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Factors Associated with Distribution of Pre-Eclampsia and Eclampsia Among Rural and Urban Women in Child Bearing Age – A Case of Mbala General Hospital, Northern Province, Zambia

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Abstract

Preeclampsia and eclampsia cases continue to rise in northern Zambia as people search for babies and continuity of clans' survival. Due to the competitive nature of cultural demands/ myths on pregnancy and maternal socio-demographic factors (low-age, low socio-economic status, and poor health-seeking behaviour), women in rural prefer unprofessional primary health care services that are presumably affordable to them thereby, delaying in seeking for professional healthcare services. High levels of poverty in resource-limited areas have put many female adolescents at risk of falling pregnant. Thus, this study probed on the interaction between these maternal socio-demographic factors and disease distribution in both rural and urban areas with respect to various pregnancy outcomes. The study used retrospective quantitative methods in eliciting information from data sources (women, registers) in Mbala, Mpulungu, Senga, and Mungwi districts covering 3-year period (2017-2019). In all, 202 female respondents from Northern Zambia were interviewed through self-administered questionnaires. Thereafter, data were analysed using a statistical package for the social sciences (SPSS v16). Findings indicate severe; socio-economic status and low maternal age affect pre-eclampsia disease distribution coupled with adverse pregnancy outcomes more in rural than urban areas. The better the socio-demographic conditions, the lower the disease distribution with good pregnancy outcomes. However, worsening maternal socio-demographic conditions may increase the incidence of pre-eclampsia among pregnant women of northern Zambia. The study recommended interventions tarred towards public health programmes such as social behaviour change and communication (SBCC) towards adolescent women and socio-economic empowerment of pregnant women in resource-limited areas.

Keywords*: Average ANC timing, Preeclampsia, Residency, Socio-economic, Teenage pregnancy.*

Introduction

The increasing obstetrical/ gynaecological skilled quality health service provision at Mbala general hospital keep on attracting more pregnant women from all parts of Senga, Mbala, Mpulungu, and Mungwi (kayambi) districts. Among these are women with hypertensive disorders in pregnancy and the most prevalent being pre-eclampsia that had shown a constant increase of cases over the period under this study [1]. In the struggle to cope with standard healthcare services, some women fall into vulnerable socio-demographic conditions leading to poor health for both mother and baby.

Pre-eclampsia is a pregnancy-related hypertensive disorder that usually occurs after 20 weeks of gestation, and if treatment delays, it progresses to eclampsia which is basically fitting in patients with severe forms of pre-eclampsia [2]. Therefore, pre-eclampsia and eclampsia are not distinct disorders but the manifestation of the spectrum of clinical signs

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and symptoms of the same condition. Pregnancy-induced hypertension is the mildest disorder in this continuum which becomes pre-eclampsia, when proteinuria appears, and the addition of convulsions changes the condition to eclampsia [3]. However, the pathogenesis of eclamptic convulsions remains unknown. Cerebral imaging suggests that cerebral abnormalities in eclampsia are similar to hypertensive encephalopathy that are vasogenic in nature. The convulsions can occur in antepartum (38–53%), intrapartum (18–36%), or postpartum (11–44%) periods [4]. Recent data reveal an increase in the proportion of women who develop eclampsia beyond 48 hours after delivery [5]. There are no reliable tests or symptoms for predicting the development of eclampsia other than early detection of pre-eclampsia. In developed countries, the majority of cases reported in recent series are considered unpreventable [6]. 5-7% of all pregnancies are complicated by pre-eclampsia. In the pathogenesis of pre-eclampsia, proteinuria and hypertension dominate the clinical picture because the chief target organ is the kidney, and it suffers from glomerular endotheliosis [7]. The pathogenesis of pre-eclampsia is complex; numerous genetic, immunologic, and environmental factors interact. It has been suggested that pre-eclampsia is a two-stage disease. Stage I: (Placentation Abnormalities) - this stage is asymptomatic, characterized by abnormal placental development during the first trimester resulting in placental insufficiency and the release of excessive amounts of placental materials into the maternal circulation [7]. Stage II: (Maternal Syndrome) - this stage is symptomatic, and the pregnant woman develops characteristic hypertension, renal impairment, and proteinuria and is at risk for the hemolysis, elevated liver function enzymes and low platelets (HELLP syndrome), eclampsia, and other end-organ damage [5]. Therefore, abnormal placentation in stage I, resulting from the failure of trophoblastic remodelling of uterine spiral arterioles, leads to the release of secreted factors that enter the mother's circulation, which give rise to clinical signs and symptoms of pre-eclampsia. Thus, all the clinical manifestations of pre-eclampsia are due to malfunctioning of kidneys resulting from glomerular endotheliosis, increased vascular permeability, systemic inflammatory response, and hypoperfusion that results in end-organ damage [5]. These clinical manifestations typically occur after the 20th week of pregnancy [5, 7]. Scholars have shown in several studies that risk factors for pre-eclampsia include; body mass index raised systolic blood pressure, raised diastolic blood pressure, black race, clinical centre, and smoking [6, 7]. Adjusted odds ratios computed with a Logistic regression model revealed that body mass index (odds ratio 3.22 for ≥35 kg/m2 vs. <19.8 kg/m2), systolic blood pressure (odds ratio 2.66 for ≥120 vs. <101 mm Hg), diastolic blood pressure (odds ratio 1.72 for ≥61 mm Hg vs. <60 mm Hg), and clinical centre (odds ratio 1.85 for Memphis vs. the other clinical centres) were statistically significant predictors of pre-eclampsia [5]. Results of the final model fit revealed that pre-eclampsia risk increases significantly ($p < 0.0001$) with increased body mass index at randomization, as well as with increased systolic and diastolic blood pressure at randomization [5]. The other strong risk in another study was the history of pre-eclampsia in a previous pregnancy, this was found to lead to high disease recurrence. Risks for the baby include poor growth and prematurity. Although the outcome is often good, pre-eclampsia can be devastating and life-threatening [8]. Preventive measures for pre-eclampsia are vast according to world health organization scholars that emphasize on the following:

I. In areas where dietary calcium intake is low, calcium supplementation during pregnancy (at doses of 1.5–2.0 g elemental calcium/day) is recommended for the prevention of pre-eclampsia in all women,

but especially those at high risk of developing pre-eclampsia [9].

II. Use of low-dose acetylsalicylic acid (aspirin, 75 mg) for the prevention of pre-eclampsia and its related complications initiated before 20 weeks of pregnancy [8].
III. Treating women with severe hypertension during pregnancy with antihypertensive drugs.
IV. The use of magnesium sulphate to prevent eclampsia in women with severe pre-eclampsia instead of other anticonvulsants [8, 9].

Thus, scholars have shown that proven preventive interventions for pre-eclampsia so far include; use of antiplatelet agents, primarily low dose aspirin, calcium supplementation, Magnesium sulphate, and use of antihypertensive drugs, especially in women with pre-existing hypertension [8]. Women with a history of eclampsia are at increased risk of eclampsia (1–2%) and pre-eclampsia (22–35%) in subsequent pregnancies. Recommendations for diagnosis, prevention, management, and counselling of these women are provided based on results of recent studies and my own clinical experience [10]. Management of pre-eclampsia is largely dependent on signs and symptoms. Antihypertensive drugs are mandatory for very high blood pressure above - systolic of 150/ diastolic of 100 millimeters of mercury [10]. Plasma volume expansion, corticosteroids, and antioxidant agents have been suggested for severe pre-eclampsia, but trials to date have not shown benefit. Optimal timing for delivery of women with severe pre-eclampsia before 32 to 34 weeks' gestation remains a dilemma [8]. Magnesium sulphate is the drug of choice for reducing the rate of eclampsia developing intrapartum and immediately postpartum [11]. Scholars conducted 4 large randomized trials comparing magnesium sulphate with no treatment or placebo in patients with severe pre-eclampsia. The study showed that the rate of eclampsia was significantly lower in those assigned to magnesium sulphate (0.6% versus 2.0%, relative risk 0.39, 95% confidence interval 0.28–0.55), [8]. Thus, Magnesium sulphate is the drug of choice to prevent recurrent convulsions in eclampsia. The development of eclampsia is associated with an increased risk of adverse outcomes for both mother and foetus, particularly in developing nations [3]. Thus, pregnancies complicated by eclampsia require a well-formulated management plan that should be holistic in nature, covering all the symptoms on the patient. Pre-eclampsia can lead to severe complications in the end-organs such as; liver, kidneys, and brain. It also complicates the blood clotting system leading to disseminated intravascular coagulopathy (DIC), in which the clotting factors get consumed, and bleeding becomes uncontrollable, which usually leads to the death of both the mother and the unborn baby. The end-organ damage complicates into HELP syndrome, which is a very serious condition where there is massive damage to red blood cells (hemolysis), elevated liver enzymes, and reduced platelets. HELLP syndrome is a life-threatening form of pre-eclampsia with a typical laboratory triad. The incidence of the disease is reported as being 0.17–0.85% of all live births [12]. As a result of endothelial dysfunction, activation of intravascular coagulation occurs with fibrin deposition in the capillaries and consecutive microcirculation disorders. The disease manifests itself on average between 32–34 weeks' gestation. About 30% of cases of HELLP syndrome occur in the postpartum period [12] 2005. The cardinal clinical symptom of the disease is right upper quadrant (epigatric) pain accompanied with nausea, vomiting, and malaise. The increase of the aspartate transaminase (AST) and the alanine transaminase (ALT) often precedes a decrease in platelets [9, 12]. Thus, in many low-income countries, complications of pre-eclampsia are the leading cause of death amongst women of reproductive years and perinatal deaths. Perinatal mortality is high

following pre-eclampsia (9-10%) and even higher following eclampsia (14-15%) [3]. Pre-eclampsia is still a significant major factor of public health concern in both developed and developing countries, and it is one of the top three medical conditions that contribute to maternal and perinatal morbidity and mortality ratios globally [10]. However, the impact of the disease is felt more severely in developing countries, where, unlike other more prevalent causes of maternal mortality (such as haemorrhage and sepsis), medical interventions may be ineffective due to the late presentation of cases [6]. The problem is confounded by the continued mystery of the aetiology and the unpredictable nature of the disease. Thus, the purpose of this paper was to highlight the maternal socio-demographic factors associated with distribution and pregnancy outcome of pre-eclampsia/ eclampsia in developing countries and suggest measures that could be used to address them within the local context. The study used Mbala General Hospital as a pivotal referral health facility [13].

Preeclampsia and eclampsia seemed to be a huge challenge at Mbala General Hospital and its four referring districts over 3-year period with a disease trend of 33 (2017), 149 (2018), and 195 (2019) absolute cases reported. As a result of this, it had been very difficult to control maternal deaths (284/ 100,000 LB), preterm births, and perinatal deaths in the area under study [1]. Mbala General Hospital, through the ministry of health, with support from partners (CHAI, RBF, WVI, and HID), has been implementing robust interventions on FANC and EmOC services in order to reduce morbidity and improve on pregnancy outcomes. But this could not yield a desirable reduction in pre-eclampsia and eclampsia cases in the region under study. Thus, solutions to this problem should be directed towards studying factors affecting disease distribution among rural and urban women, of which factors associated with SBCC such as early ANC booking, good health-seeking behavior, and social economy could provide the best solution base. The major limitations have been longer distances and poor social-economic factors among many expecting women with known risk factors of pre-eclampsia (very difficult to sustain them in waiting for mother's shelters). The other limitation was demotivated CHW such as TBAs and SMAGs due to lack of provision of survival incentives by implementing entities. However, the presence of CHWs (TBAs & SMAGs), competent workforce, and mother's shelters in all the four districts is a great achievement towards the fight to reduce pre-eclampsia and eclampsia disease burden.

Significance of the Study

Information on the effect of maternal factors (age, health-seeking behaviour, and socio-economic status) on pre-eclampsia distribution with respect to residency and pregnancy outcome is important in containing disease burden, especially in rural areas. The outcome of this study will also bridge the scientific knowledge gap and contribute to a paradigm shift in the prevention and management of pre-eclampsia a public health perspective. Lastly, it will contribute to the debate on providing socio-economic assistance to vulnerable groups such as risk pregnant women, especially adolescents in resource-limited areas. This will provide the adequate scientific evidence needed by policy-makers for robust decision-making.

Problem Statement

The desire to reproduce and grow clans has seen an increase in the number of 'women of childbearing age (WCBA) in northern Zambia. Pregnancy is something that communities treasure in northern Zambia, and it signifies life, and the district is mainly occupied by Christian denominations (mostly Roman Catholics) of different tribes. It is a respected expectation of the outcome of every marriage, as it is considered the source of pride for every family. To cope with this demand in the presence of various maternal socio-

demographic variables, women are increasingly suffering from pre-eclampsia [14]. This is compounded by strong cultural belief (Amagini) that negatively affects professional health-seeking behaviour among these vulnerable eclamptic women with a three-year upward trend of 33, 149, and 195 cases [14, 15]. In northern Zambian culture, 'fitting in pregnancy' is considered a 'spiritual possession' called "Amagini"- a popular name given to eclampsia by traditional healers to mean 'water' or 'snake-like spirits'. The word "ma" is singular for mother, "Ama" plural. While "gini" means 'evil spirits', hence "Amagini" to denote mothers with evil spirits moving in the body like a snake [14].

Henceforth, despite the robust interventions done by the ministry of health with support from partners (CHAI, RBF, WVI, and HID), the cases of pre-eclampsia and eclampsia still seem to be a huge challenge at Mbala General Hospital and its four referring districts. As a result of this, it had been very difficult to control maternal mortality (284/ 100,000 LB), preterm births, and perinatal deaths in this region [1]. Thus, the need for this study that would enhance surveillance of more factors that could be contributing to these escalating cases by looking at low maternal age (teenage pregnancy), maternal residency, maternal socio-economic status, and health seeking behaviour (antenatal care services) in relation to distribution of pre-eclampsia and eclampsia.

Materials and Methods

Research Design and Study Population

We conducted a retrospective structured study, quantitative and comparative in nature, at Mbala General Hospital and the four referring districts from 2017 to 2020. The primary exposure was pre-eclampsia/ eclampsia hospitalized, using clinical assessment method. The secondary exposure was residential area. The primary outcomes included pregnancy outcomes, evaluated using Mayo clinic assessment schedule on pre-eclampsia. While the secondary outcome was disease distribution among rural and urban women with respect to study selected factors namely; maternal – age, socioeconomy, and health seeking behaviour (ANC visits/ timing).

The study involved sample of 202 respondents calculated (eq. 1) and selected using systematic/ simple random sampling. Data was collected in two months from November to December 2020 using; a check list (ANC/ delivery, referral), structured questionnaire, and structured personal interviews. The study used a statistical package for social sciences (SPSS) version 16 in analysing data using binary logic regression in which residency (rural/ urban) and pregnancy outcome (abnormal/ normal) were used as dependent variables while maternal socioeconomy, maternal age, and antenatal timing were covariates.

Ethical Considerations

In compliance with the ethical guidelines of the University of Zambia – School of Medicine and ERES Ethics Review Board, the researcher clearly stated the purpose of the research, duration, methods used, and data collection instruments which were approved. Participants' consent was sought before interviews all the time. Interviews were made short in order to preserve time for research respondents.

Sample Size Determination

The study first used systematic sampling in which all the women treated with pre-eclampsia/ eclampsia from 2017 to 2019 at the hospitals were recruited to create a sampling frame of 377, from which the final representative sample of 202 for the study were selected using simple random sampling. This meant that participants were randomly selected to participate in the research after accessing sufficient information and an adequate understanding of both the proposed research and the implications of participating in the research. The final sample size of a selected

woman was then subjected to structured personal interviews.

Data collection

Data was collected using; a checklist and structured questionnaire (ANC/ delivery, referral), structured personal interviews, and collateral personal interviews for the dead women was used. The interview questionnaire was administered during the scheduled visits to all the rural health facilities where sampled respondents came from. The questionnaire targeted maternal factors; age, socio-economic status, residency, health-seeking behaviour, and pregnancy outcome. The questionnaire was in English; thus, research assistants were multilingual with proficiency in Mambwe, Lungu, Namwanga, and Bemba for easy translation whenever needed.

The collected data was cleaned and analysed using descriptive statistics. Adjusted Odds and percentages were used to describe the effects of maternal factors on pre-eclampsia distribution between rural and urban and how they affect pregnancy outcomes using binary logistic regression model, under statistical package for social sciences (SPSS) version 16.

A total of 202 patients met eligibility criteria and were enrolled into the study. Of these patients, 1 died after 4 days of hospitalization, but was included in the primary analysis using collateral data from the caretaker by then.

Objective 1: To determine whether maternal socio-demographics factors (age, economic status, health-seeking behaviour) are associated with pre-eclampsia distribution with respect to residency in northern Zambia.

Hypothesis 1: The study rejects the Null Hypothesis (H0) that "none" of the maternal socio-demographic factors (age, economic status, health-seeking behaviour) are associated with pre-eclampsia distribution with respect to 'residency' and accepts the Alternate Hypothesis (H1) that at "least one" of the maternal socio-demographic factors (age, economic status, health-seeking behaviour) is associated with pre-eclampsia distribution with respect to 'residency', because the adjusted odds ratios produced by binary logic regression model for age [1.171 (CI 95%, 1.106 – 1.240, $p < 0.05$)], and socio-economic status [0.246 (CI 95%, 0.133 – 0.455, $p < 0.05$)], are statistically significant at 95 % confidence level.

Results

Table 1. Binary Logic Regression of Residency *Age, Occupation, ANC Timing Variables in the Equation

Variables	B	SE	Wald	Df	Sig.	Exp(B)	95%CI for EXP(B)	
							Upper	Lower
Age	.158	.029	29.347	1	.000	1.171	1.106	1.240
Occ/w	-1.404	.314	19.93	1	.000	.246	.133	.455
ANC/t	.131	.225	.339	1	.560	1.140	.733	1.772
Constant	-4.070	1.026	15.737	1	.000	.017		

Results 1

1. Age – Adjusted Odds Ratio 17.1%, CI 10.6 – 24.0%, statistically significant at 95% CL, $p = 0.000$.
2. Maternal Occupation - Adjusted Odds Ratio 24.6%, CI 13.3 – 45.5%, statistically significant at 95% CL, $p = 0.000$.
3. ANC timing - Adjusted Odds Ratio 14.0%, CI 73.3 – 77.2%, statistically insignificant at 95% CL, $p = 0.560$.

Objective 2: To determine whether maternal socio-demographics factors (age, economic status, health-seeking behaviour) are associated with pre-eclampsia distribution with respect to pregnancy outcome in northern Zambia.

Hypothesis 2: The study rejects the Null Hypothesis (H0) that "none" of the maternal socio-demographic factors (age, economic status, health-seeking behaviour) are associated with pre-eclampsia distribution with respect to 'pregnancy outcome' and accepts the Alternate Hypothesis (H1) that at "least one" of the maternal socio-demographic factors (age, economic status, health-seeking behaviour) is associated with pre-eclampsia distribution with respect to 'pregnancy outcome' because the adjusted odds ratios produced by binary logic regression model for age [1.162 (CI 95%, 1.099 – 1.228, $p < 0.05$)], and socio-economic status [0.261 (CI 95%, 0.143 – 0.477, $p < 0.05$)], are statistically significant at 95 % confidence level.

Table 2: Binary Logic Regression of Pregnancy Outcome *Age, Occupation, ANC Timing Variables in the Equation

Variables	B	SE	Wald	Df	Sig.	Exp(B)	95%CI for EXP(B)	
							Upper	Lower
Age	.150	.028	27.706	1	.000	1.162	1.099	1.228
Occ/w	-1.343	.307	19.111	1	.000	.261	.143	.477
ANC/t	.224	.220	1.034	1	.309	1.251	.812	1.927
Constant	-4.188	1.019	16.901	1	.000	.015		

Results 2

4. Age – Adjusted Odds Ratio 16.2%, CI 9.9 – 22.8%, statistically significant at 95% CL, $p = 0.000$.
5. Maternal Occupation - Adjusted Odds Ratio 26.1%, CI 14.3 – 47.7%, statistically significant at 95% CL, $p = 0.000$.
6. ANC timing - Adjusted Odds Ratio 25.1%, CI 81.2 – 92.7%, statistically insignificant at 95% CL, $p = 0.309$.

Findings 1 & 2

Findings show that those aged 20 years and below, 15-19 years, and 25-29 years, for instance, were about three-fold at risk of developing pre-eclampsia with complications to either mother or baby and likely to be in rural set up. Therefore, low maternal age and low socio-economic status were associated with high levels of pre-eclampsia and dictated the disease distribution and pregnancy outcome as we found more women with lower ages and lower social economic status in rural where pre-eclampsia distribution was more prevalent with various pregnancy outcome complications. While health-seeking behavior was not associated with pre-eclampsia distribution with respect to neither residency nor pregnancy outcome in northern Zambia.

Discussion

This retrospective study found that disease distribution and pregnancy outcome were significantly and independently associated with lower maternal age and lower maternal socio-economy among hospitalized women with pre-eclampsia at Mbala general hospital and its four referring districts (Mbala, Mpulungu, Senga, and Mungwi) in the northern part of Zambia. A total of 37.1% of patients in this population were teenagers, who were distributed as 37.1% rural and 00.0% urban. 31.7% were for the age group 16 to 19 years old teenagers and was the most affected teenage population. While 5.4% consisted 10 to 15 years old group. This is actually consistent with findings by other scholars that a significant difference between pregnant adolescents and adult women do occur with up to 20% more pre-eclampsia events in pregnant adolescents than in adult women [16]. When compared pregnancy outcomes between rural and urban, using the age groups, the study found that pregnancy complications (preterm, low birth weight, perinatal and maternal deaths) were higher in rural compared to urban, with a

peak at 19 years old 6.93%, and started decreasing exponentially approaching zero after age 40 (eq. 2).

Maternal socio-economy was also found to be significantly and independently related to pregnancy outcomes with odds of 1.261 (CI 95%, 1.143 – 1.473, p < P) among patients. The study estimated that 64.4% of women that suffered pre-eclampsia were housewives that survived on less than US$ 1 per day, while only 3.5% were found to be living on US$ 2.5 per day. The pregnancy complications among women in the study were more common and severe among house-wives but turned to be stable among both those in informal and formal employment. Women in rural were three-fold more affected when compared to urban after adjusting for relevant covariates. To my knowledge, this is the first retrospective study of hospitalized pre-eclampsia patients in a rural-urban setup looking at maternal socio-economy as one of the factors affecting disease distribution and determining pregnancy outcomes. Thereby providing new and robust data regarding comprehensive community-based management of pre-eclampsia through use of preventive public health interventions, especially in low-resource countries like Zambia.

In 2008, it was shown that Low maternal socio-economic status is a strong risk factor for pre-eclampsia. Only a small part of this association could be explained by the mediating effects of established risk factors for pre-eclampsia [17]. However, further research was needed to disentangle the pathway from low socio-economic status to pre-eclampsia and its effect on disease distribution in rural-urban set ups and command on pregnancy outcomes.

However, the study found that antenatal timing (early or late booking) had no significant and independent association with neither distribution nor command on pregnancy outcomes with adjusted odds of Odds Ratio 1.14 (CI 95%, 1.733 – 1.772, p > P), and 1.251 (CI 95%, 1.812 – 1.927, p > P) respectively and rendered it to be statistically insignificant. Thus, the study proved that improving early antenatal bookings among women with the risk of pre-eclampsia does not affect the distribution of disease nor improve the pregnancy outcomes. Other Scholars have argued that early antenatal booking could be used to assess risks so that a suitable surveillance routine to detect pre-eclampsia can be planned for the rest of the pregnancy [18]. However, no study has shown the association between early antenatal booking and pregnancy outcome among women with pre-eclampsia so far. Thus, further research is needed to study specific pathways on how low maternal age (teenage) and low socio-economic status (house-wife) determines the distribution of pre-eclampsia between rural-urban areas and command pregnancy outcomes.

The mean age of this Zambian cohort is generally lower (22 years old) than most cohorts of patients included in developed countries like the US (38) and European (35) studies of pre-eclampsia [19], which has important public health implications with regard to the high rates of death and disability seen in this younger patient population. There are several reasons for this; firstly, Zambia has a younger overall population with lower life expectancy compared to those in found developed countries. Secondly, the county is medically and socioeconomically vulnerable with high rates of poverty, malnutrition, and other comorbidities, which, combined with inequitable access to quality healthcare, likely contributed to an overall younger cohort with 79 teenagers out of 202, all coming from rural areas [19].

Primary health care in Zambia is undergoing a rapid transformation with an aim toward implementing the Sustainable Development Goals and advancing universal health coverage. However, the health system faces challenges associated with inequitable access and affordability of healthcare for those living in rural and poverty-stricken areas, as well as insufficient human resources, frequent drug

stock outs, and shortages of medical equipment, technology, and transportation. Further exploration of whether structural issues in the healthcare system, including gaps in primary health care, led to the high abnormal pregnancy outcomes and significant disease burden of pre-eclampsia on hospitalization would be an objective of a future study.

This study had several other strengths. The sample size was large for a retrospective study of hospitalized patients (N = 202) and included both medical (gave birth vaginally) and surgical (underwent caesarian) admissions. The admission criteria was evaluated using a validated tool for pre-eclampsia assessment. All outcome assessment of participants was blinded to their pre-eclampsia exposure.

Equations

$$ESS_{20\%} = Z\ 2\ Q\ P\ /\ D2\ (1 - 0.2)\ (1)$$

$$\int_0^{r_2} F(r,\phi)\ dr\ d\phi = \left[\frac{\sigma r_2}{2\mu_0}\right] \cdot \int_0^{\infty\int_{j_i}^{-1}} {}^{1}z_{0i}\ \ exp\ (2)$$

Competing Interests

The authors declare no competing interests for this manuscript.

Conclusion

This study examined the factors affecting the distribution of pre-eclampsia between rural and urban areas of northern Zambia, using a retrospective approach and quantitative method.

Findings indicate severe; socio-economic status and low maternal age among preeclamptic women. These socio-demographic characteristics have implications on disease distribution and pregnancy outcomes. The better the socio-demographic conditions, the lower the disease distribution coupled with good pregnancy outcomes.

Preeclampsia disease burden among hospitalized rural women was higher compared to urban areas of Northern Province of Zambian with a significant burden of teenage pregnancies and poverty. Pregnancy outcome was a strong independent predictor of maternal and neonatal morbidity. This data speaks to the fact that maternal-age and maternal-socioeconomic status are important in predicting pregnancy outcomes in hospitalized preeclamptic patients admitted to Maternal and Child Health wards in the northern province of Zambia. Since these two factors are not routinely included in the prevention and management of pre-eclampsia in sub-Saharan African countries, there is an unmet driving need to understand better the public health interventions directed to reduce disease burden and improve maternal and child health outcomes among women and children affected by pre-eclampsia in resource-limited settings. We must build on these data to understand whether detection, prevention, and appropriate management of pre-eclampsia (most of which consists of non-pharmacological interventions) can improve patient outcomes.

Our results also demonstrate that focusing on Social Behavioural Change and Communication (SBCC) on reducing teenage pregnancies, child-marriages and introducing financial empowerment of vulnerable pregnant women such as ‘pregnant women social cash transfer’ would reduce the prevalence and improve pregnancy outcomes among risk population in second and third world countries like Zambia, and this is in line with assertions by other scholars [20]. Thus, robust measures must be directed towards addressing the major findings of the study through social intervention packages by the government, the ministry of health, and its partners.

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References

[1] Northern HIMS. (2019). Provincial Health Information Management System: PHO. Kasama. Zambia.

[2] Chowa P. E. et al. (2011). Prevalence of Hypertension among Women of Child-Bearing Age in Zambia: *Medical Journal of Zambia*, 38 (3), 1-6, Retrieved from https://www.ajol.info/index.php/mjz/article/view/81443.

[3] Andrea P. M. (2001). Pregnancy-related mortality from pre-eclampsia and eclampsia: The American College of Obstetricians and Gynecologists. Elsevier Inc. 97 (4), 533-8, Retrieved from https://pubmed.ncbi.nlm.nih.gov/11275024/.

[4] Sibai. B. M. (2005). Diagnosis, Prevention, and Management of Eclampsia: The American College of Obstetricians and Gynecologists. Elsevier, 105(2), 402-410, Retrieved from https://pubmed.ncbi.nlm.nih.gov/15684172/.

[5] Sibai. B. M. (1997). Risk factors associated with pre-eclampsia in healthy nulliparous women: *American Journal of Obstetrics and Gynaecology*. Elsevier, 177 (5), 1003-1010, Retrieved from https://www.ajog.org/article/S0002-9378(97)70004-8/fulltext.

[6] Kayode O. Et al. (2011). Public Health Perspectives of Preeclampsia in Developing Countries: Implication for Health System Strengthening. *Journal of Pregnancy*, Hindawi, 1 (1), 1-6, Retrieved from https://www.hindawi.com/journals/jp/2011/481095/.

[7] Hladunewich. M. Et al. (2007). Pathophysiology of the Clinical Manifestations of Preeclampsia. *Clinical Journal of the American Society of Nephrology*. Google Scholar, 2 (3), 543-549, Retrieved from https://cjasn.asnjournals.org/content/2/3/543.

[8] Duley. L. (2009). The Global Impact of Pre-eclampsia and Eclampsia: Seminars in Perinatology. 33 (3), 130-137, Retrieved from https://doi.org/10.1053/j.semperi.2009.02.010.

[9] WHO. (2015). Recommendations for Prevention and treatment of pre-eclampsia and eclampsia. WHO Press, Geneva 27, Switzerland, human reproduction programme ,1-38 Retrieved from http://apps.who.int/iris/bitstream/handle/10665/44703/9789241548335_eng.pdf?sequence=1.

[10] Chisoko. E. C et al. (2013). Pre-eclampsia: Maternal and Fetal outcomes according to symptomatology and proteinuria at University Teaching Hospital, Lusaka, 1 (1), 26-29, Retrieved from http://dspace.unza.zm/handle/123456789/3145.

[11] Yasuhiro, M. (2019). Significance of pre-hospital care to reduce the morbidity of eclampsia in rural Zambia: International Society for the Study of Hypertension in Pregnancy. Elsevier B.V, 17 (1), 100-103, Retrieved from https://pubmed.ncbi.nlm.nih.gov/31487623/.

[12] Rath. W. Et al. (2005). HELLP syndrome. *Journal of Perinatal Medicine*, 28 (4), 249-260, Retrieved from https://pubmed.ncbi.nlm.nih.gov/11031696/.

[13] Mbala General Hospital HMIS. (2019). Hospital Health Information Management System: Mbala GH. Zambia.

[14] Mbala DHMIS. (2019). District Health Information Management System: Mbala DHO. Zambia.

[15] Chansa. R. et al. (2009). Childbirth Complications among Adolescent Mothers at Mbala General Hospital in Mbala District, Zambia. *Open Journal of Nursing*, 9 (7), 629-675, Retrieved from https://www.scirp.org/journal/paperinformation.aspx?paperid=93777.

[16] Rosales-Ortiz. S. Et al. (2019). Adolescence and Pre-eclampsia: Prediction of Maternal and Fetal syndrome of Preeclampsia. Retrieved from https://www.intechopen.com/books/prediction-of-maternal-and-fetal-syndrome-of-preeclampsia/adolescence-and-preeclampsia.

[17] Silva, Lindsay M. Et al. (2008). Low socio-economic status is a risk factor for pre-eclampsia: the Generation R Study. *Journal of Hypertension*, 26 (6), 1200-8, Retrieved from https://pubmed.ncbi.nlm.nih.gov/18475158/.

[18] Kirsten. D. et al. (2005). Risk factors for pre-eclampsia at antenatal booking: a systematic review of controlled studies. BMJ, 330 (7491), 565, Retrieved from https://pubmed.ncbi.nlm.nih.gov/15743856/.

[19] Abalos. E. et al. (2013). Global and regional estimates of pre-eclampsia and eclampsia: a systematic review. *European Journal of Obstetrics & Gynaecology and Reproductive Biology*. Elsevier, 170 (1), 1-7, Retrieved from https://pubmed.ncbi.nlm.nih.gov/23746796/.

[20] Namakau C. M. et al. (2015). Cultural and health beliefs of pregnant women in Zambia regarding pregnancy and childbirth. *PMC*, 38 (1), 788-793, Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6091768/.