 mm Hg or greater. Blood pressure was measured using a digital machine only once at time of encounter for women who had normal blood pressure whilst for those who had raised blood pressure a repeat check was done after 10 to 15 minutes of rest just to confirm the hypertension status. Thereafter, those

who had raised blood pressure of 140/90 mm Hg or greater were put on monitoring plan for three consecutive days at the facility to really confirm the hypertension status and plan their medical management.

Weights were measured at the time of data collection by using portable digital Seca scale. Height was measured to the nearest 1metre (M) and weight to the nearest 1 kilogram (kg). Body mass index was calculated as weight/height: (BMI = kg/m2) where kg is a person's weight in kilograms and m2 is their height in meters squared. The healthy range of BMI is 18.5 to 24.9, then 25.0 to 29.9 is considered to be overweight while above 30.0 it is obese (12) .After doing all the measurements, a copy of measurements was recorded and issued to participants for them to report to their respective physicians in case of any abnormal results and appropriate measures were taken accordingly.

Emphasis was placed on upholding the dignity of research participants, with full written consent obtained from each participant prior to their participation. Access to participant information was restricted solely to the researchers, and no personal details were collected during data collection. To safeguard confidentiality, participant information was stored in a password-protected file accessible only to the researchers. Ethical clearance was obtained from the University of Zambia Biomedical Research Ethics Committee (UNZABREC), followed by final approval from the National Health Research Authority (NHRA), along with permission from relevant authorities and written consent or assent from participants prior to data collection.

Participation in the study was voluntary, and participants were assured that refusal to participate would not impact their antenatal care. Participants retained the freedom to withdraw from the study at any time without facing coercion. Not only that, participants were assured that there were no personal risks or benefits associated with their involvement in the study.

Statistical Analysis

Data was analyzed using STATA Version 13 for Windows. Demographic characteristics, anthropometric characteristics and prevalence were presented using descriptive statistics in form of percentages, graphs. Chi-square and Fisher's exact tests were used to determine the association between PIH and other variables. After testing for association, the explanatory and outcome variables were entered in the univariate logistic regression. Thereafter, multivariate logistic regression was used to determine factors associated with pregnancy induced hypertension. Variables that showed association in multivariate logistic regression based on AOR and had p-value of <0.05 at 95% confidence interval were identified and re-entered in the multivariate logistic regression to pick on the best predictors of PIH. Finally, the Test for goodness of fit model was used to check for evidence of lack of fit. We found Prob > chi2 =0.2895 and Hosmer-Lemeshow chi2 =9.66 which indicates that the model we used was the best fit model and thereafter we settled for the model.

RESULT

The total sample size for the study was 427 but only 413 participants took part in the study thus we had 97% response rate. Chipata and Chawama general hospitals had 148 (36%) participants each, whereas 117 (28.0%) were from Matero general hospital.

Sociodemographic Characterisitcs of the participants and Variables related to medical and obstetrical conditions

The majority of participants 322 (78%) were aged between 20 – 34 years old followed by 45 (10.92%) both for those below 20 years old and above 35 years old. Regarding exercise 249(60.9%) women were doing vigorous physical exercise during their current pregnancy whilst 164 (39.71%) women were doing moderate exercises. About 39 (9%) of the participants indicated that they took alcohol during their current pregnancy. Regarding participants' educational level, 283(68.5%)

attained secondary school whilst only 11(2.7%) had no education. On marital status 334(80.9%) were married whilst 1(0.24%) was a widow. On occupation status, 267(64.7%) were unemployed and 48(11.6%) were in formal employment. Out of the total participants in the study, 152(36.9%) had body mass index of being overweight, 76(18.5%) were obese whereas 172(41.9%) were healthy. Regarding mid upper arm circumference (MUAC) 224(84.8%) were healthy whereas 8(3%) had severe malnutrition.

Regarding medical and obstetrical conditions, out of the total number of pregnant women who participated in the study, 163 (40%) were in the second trimester while 244(60%) were in the third trimester of pregnancy. Only 61(15%) of the participants were HIV positive and 180(43.8%) had history of hypertension in the family, then 85(20.63%) had history of diabetes in the family and only 8(1.95%) were diabetic. Regarding gravida, 266(64.56%) were multigravida whilst 146(35.44%) were primigravida (see Table 1. below).

Table 1: Distribution of the study participants by their socio-demographic characteristics and Variables related to medical and obstetrical conditions at Chawama, Matero and Chipata general hospitals, Lusaka, April 2020.

Characteristic		Frequency=413	Percentage (%)
Site	Chawama	148	35.84
	Chipata	148	35.84
	Matero	117	28.33
Age (years)	<20	45	10.92
	20-34	322	78.16
	≥35	45	10.92
Marital Status	Divorced	2	0.48
	Married	334	80.87
	Not married	76	18.40
	Widow	1	0.24
Educational Level	No education	11	2.66
	Primary school	103	24.94
	Secondary school	283	68.52
	Tertiary	16	3.87
Occupation	Formal	48	11.62
	Self employed	98	23.73
	Unemployed	267	64.65
Body Mass Index (BMI)	Underweight	11	2.68
	Healthy	172	41.85
	Overweight	152	36.98
	Obese	76	18.49
Mid-Upper Arm Circumference (MUAC)	Severe Malnutrition	8	3.03
	Underweight	32	12.12
	Healthy	224	84.85
Exercise	Yes	249	60.29
	No	164	39.71
Smoking cigarrete	Smoker	0	0
	None smoker	413	100.00
Alcohol Consumption	Yes	39	9.44
	No	37.4	90.56
Stress during pregnancy	Yes	156	37.86
	No	256	62.14
Gestational Age	Second trimester	163	40.05
	Third trimester	244	59.95
Gravida	Multi	266	64.56
	Prime	146	35.44
HIV status	Positive	61	15.02

	Negative	349	84.98
Diabetes	Yes	8	1.95
	No	403	98.05
History of Diabetes in family	Yes	85	20.63
	No	326	79.13
History of HTN in the family	Yes	180	43.8
	No	231	56.2

Prevalence of Pregnancy Induced Hypertension at Chawama, Chipata and Matero general Hospitals of Lusaka District, April, 2020.

The study found twenty-one percent (21%) as the overall prevalence of PIH and it was calculated using data from all the three facilities combined. Thereafter, data was separated according to each facility and then prevalence for each facility was also calculated. To come up with the prevalence of pregnancy induced hypertension, participants were grouped into two groups. The first group consisted of those with systolic blood pressure greater than or equal to 140 mmHg and or diastolic blood pressure greater than or equal to 90 mmHg. The second group consisted of those with systolic and diastolic blood pressure less than the above stated limits. Chawama had 18(5%) of pregnant women with PIH, Chipata 57(14%) whereas Matero 8 (2%)

Univariate and Multivariable logistic regression

Results of univariate analysis indicated that age, HIV status, living with smoker, trimester, HTN in family, body mass index and gravida, marital status, occupation and education level were not statistically significant whilst alcohol, exercise and stress during pregnancy were statistically significant. Consuming alcohol during pregnancy was positively associated with pregnancy induced hypertension with increased odds of 2.17 times as compared to women who did not consume alcohol (OR =2.17, p=0.034, CI=1.06-4.46). The odds of PIH among women who did moderate exercises during pregnancy were 0.51 times less as compared to women who did not exercise (OR=0.51, P=0.007, CI=0.31-0.83). The odds of PIH among women with stress during pregnancy were 2.71 times greater compared to women who did not exercise (OR=2.71, P<0.000, CI=1.65-4.44) (See table 2 below).

To run multivariable logistic regression, all the explanatory variables were put in the model. Results of multivariable analysis indicates that alcohol, exercise and stress during pregnancy were statistically significant meaning they are associated with increased risk of developing PIH whilst the rest of the explanatory variables that is: age, HIV status, living with smoker, trimester, HTN in family, body mass index, gravida, marital status, occupation and education level were not statistically significant (see table 2 below).

Table 2: Showing univariate and multivariable Logistic Regression model (Unadjusted and adjusted estimates).

	UNADJUSTED			**ADJUSTED**		
Predictor	**Odds Ratio**	**P-value**	**95% CI**	**Odds ratio**	**P-value**	**95% CI**
HIV status						
Negative	Ref			Ref		
Positive	1.25	0.491	0.65-2.42	1.13	0.75	0.50-2.56
Alcohol						
Does not take beer	Ref			Ref		
Takes beer	2.17	0.034	1.06-4.46	2.21	0.05	0.91-5.37
Age in years						
20-34	Ref			Ref		
<20	0.87	0.748	0.38-1.97	1.46	0.46	0.52-4.08

≥35	1.81	0.100	0.89-3.69	0.92	0.86	0.38-2.21
Body Mass Index						
<18.4 underweight	Ref			Ref		
18.5-24.9 normal weight	1.80	0.581	0.22-14.7	0.88	0.91	0.99-7.98
25.0-29.9 over weight	3.00	0.302	0.37-24.3	1.48	0.72	0.16-13.4
> 30.0 obese	4.48	0.164	0.54-37.2	2.5	0.42	0.26-23.7
Smoking cigarrete						
No	Ref			Ref		
Yes	0.97	0.938	0.54-1.75	0.74	0.40	0.37-1.48
Trimester /gestation age in weeks						
≥20 weeks	1.18	0.510	0.71-1.94	1.03	0.91	0.57-1.84
Exercise						
No	Ref			Ref		
Yes	0.51	0.007	0.31-0.83	0.39	0.002	0.21-0.70
Stress during pregnancy						
No	Ref			Ref		
Yes	2.71	0.000	1.65-4.44	2.17	0.007	1.23-3.79
HTN in family						
No	Ref			Ref		
Yes	1.26	0.345	0.77-2.05	1.09	0.74	0.62-1.92
Gravida						
Multi	Ref			Ref		
Prime	0.82	0.460	0.49-1.37	1.14	0.71	0.56-2.29
Marital status						
Divorced	Ref			Ref		
Married	1.17	0.61	0.62-2.23	126	0.98	0
Not married	1	-	-	101	0.98	0
Widow	1	-	-	1	-	-
Education level						
No education	Ref			Ref		
Primary school	3.28	0.26	0.39-27.0	4.91	0.187	0.46-52.3
Secondary school	2.29	0.43	0.28-18.2	3.83	0.25	0.37-39.0
Tertiary	7.5	0.08	0.74-75.7	19.9	0.02	1.46-271
Occupation						
Formal	Ref			Ref		
Self employed	1.93	0.12	0.83-4.51	3.31	0.02	1.19-9.17

Best fit model showing predictors of Pregnancy induced hypertension

The goodness of fit was used to check for the best fit model (Hosmer-Lemeshow chi2 (8) =9.66, Prob > chi2 =0.2895). In the model it was noted that one unit increase in body mass index predicted increased risk of developing pregnancy induced hypertension by 1.58 times greater as compared to mothers with normal BMI (AOR=1.57, p=0.007, 95% CI =1.12-2.19), taking into account of age, HIV status, trimester, gravida, smoking cigarrete, hypertension in family, marital status, education level and occupation. Women who took alcohol during pregnancy had increased risk of 2.29 times of developing pregnancy induced hypertension as compared to those who did not consume alcohol (AOR = 2.29, 95% CI =1.03 – 5.09, p = 0.042). Women who exercised moderately during pregnancy had reduced chance of 0.48 times developing pregnancy induced hypertension as compared to those who did not exercise (AOR =0.48, 95% CI =0.28-0.81, p =0.007). The odds of pregnancy induced hypertension were 2.28 times greater in women with stress during pregnancy as compared to women without stress (AOR = 2.28, 95% CI = 1.35-3.85, p = 0.002), controlling for all variables in the model (see table 3 below).

Table 3: Best fit model showing predictors of Pregnancy induced hypertension

	ADJUSTED		
Predictor	**Odds Ratio**	**P-value**	**95% CI**
Body mass index			
	1.57	0.007	1.12-2.19
Alcohol			
No	Ref	N/A	N/A
Yes	2.29	0.042	1.03-5.09
Exercise			
No	Ref	N/A	N/A
Yes	0.48	0.007	0.28-0.81
Stress during pregnancy			
No	Ref	N/A	N/A
Yes	2.28	0.002	1.35-3.85

DISCUSSION

Prevalence of pregnancy induced hypertension

The present study found 21% prevalence of Pregnancy induced hypertension among pregnant women who attended antenatal clinic from three general hospitals. This finding may contribute to a rise in number of maternal complications or diseases and number of deaths among the pregnant mothers and foetus. It is a public health concern that underscores the need for early antenatal booking to identify and manage maternal problems promptly. In order to prevent these unforeseen circumstances of maternal complications, it can be suggestive that women adhere to eight antenatal contact visits in order to achieve good maternal management.

The magnitude of PIH in this study is similar with the study conducted in Zimbabwe which found 19.4% (13). However, when compared to other countries it is higher than studies conducted in Iran 9.8%, Ethiopia Jimma University specialized hospitals 8.48% and Dessie Referral hospital 8.4%(14-16). This disparity mighty be as a result of differences in the health policies in terms of infrastructure, logistics, environment and human resource development capacity.

Current statistics in Zambia indicates that the number of doctors and midwives working in public health sector has declined over the years and this has affected quality care of women and children in the country in that there is less human resource against the number of women attending antenatal clinics that leads to long waiting hours at the clinic hence other women do not seek medical attention on time (17).

Regarding referral system policies, sometimes the referral system delays the management of the pregnant women therefore this may lead to women developing some maternal complications. Also, the availability of logistics such as medical supplies to use on the pregnant women attending antenatal clinic in some public health facilities are inadequate hence this may compromise the type of health service rendered to the women. On the other hand, the discrepancy of the magnitude of Pregnancy induced hypertension seen in other countries compared to the magnitude in our study could also been attributed to different study period and sample size. Also, the population of the study participants might be different in their lifestyle, culture and health seeking behaviors of the pregnant women.

Association between stress and pregnancy induced hypertension

The study revealed that women who worked long hours in a stressful environment during their current pregnancy, those who had discomforts of pregnancy, those who had negative life events such as divorce, serious illness and job loss were stressed and had an increased likelihood of developing of pregnancy induced hypertension. Our finding is similar with the meta-analysis that showed association of mental stress with increased risk of gestational

hypertension (18). Other theories also support that increased levels of stress during pregnancy has a possible effect of raising blood pressure which in turn has increased chance of pregnant women having preterm labour or giving birth to an infant with low birth weight (19).

Several factors can cause stress during pregnancy such as having problems with income, being abused or having serious health problems and being worried about their unborn baby or about how they will cope with labour and child birth especially in instances where the woman has had previous maternal complications. (19). In such circumstances, health care providers have a duty to offer psychological support and advice to pregnant mothers on how to handle discomforts during pregnancy such as having enough rest, doing exercise and eating healthy foods so as to prevent risk of developing hypertension in pregnancy.

Association between physical exercise and pregnancy induced hypertension

The study also revealed that mothers who did moderate-intensity physical activity and not necessarily strenuous exercises during their current pregnancy for at least 150 minutes throughout the week as recommended by WHO (20) had a reduced risk of developing pregnancy induced hypertension as compared to their counterpart's who did not exercise. These results are similar to a study conducted in Canada where pregnant mothers who exercised during pregnancy had a lower chance of having hypertension (21). Regular exercise promotes blood circulation in the body, improves muscle strength and oxygen supply to all parts of the body. In another study by (22) it was evidenced that aerobic exercise during pregnancy for 30-60 minutes for two to seven times per week is less associated with the risk of gestational hypertensive disorders and cesarean delivery. In a nutshell, regular exercises improve the health of an individual hence the need to educate pregnant mothers' importance of physical exercises before and during pregnancy.

Association between alcohol consumption during pregnancy and pregnancy induced hypertension

This study revealed that consuming alcohol during pregnancy increases the risk of developing pregnancy induced hypertension. This corresponds with a previous study in Japan that showed an increased risk of developing hypertensive disorders of pregnancy in pregnant women who consumed alcohol, which is one of the risk factors for preterm delivery (23). In a previous study by (24) many body mechanisms are affected by alcohol consumption such as : an imbalance of the central nervous system , impairment of the baroreceptors and enhanced sympathetic activity may lead to alcohol induced hypertension. Therefore, health education should be intensified to the antenatal mothers on effects of alcohol consumption during pregnancy to prevent hypertension that may cause maternal complications.

Association between body mass index and pregnancy induced hypertension

Regarding results on maternal body mass index (BMI) of >30kg/$m^{2,}$ our study found an association between BMI and diastolic blood pressure. As maternal BMI increases, the risk of developing hypertension ordinarily increases and these results build on existing evidence as indicated in different literatures such as (25) . Similarly another study conducted in Brazil, also found that, the Mean BMI was higher in women with hypertensive disorders , and it is a defined risk factor for developing pregnancy-induced hypertensive disorders, including preeclampsia disorder (26).

Pregnant women should be educated on eating healthy foods to maintain healthy weights in order to prevent accumulation of high cholesterol that may lead women to become overweight and obese which may predispose them in developing hypertensive

disorders such as pregnancy induced hypertension.

Association between level of education and pregnancy induced hypertension

As regard to education of the pregnant women, our study showed no statistical significance between levels of education and pregnancy induced hypertension (PIH). Contrary to our finding, other literatures indicates that PIH is more common in women with low education level (27). Similarly, study of (28) showed that women with relatively low levels of education had a higher risk of pregnancy induced hypertension than women with high education levels. According to findings of this study, the higher risk of developing PIH among low educated women could have been influenced by other factors such as higher rates of overweight and obesity.

The implication of low or no education among women could be that, they may not understand how important early identification of antenatal clinic /visits are; therefore, they are likely to develop hypertensive disorders and other negative health outcomes to both the mother and the baby. Nevertheless, there was no statistical relationship between level of education and PIH in our study.

Association between occupation status and pregnancy induced hypertension

Our study revealed that there is no statistical relationship between pregnancies induced hypertension and maternal occupation. This finding correlates with a study conducted by (29) that showed no statistical significance between pregnancy induced hypertension and occupation.

Other literature of a meta-analysis study based on four studies showed that, the physically demanding work was significantly associated with pregnancy induced hypertension and preeclampsia (30). Also, findings of (31) showed that being exposed to occupation that is physically demanding and stressful at early stages of pregnancy increases the risk of hypertensive disorders such as pregnancy induced hypertension and preeclampsia.

Strengths and Limitations of the study

Some questions may have been intrusive such as marital status. Women who were single, separated or divorced could have felt uncomfortable sharing this information. However, measures were taken to minimize this limitation by using targeted questions on the marital status of the participant and not primarily asking for the reason why one was not married, single or divorced.

Other questions such as whether they consumed alcohol or not or whether they smoked cigarette or not, could also have made them uncomfortable as these are culturally unacceptable, and therefore women could instead give a socially desirable response, thereby introducing bias. To mitigate these limitations, the participants were reassured that their responses were strictly confidential and that their names were not used in the study.

Some women may not have known their hypertension status because of not being routinely screened for hypertension in the past. This could have led to under reporting of chronic hypertension. In order to address this, we opted to source for more information from hospital records of the pregnant women such as antenatal cards and patients' records.

Also, some self-reported variables such as stressed or not stressed and exercises where subjective hence women mighty have given either correct or incorrect information and this may lead to under reporting. To minimize under reporting, we used précised and closed ended questions.

Further, since the study enquired about some past events recall bias may also have been possible as some participants may recall better than others regarding historical information related to history of hypertension in the family.

However, the strength of this study included a calculated sample size which included three selected general hospitals from the same District is a strength with a good representative population of pregnant women attending antenatal clinics. This

makes the study findings generalizable to women in Lusaka and in similar settings.

CONCLUSION AND POTENTIAL IMPLICATIONS

The prevalence of pregnancy induced hypertension was 21% which signifies that a good number of pregnant women who attended antenatal clinic at Chipata, Chawama and Matero general hospitals developed pregnancy induced hypertension. Findings of our study showed that, women with stress during pregnancy, lack of doing moderate exercise during pregnancy and consuming alcohol during pregnancy are associated with increased risk of developing pregnancy induced hypertension. Therefore, pregnant women should attend all the eight antenatal visits at their clinics for quick diagnosis and management of any maternal problem such as pregnancy induced hypertension to prevent further complications. It is during this time, that pregnant women are thoroughly screened and managed according to how one presents.

The potential health implications of our findings are that:

1. Drinking alcohol during pregnancy increases the risk of miscarriage, premature birth and low birth weight. It can also cause the baby to develop a serious condition called foetal alcohol spectrum disorder (FASD).
2. Stress may lead to high blood pressure during pregnancy that may put the woman at serious risk of pre-eclampsia, premature birth ad low birth weight infant.
3. In pregnancy, moderate exercises lower the risk of some pregnancy complications thereby improving the woman's overall health. Physical inactivity during pregnancy can cause maternal obesity or excess weight gain and may create a higher risk for preterm birth, pre-eclampsia and other maternal complications.

Hence there is need to create awareness to pregnant mothers on early antenatal booking in order to prevent and manage well any maternal complication such as hypertension in pregnancy.

List of abbreviations

PIH: pregnancy induced hypertension; ANC: Antenatal care/ Antenatal clinic; Bp: Blood pressure; BMI: Body Mass Index; HTN: Hypertension, MUAC: Mid Upper Arm Circumference; IUFD: Intrauterine Fetal Death; WHO: World Health organisation

Ethical Approval

Ethical clearance was sought from the University of Zambia Biomedical Research Ethics Committee (UNZABREC) Ref Number: 313-2019, then final approval from National Health Research Authority ((NHRA) and permission from respective authorities and written consent/ assent of the respondents was obtained before the data collection.

Participation in this study was voluntary and denial to participate did not have consequences on the antenatal care of the participant. The participants were free to withdraw from the study at any time they wanted**.**

Acknowledgement

We extend our gratitude to UNZA School of Public Health for granting us with an opportunity to conduct this research. We are indebted to Lusaka province health authorities, members of staff at general hospitals of Lusaka District for their generous support and guidance. Also, many thanks go to Dr Jeremiah Banda for helping me develop sampling skills and Mutale Sampa Kawana for her effortless time in helping me develop statistical skills.

Special thanks to the participants for their time spent participating in the study. My heart-felt gratitude goes to my family members for their unstoppable support throughout the period of study.

Author's contributions

Note: The authors' initials are in order of appearance in the author list.

MMM conceived the study, study design, data collection, analysis and drafted the manuscript.
CJ contributed in data analysis, methodology and review of manuscript
TSS Review of manuscript and data collection
MMC edited, reviewed the manuscript, oversaw and guided the entire writing process and approved the final version.
All authors read and approved the final manuscript

Source of Funding: Our research did not receive any form of financial support from any funding agencies.
Conflict of Interest: The authors declare that they have no competing interests

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How to cite this article: Marian Matipa Mulenga, Choolwe Jacobs, Tinkler Saul Simbeye, Mpundu Makasa Chikoya. Magnitude and determinants of pregnancy induced hypertension in selected general hospitals in Lusaka, Zambia: a cross-sectional study. *International Journal of Science & Healthcare Research.* 2024; 9(2): 297-309. DOI: *https://doi.org/10.52403/ijshr.20240240*

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