ANTENATAL CARE PRACTICES AND PREGNANCY OUTCOMES AMONG REFERRED AND BOOKED PATIENTS WITH PRE-ECLAMPSIA AT PUMWANI MATERNITY HOSPITAL: A RETROSPECTIVE COHORT STUDY

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IN PART FULFILMENT FOR THE DEGREE OF MASTER OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY, UNIVERSITY OF NAIROBI

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DECLARATION

This is to certify that this study is my original work and has not been presented for a degree course in any other university. References to work done by others have been clearly indicated. I further certify that my study has been supervised by senior members in the department of Obstetrics and Gynaecology, University of Nairobi.

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Signature.....

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APPROVAL

This is to certify that the commentary in this dissertation was researched upon by Dr. Kinuthia Claire Gathoni under my guidance and supervision and the dissertation is submitted with my approval.

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This is to declare that this dissertation is the original work of Dr. Kinuthia Claire Gathoni, Master of Medicine student in the Department of Obstetrics and Gynaecology, registration number H58/66723/2011, University of Nairobi (2011-2015). The research was carried out in the department of Obstetrics and Gynaecology, School of Medicine, College of Health Sciences. It has not been presented in any other university for the award of a degree.

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DEDICATION

For Dr. F. J. K. Muriu, Dr.(Mrs) Margaret Muriu, Kevin and Brian; the best family anyone could be blessed with. This one is for our team.

LIST OF ABBREVIATIONS

PMH Pumwani Maternity Hospital

Km kilometres

ANC antenatal care

BP Blood pressure

HELLP Haemolysis, elevated liver enzymes and low platelets

FSB fresh still birth

MSB macerated stillbirth

C/S cesarean section delivery

WHO World Health Organization

MDG Millennium Development Goal

DIC Disseminated Intravascular Coagulopathy

KDHS Kenya Demographic and Health Survey

SOP Standard Operating Procedures

MDG Millennium Development Goal

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DEFINITION OF TERMS

Gestational hypertension: Blood pressure of more than 140/90 mm Hg or a rise in systolic pressure of at least 30 mm Hg, or a rise in diastolic pressure of at least 15 mm Hg over the previously known blood pressure for the first time in pregnancy after 20 weeks, without proteinuria. (3)

Pre-eclampsia: New-onset hypertension (BP is >140 mmHg systolic and/or >90 mmHg diastolic) occurring in a pregnant woman after 20 weeks' gestation, with proteinuria (defined as urinary excretion of > 0.3g protein in 24 hours). (4, 5)

Severe pre-eclampsia: Diagnosis is made if the following criteria are present:

- BP is >160 mmHg systolic and/or >110 mmHg diastolic (on 2 occasions at least 6hrs apart, while the patient is on bed rest)
- Proteinuria of >5g/24hours or more than 3+ (on 2 random urine samples, collected at least 4 hours apart)
- Oliguria <500ml/24 hours
- Cerebral or visual disturbances
- Pulmonary oedema or cyanosis
- Epigastric or right upper quadrant pain
- Impaired liver function
- Thrombocytopenia
- Fetal growth restriction (4,5)

Superimposed pre-eclampsia: Includes "new-onset proteinuria" in a woman with hypertension before 20 weeks of gestation, a sudden increase in proteinuria if already present in early gestation, a sudden increase in hypertension, or the development of HELLP syndrome. Women with chronic hypertension who develop headache, scotomata or epigastric pain also may have superimposed pre-eclampsia. (5)

Eclampsia: The presence of new-onset grand mal seizures not attributable to any other causes in a woman with pre-eclampsia. The seizures may occur before, during or after delivery. (4) Antepartum eclampsia accounts for about 75% of all cases while the rest occur in labour or within 48hrs of delivery. Late postpartum eclampsia occurs more than 48 hours after delivery but less than 4 weeks postpartum. (6)

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ABSTRACT

Background: Hypertensive disorders are the most common medical complication occurring in 12-22% of all pregnancies and contribute significantly to both maternal and perinatal morbidity and mortality. Early identification and effective management in addition to timely referral to higher level facilities for specialized management plays a significant role in ensuring good maternal and perinatal outcomes. Despite the availability of screening tools and management guidelines, severe pre-eclampsia and eclampsia continues to be a major cause of severe maternal and perinatal complications especially so in developing countries. Antenatal care is a key instrument in the detection of pregnant women at high risk of developing pre-eclampsia and instituting proper management to control the disease before complications arise.

Objective: To determine and compare the pregnancy outcomes of patients with pre-eclampsia who received antenatal care at Pumwani Maternity Hospital and those who received antenatal care at its referring health facilities.

Study design: A retrospective cohort study, where exposure of interest was antenatal clinic attendance at Pumwani Maternity Hospital.

Methods: Study population consisted of 224 patients diagnosed with pre-eclampsia who delivered at Pumwani Maternity Hospital from June 2009 to June 2014 in two equal cohorts of 112 patients each, namely, those who attended ANC at Pumwani and those who attended ANC at its referring health facilities. Data was extracted from patient records using a structured questionnaire.

Results: Data was retrieved from a total of 224 patients files, 112 files were from patients who received antenatal care at Pumwani Maternity Hospital and the other 112 files were from patients who received antenatal care outside Pumwani Maternity Hospital. ANC attendance at PMH was associated with development of fewer maternal complications (12.5%) compared to attendance at its referring health facilities (26%) p-value=0.011. There was no significant difference in neonatal outcomes in both cohorts with similar newborn complications in both cohorts including admission to newborn unit at 50% in Pumwani and 41.7% from its referring facilities and perinatal death of 8% from PMH and 10.6% from its referring facilities. ANC attendance at PMH was associated with better screening, appropriate investigations and timely institution of medical management compared to attendance at its referring facilities. Antenatal care practices contributed most significantly towards the development of adverse pregnancy outcomes.

Conclusion and Recommendations: Antenatal care practices play a significant role in the early diagnosis and management of pre-eclampsia thus greatly affecting pregnancy outcomes. Facilities at all levels in the health care system (level 1-6) require targeted support to improve their antenatal service provision for management of pre-eclampsia especially so for lower level facilities (level 1-4) that cater for the majority of pregnant women in the community.

1.1 INTRODUCTION

Hypertensive disorders are the most common medical complication of pregnancy. They occur in 12-22% of all pregnancies. (1) High blood pressure in pregnancy is recognised as one of the major direct causes of maternal morbidity and mortality and is only surpassed by haemorrhage and infection. (2) Hypertension can first occur in pregnancy or, in cases where the woman has chronic hypertension, be worsened when she becomes pregnant.

Early identification and effective management of hypertension in pregnancy plays a significant role in ensuring good maternal and perinatal outcomes. Early and regular attendance of antenatal clinic during pregnancy offers an opportunity for screening for risk factors as well as early detection of elevated blood pressure. This provides health practitioners with the opportunity to start preventive measures for those pregnant women at risk of developing pre-eclampsia. For patients found to have elevated blood pressure early on, the health practitioner is then able to start treatment or refer to higher level facilities for specialist attention.

This study is part of a joint initiative involving the departments of Obstetrics and Gynaecology, Paediatrics and Pharmacy and is funded by MEPI. Its main objective is to evaluate the management and clinical outcomes of pregnant women with severe pre eclampsia and eclampsia at Pumwani Maternity Hospital. The results from each individual study by a postgraduate student from each department will be compiled to produce comprehensive information aimed at improving healthcare provision as well as informing Ministry of Health policy on Pre-eclampsia and Eclampsia.

1.2 LITERATURE REVIEW

Burden of disease

According to the World Health Organization more than 500,000 women world-wide die from pregnancy related complications and 99% of these maternal deaths occur in developing countries. The maternal mortality ratio (MMR) in developing countries is 240 per 100 000 births verses 16 per 100 000 in developed countries. (2) In Kenya, the MMR is 488 per 100 000 live births. (8)

Pre-eclampsia and eclampsia is one of the leading causes of maternal and perinatal morbidity and mortality. About 10% of pregnant women develop pregnancy-induced hypertension or pre-eclampsia with the incidence in primigravidae at about 10% and 5% in multigravidae. (8,9) WHO estimates the incidence of pre-eclampsia to be seven times higher in developing countries (2.8% of live births) than developed countries (0.4%) (10) In the developed countries of North America and Europe, the incidence of eclampsia is estimated to be about 5-7 cases per 10,000 deliveries. In developing countries, it varies widely, ranging from 1 case per 100 pregnancies to 1 case per 1700 pregnancies (11,12) Rates from African countries such as South Africa, Egypt, Tanzania and Ethiopia vary from 1.8% to 7.1% (13-16) In Nigeria, prevalence ranges between 2% to 16.7% (17-19)

Severe forms of pre-eclampsia and eclampsia are more common in developing countries ranging from a low of 4%of all deliveries to as high as 18% in parts of Africa. (20) At Kenyatta National Hospital the incidence of eclampsia in recent studies was reported as 10/1000 in 2000 (21) and 11/1000 in 2011 (22). No current statistics are available on the burden of severe pre-eclampsia and eclampsia at Pumwani Maternity Hospital.

A review article written in Nigeria in 2010 concluded that pre-eclampsia and eclampsia should be identified as a priority area in reducing maternal mortality in developing countries. It recommends that since the mainstay of control remains health care based

strategies, national governments and supporting agencies should channel efforts at strengthening the public health systems and improving access to trained healthcare providers. (51)

Risk factors and role of early detection

Primiparous women are twice as likely to develop pre-eclampsia as multiparous women (24) Women who have suffered from pre-eclampsia in their first pregnancy are at risk in their second pregnancy as well, especially so when severe pre-eclampsia occurs in the first pregnancy. (25) Other risk factors include patients with a positive family history, obesity, new paternity, pre-existing vascular disease, placental abnormalities and thrombophilias. (8)

Higher risk of developing pre-eclampsia is associated with various obstetric conditions such as multiple pregnancy, hydatidiform mole and hydrops foetalis. It is also associated with various medical conditions such as diabetes mellitus, chronic hypertension, and renal disease such as polycystic kidneys, acute glomerulonephritis and chronic pyelonephritis. (26)

Several risk markers can easily be measured at the first as well as subsequent antenatal clinic visits. (27) In risk assessments done after 20 weeks gestation, attention should be paid to the possible onset of pre-eclampsia by identification of any of the following signs and symptoms: new hypertension, new proteinuria, symptoms of headache, visual disturbance, epigastric pain, vomiting, reduced fetal movements, and an infant that is small for gestational age. (28) Patients with any signs or symptoms can then be referred for specialist management.

Early detection of women at risk for developing pre-eclampsia is an important tool in preventing the development of the disease. This is done by starting preventive therapy with Asprin before 16 weeks of pregnancy (29)and calcium supplementation. (30)Proper

screening and early diagnosis ensures that women with elevated blood pressure in pregnancy are started on treatment right from the onset of disease therefore resulting in better control of the blood pressure.

Early detection is based on three main points of focus: a detailed medical history, the collection of biophysical parameters and the determination of biochemical parameters. (31) Of 27 tests reviewed by Meads and colleagues (32) only a few reached specificities above 90%. These were body-mass index of 34kg/m2 or higher, alpha-fetoprotein and bilateral uterine Doppler notching. Sensitivities of higher than 60% were achieved only by uterine Doppler resistance index and combinations of indices. No single test, however, met the clinical standards for a predictive test. (33) Because any single biomarker is unlikely to be effective in prediction of the onset of a disorder as heterogeneous as pre-eclampsia, researchers have suggested that combinations of tests such as ultrasound assessment of Doppler waveforms, placental thickness and homogeneity and serum markers could raise the effectiveness of history and physical-based screening. (34)

Maternal and perinatal outcomes and complications

If pre-eclampsia goes undiagnosed or inadequately treated, the disease progresses to severe pre-eclampsia or eclampsia. Overall, 10% to 15% of direct maternal deaths are associated with pre-eclampsia and eclampsia. Severe maternal and perinatal morbidity and mortality are more often associated with eclampsia as opposed to pre-eclampsia. (30)

Maternal organ systems that are susceptible to excessive inflammation and endothelial damage are the CNS, lungs, liver, kidneys, systemic vasculature, coagulation and the heart. The placenta and fetus are also at risk. The more organ systems are affected, the more maternal and perinatal complications arise. Clinicians should take caution not to undervalue clinical signs and symptoms in severe pre-eclampsia because they can be non-specific such as nausea and vomiting. (35)

Immediate maternal complications during pregnancy include eclampsia, antenatal haemorrhage due to placental abruption, postpartum haemorrhage, visual disturbances, pre-term labour, HELLP syndrome, acute respiratory distress, renal failure and cerebral haemorrhage. Remote maternal complications include residual hypertension, recurrent pre-eclampsia and chronic renal disease. (3)The risk of maternal mortality is mainly related to complications such as eclampsia, haemorrhage, hepatic rupture, acute renal failure, pulmonary oedema, disseminated intravascular coagulopathy and HELLP syndrome.(3)

The fetal risk is related to the severity of pre-eclampsia, duration of the disease and the degree of proteinuria. The possible complications include intrauterine death, intrauterine growth restriction, intrauterine and early neonatal asphyxia and prematurity. (3)

A prospective study carried out at a tertiary hospital in India in 2009 found a high incidence of maternal and perinatal complications in 100 women with severe pre-eclampsia and eclampsia. Maternal and perinatal outcomes were much poorer in eclampsia as compared to severe pre-eclampsia. The study also found that a majority of the patients with severe pre-eclampsia and eclampsia were unbooked and had not attended any clinics for antenatal care (82%), belonged to low socioeconomic status (84%), had rural background with low level of education (84%), were less than 30 years of age (90%) and were primigravidae (73%) (36)

Role of Antenatal care and follow up

Antenatal care is one of the four pillars of safe motherhood, as formulated by the Maternal Health and Safe Motherhood Programme, WHO 1994) (37)The rationale for antenatal care is that it is essential to screen a predominantly healthy population to detect early signs of or risk factors for disease, followed by timely intervention. (38)

The WHO developed a model for antenatal care in developing countries whereby women with uncomplicated pregnancies receive a minimum of four antenatal visits, first visit

before 12 weeks of pregnancy, second at 26 weeks, third at 32 weeks and fourth at 38 weeks. This basic antenatal care is suitable for about 75% of pregnant women. Women with medical conditions or risk factors during the current or prior pregnancies will require more frequent visits and possible referral to a specialist or higher level facility for further management and delivery. (38)

In developing countries, comparison of outcomes among women who did and did not receive antenatal care, or who first attended late vs. early in pregnancy have been shown to be confounded by Socio-economic factors, education, unwanted pregnancy, maternal age and other factors that influence the outcome of pregnancy (39, 40) Further confounding factors are likely to be knowledge of, distance from, access to and utilization of other health services, including those for delivery. No studies have been identified that control adequately for these factors. (41)

Antenatal care is a key instrument in the detection of pregnant women at high risk of developing pre-eclampsia. Several risk factors can be identified during antenatal visits. According to the KDHS 2008-2009, 92% of Kenyan women who had given birth in the past 5 years received antenatal care from a skilled provider. However, only 44% of these women had a skilled attendant assist during their delivery and only 43% delivered in a health facility. (8) Antenatal care is well received locally and is therefore a good opportunity to identify and treat patients found to be hypertensive in pregnancy as well as institute preventive measures for those at risk of developing pre-eclampsia or its complications.

A prospective, quasi-experimental study was carried out in 2009 in urban health centers in five townships of Mandalay, Myanmar. It highlighted the role of quality antenatal care in early detection of pre-eclampsia for improved pregnancy outcomes. (42-46) The study identified some of the challenges that may have affected the quality of antenatal care given to women in attendance. It found that the midwives were overloaded with large

patient numbers as well as MCH tasks and other public health activities therefore they were unable to concentrate on quality care of the individual patients. They also found that the midwives skills on measurement of blood pressure and urine protein detection with dipstick test were wanting. The findings in this study highlight how health care providers can hinder the provision of quality antenatal care. (42)

Guidelines for Antenatal Care

In Kenya, various clinical guidelines have been written to help standardize the quality of care provided for various medical conditions. (47, 48) These guidelines contain a section detailing the diagnosis and management of pre-eclampsia and eclampsia at level one to level six facilities including a list of risk factors and clinical features to assess for during review of pregnant women antenatally. Once identified, several investigations are recommended including haemogram, urinalysis for protein, blood urea and electrolytes, liver function tests, coagulation profile and ultrasound to evaluate the foetus. (48)

i) General Management

Continuous assessment of maternal and fetal condition is advised with bed rest and drug therapy where appropriate. Delivery options must be evaluated. The Guidelines recommend admission to a level 4-6 facility if the patient has pre-eclampsia at term for delivery, has severe pre-eclampsia at any gestation, has imminent eclampsia or eclampsia for management and delivery, has a complicating obstetric condition such as preterm labour or antepartum haemorrhage or if there is intrauterine fetal growth restriction or death.

Patients with mild pre-eclampsia may be managed as out-patients with weekly follow up at level 2-6 facilities for blood pressure monitoring, dipstix urinalysis and fetal monitoring. These patients must be advised on the danger signs that may occur and instructed to seek immediate medical attention. (48)

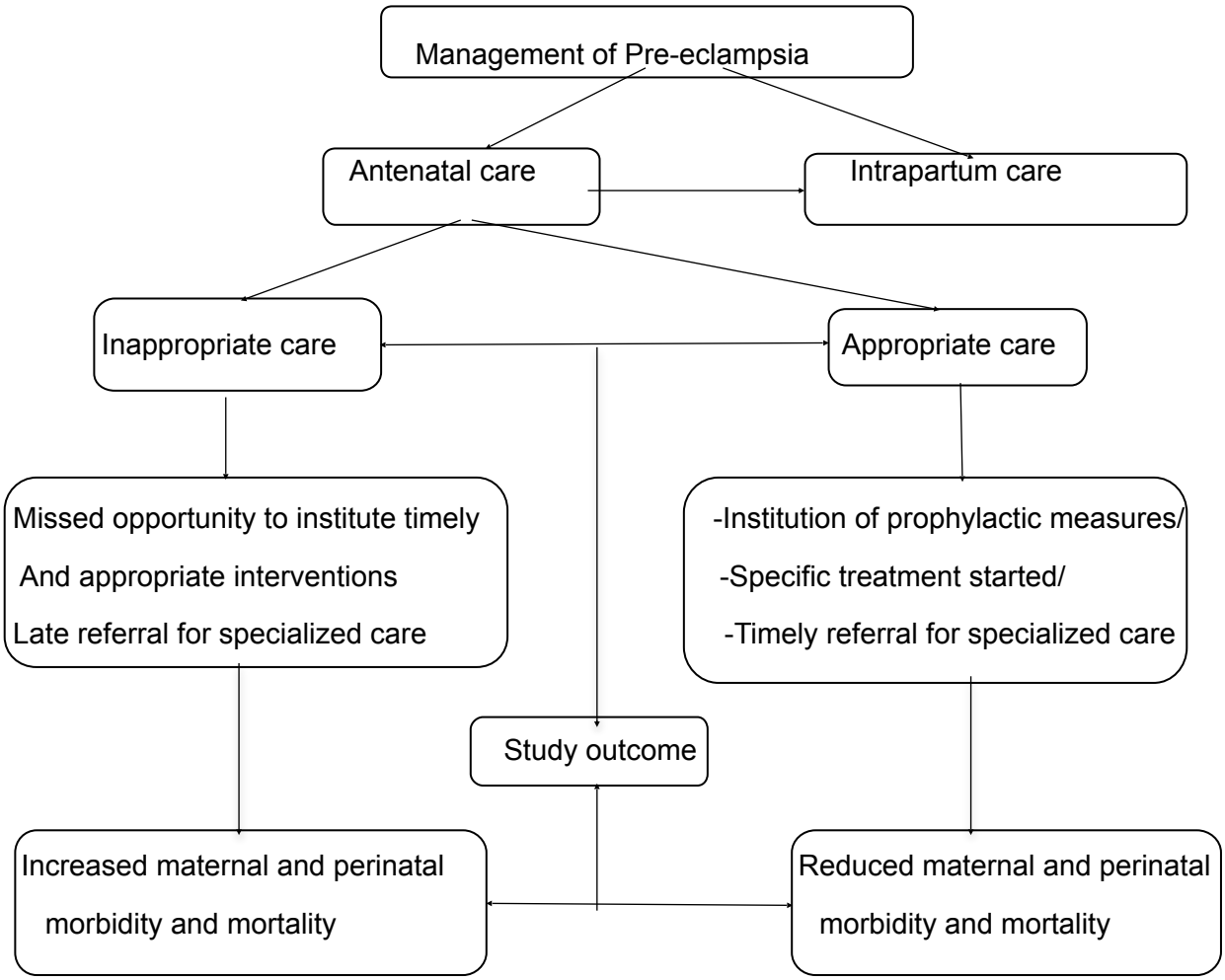
ii) Management of Severe pre-eclampsia

Patients with severe pre-eclampsia should be referred to a level 4-6 facility for admission and management. The guidelines emphasize delivery as the definitive management of severe pre-eclampsia. The patient should be admitted to a quiet room with 24 hour nursing care. An indwelling catheter is inserted and input-output charting started. Magnesium sulphate prophylaxis is started to prevent convulsions and patient's blood pressure controlled with antihypertensives. A vaginal examination is conducted to assess bishop score in order to determine the appropriate mode of delivery (vaginal or abdominal delivery) (48)

iii) Management of imminent eclampsia and Eclampsia

The patient should be admitted in the acute room and patient's airway, breathing and circulation checked and secured. Review by critical care personnel should be requested where available. Magnesium sulphate should be administered to control the convulsions and antihypertensives administered to control blood pressure. Emergency investigations should be carried out including haemogram, urea and electrolytes, liver enzymes and bilirubin levels as well as urinalysis. A Foley catheter should be inserted and strict input-output monitoring carried out. Delivery should be carried out as soon as the patient is stabilized. (48)

1.3 CONCEPTUAL FRAMEWORK



Conceptual Framework Narrative

Antenatal care allows for early identification of risk factors for pre-eclampsia and early diagnosis for those who have developed symptoms and signs of pre-eclampsia. All health facilities should ensure the provision of comprehensive, quality antenatal care to identify pregnant women with pre-eclampsia in a timely manner and institute the appropriate management to control blood pressure and prevent end organ damage. Lower level facilities should refer patients for specialized care in a timely manner. This reduces overall rates of maternal and perinatal morbidity and mortality.

1.4 PROBLEM STATEMENT AND JUSTIFICATION

Severe pre-eclampsia and eclampsia remains a common Obstetric emergency in health facilities in Kenya and is associated with severe maternal and perinatal morbidity and mortality. The basic assumption of this study is that early detection and timely decision making on appropriate interventions will lead to improved maternal and perinatal outcomes.

In Kenya, pregnant women are now attending clinic as recommended by WHO with 47% women attending clinic at least four times. (8) This gives health care workers the opportunity to screen for hypertensive disorders in pregnancy ensuring the early detection and proper management of these patients. A critical review by Mac dough emphasised that to have any effect antenatal care must be part of a system of care that culminates in good local obstetric facilities with adequately trained staff. (49)

A study done in PMH in 2009 showed that pregnancy outcomes were better for those women who attended the antenatal clinic at PMH compared to those who were referred to the hospital from antenatal clinics at peripheral facilities. The outcomes noted in referred patients included poorer general appearance, higher incidence of cesarean section deliveries, more cases of manual removal of placenta after failed controlled cord traction, higher incidence of blood transfusions and more cases of febrile illness and wound sepsis post-delivery. However the problem of pre-eclampsia was not addressed specifically. (50)This study seeks to determine if the same differences are present based on where one attends ANC, in patients with pre-eclampsia, and to identify the gaps that have contributed to a continually high maternal and perinatal morbidity and mortality associated with severe pre-eclampsia and eclampsia. (10, 23)

1.5 RESEARCH QUESTION

Is there a difference in pregnancy outcomes among patients with pre-eclampsia who received antenatal care at Pumwani Maternity Hospital compared to those who received antenatal care at its referring health facilities?

NULL HYPOTHESIS

There is no difference in the pregnancy outcomes among patients with pre-eclampsia who received antenatal care at Pumwani Maternity Hospital compared to those who received antenatal care at its referring health facilities.

BROAD OBJECTIVE

To determine and compare the pregnancy outcomes between patients with pre-eclampsia who received antenatal care at Pumwani Maternity Hospital and those who received antenatal care at its referring health facilities.

SPECIFIC OBJECTIVES

Among patients with pre-eclampsia who received antenatal care at Pumwani Maternity Hospital and those who received ANC at its referring health facilities, to determine and compare:

1. Antenatal care practices such as screening, diagnosis and treatment of preeclampsia.
2. The maternal outcomes
3. The neonatal outcomes
4. The factors influencing the pregnancy outcomes

2.0 STUDY DESIGN AND METHODOLOGY

2.1 Study design

The study was a retrospective cohort study, a design that allowed analysis of the data to answer the research question without introducing service provider bias. The exposure of interest was receiving antenatal care at PMH.

2.2 Study site and setting

The study was conducted at Pumwani Maternity Hospital (PMH) which was established in 1948 and is the largest maternity unit in Kenya. The facility is managed by the Nairobi City Council and is situated 4km to the East of the city centre.

The hospital has a bed capacity of 358 with 7 postnatal wards, 1 antenatal ward, 1 labour ward, 1 nursery with 150 baby cots and 2 operating theatres. The average delivery rate is 70 per day. It also runs antenatal, postnatal and gynaecology outpatient clinics. The medical staff attending to the patients include Consultant Obstetricians/Gynaecologists, Medical officers, Medical officer interns, Clinical officers and midwives.

PMH is a level 5 referral hospital and therefore receives patients who are at risk of maternal and fetal complications from other health facilities around Nairobi. This includes lower level city council facilities as well as private facilities and clinics in its environs. It was therefore a suitable site for this study.

There is no established protocol for the management of women with severe pre-eclampsia and eclampsia at the hospital but the medical staff have access to the government protocol established and distributed nationally in the Clinical Guidelines for Management and Referral of common Conditions at level 4-6 Hospitals booklet. (26)

2.3 Study population

The study population consisted of women diagnosed with pre-eclampsia who delivered at PMH. The exposed group were women who received antenatal care at PMH and the unexposed were those who received antenatal care at other health facilities.

Inclusion criteria

Exposed group

- All pregnant women diagnosed with pre-eclampsia who attended ANC and delivered at PMH
- Patients with clear records on site of ANC attendance, documented antenatal records and pregnancy outcomes
- Gestation >20 weeks admitted for delivery or termination of pregnancy

Unexposed group

- All pregnant women diagnosed with pre-eclampsia who attended ANC at other health facilities then delivered at PMH
- Patients with clear records on site of ANC attendance, documented antenatal records and pregnancy outcomes
- Gestation >20 weeks admitted for delivery or termination of pregnancy

Exclusion criteria

- Patients who did not attended ANC
- Patients who attended ANC at more than one health facility

Outcome measures

Two composite end points were used, one maternal the other neonatal. The maternal composite event included maternal death and severe maternal morbidity indicated by one or more of the following:

- Postpartum haemorrhage defined as blood loss of more than 500ml after vaginal delivery or more than 1000ml after C/S delivery
- Renal failure diagnosed clinically by oliguria or anuria with raised serum creatinine level
- Eclampsia
- Pulmonary Oedema
- Sepsis
- HELLP syndrome
- Coagulopathy diagnosed from bleeding manifestations and laboratory coagulation profile
- Referral to intensive care unit

The neonatal composite event included perinatal death and severe neonatal morbidity indicated by:

- APGAR score <7 at 5 minutes
- Delivery room resuscitation
- Admission/referral to new born unit
- Preterm delivery

• Low birth weight.

2.4 SAMPLE SIZE CALCULATION AND SAMPLING PROCEDURE

Sample size determination

The main outcome of this study is the proportion of postpartum pre-eclampsia patients who have adverse maternal and neonatal outcomes and its association with the peripheral antenatal clinic attendance as compared to PMH.

Prior studies estimate that the proportion of postpartum pre-eclampsia patients from peripheral ANC with adverse outcomes such as 5 minute APGAR score <7 was at 18%. (52) We postulate that PMH facility based ANC will decrease this proportion to 9%.

Therefore for us to detect a 50% difference in the 5 minute APGAR scores using the sample size formula [Allan Donner; Stat. Medicine (1984)] (53), we would need to study a total of 224 patients with preeclampsia (112 per group) to achieve a 80% power to detect the stated difference of 50% at a two-sided alpha=0.05 level of significance. Where we define pc=18% and pe=9% to be the proportions of 5 minute APGAR <7 in the exposed group and unexposed group respectively and

$\bar{p}$ = (p_C+ p_e)/2 ($Z_{0.25}$ =1.960, and $Z_{0.8}$ =0.842).

$$n = \{Z_\alpha \sqrt{[2\overline{P}(1-\overline{P})]} + Z_\beta \sqrt{[P_E(1-P_E) + P_C(1-P_C)]}\}^2/\delta^2$$

Total 222.49

Total study participants= 224

Exposed = 112

Unexposed = 112

Sampling procedure

Study populations were selected from patient records of women with pre-eclampsia who delivered at PMH between June 2010 and June 2014. The files were organised in a chronological manner according to date of admission. Only files with complete information on antenatal follow up, laboratory test results, referral documentation and information on pregnancy outcomes were included. The patients who fit into the study criteria were grouped into two based on site of antenatal clinic attendance and relevant information obtained from their records in a consecutive manner until the sample size was achieved.

2.5 DATA MANAGEMENT AND COLLECTION METHODS

The study was conducted by the principal investigator under the guidance of two supervisors from the department of Obstetrics and Gynaecology, University of Nairobi. Two research assistants were recruited to retrieve all relevant patient files from the records office. The study instrument used to extract relevant data from the patient records was a coded structured questionnaire. This tool was used to collect the patients' socio-demographic data, past medical and obstetric history, obstetric information concerning the current pregnancy and pregnancy outcomes. The final part of the questionnaire collected information on both maternal and perinatal outcomes and complications noted within 72 hours of delivery.

Data Management and statistical Analysis

Data was entered into a MS Excel database and later exported to Statistical Package for the Social Sciences (SPSS) version 21.0 for data analysis and hypothesis testing.

Data quality was enhanced at all stages of data collection, entry and analysis. The entered data will be coded and for the specified questions cleaning done. Quality of data was

assessed by conducting consistency and validity checks. Data was stored in a password protected computer. Patient's files were not removed from the records office at PMH. Continuous variables such as age, weight, etc were summarized using central tendency measures such as mean, mode, median and measures of dispersion such as standard deviation and variance. P value of less than 0.05(α-level) was considered statistically significant. Results are presented in tables, charts and figures where applicable.

Data analysis based on the specific objectives:

Specific objective 1*: To determine antenatal care practices at PMH and at its referring health facilities.*

We evaluated the antenatal care practices at PMH and at its referring health facilities through bivariate analysis using logistic regression. Significance was estimated using p-values and reported appropriately.

Specific objective 2: *To determine association between site of ANC and adverse maternal outcomes*

We evaluated the relationship between site of ANC and adverse maternal outcomes as binary variables (yes/no) through bivariate analysis using logistic regression. Significance was estimated using p-values and reported appropriately.

Specific objective 3*: To determine association between site of ANC and adverse neonatal outcomes*

We evaluated the relationship between site of ANC and adverse neonatal outcomes as binary variables (yes/no) through bivariate analysis using logistic regression. Significance was estimated using p-values and reported appropriately.

Specific objective 4: *To determine factors associated with adverse (a) maternal and (b) neonatal outcomes.*

We evaluated the factors associated with adverse maternal and neonatal outcomes as binary variables (yes/no) through bivariate analysis using logistic regression.

Strengths of association were estimated using relative risk and 95% Confidence Intervals as presented. Significant factors were subjected to multiple logistic regression to determine the best model that explains the association.

2.6 ETHICAL CONSIDERATIONS

Approval for the study was obtained from the ethics review board in Kenyatta National Hospital and permission sought from the Pumwani Maternity Hospital medical superintendant to allow access to patient files and data in their records department.

The participants in this study were women of reproductive age (18-49years) with a diagnosis of pre-eclampsia who delivered at PMH between June 2010 and June 2011. Required data was obtained from the patient records maintained by Pumwani Maternity Hospital records office.

Confidentiality was upheld throughout the study. All study participants' identifiers were omitted from all data extracted prior to data analysis. All patients' records and files were handled only by the principal investigator and research assistants. All patient paper records were kept in locked cabinets and electronic records within the database and were password protected. No patient records were removed from the records office.

3.0 RESULTS

The study population consisted of patients with pre-eclampsia who delivered in Pumwani Maternity Hospital (PMH) between June 2010 and June 2014. A total of 987 files were retrieved. Out of these, only 396 files had adequate and complete data for collection. They were divided into two groups depending on place of ANC attendance and then organised according to date of admission and sampled consecutively until 112 files were retrieved for each cohort in equal proportions of 1:1. The exposure of interest was attendance of ANC at PMH. One cohort consisted of those who received antenatal care at Pumwani Maternity Hospital (ANC at PMH) and the other, those who received antenatal care at its referring health facilities (ANC Elsewhere) making up a total of 224 patients. Findings included antenatal care practices, maternal outcomes, neonatal outcomes and factors that influenced the pregnancy outcomes of patients in the two cohorts.

3.1 Socio-demographic characteristics

Table 1 shows the socio-demographic characteristics of the study population. Their ages ranged from 16 to 41 years with a mean age of 26.7 where majority 41(36.6%) PMH patients were aged between 26-30 years as compared to majority of 42(37.5%) Non-PMH patients aged 21 to 25 years. Mean age of PMH patients was 27.45 within the range of 18 to 40 years and Non-PMH patients was 26.10 within the range of 16 to 41 years.

Response rate on levels of education was very low at 57(25.5%). This was because of poor documentation of this parameter in the patient records. The distribution of employment status was different across categories of ANC attendance status (p-value=0.017). Fewer patients who attended clinic at Pumwani were unemployed (58%) compared to those who attended clinic at its referring facilities (73.2%).

Table 1: Socio-demographic characteristics of the study population

Characteristic		ANC at PMH	ANC Elsewhere	P Value
		n (%)	n (%)	
Age (in Years) N=112	16 - 20	9(8)	18(16.1)	0.056
	21 - 25	32(28.6)	42(37.5)	
	26 - 30	41(36.6)	30(26.8)	
	31 - 35	25(22.3)	12(10.7)	
	36+	5(4.5)	10(8.9)	
Level of Education N(PMH)=20 N(Non-PMH)=37	None	1(5)	3(8.1)	0.716
	Lower Primary	3(15)	10(27)	
	Upper Primary	4(20)	8(21.6)	
	Secondary	7(35)	11(29.7)	
	Tertiary	5(25)	5(13.5)	
Employment Status N=112	Self-Employed	33(29.5)	17(15.2)	0.017
	Employed	14(12.5)	13(11.6)	
	Unemployed	65(58)	82(73.2)	
Residence N=112	Urban Informal	36(32.1)	39(34.8)	0.178
	Urban Low Income	62(55.4)	47(42)	
	Urban Middle Income	10(8.9)	25(22.3)	
	Urban High Income	0(0)	0(0)	
	Rural Informal	1(0.9)	0(0)	
	Rural Formal	3(2.7)	1(0.9)	
Marital Status N=112	Single	11(9.8)	11	0.929
	Married	97(86.6)	98	
	Separated	4(3.6)	3	

3.2. Antenatal Care Practices

Table 2: Antenatal care practices by place of ANC attendance

Aspect		ANC at PMH	ANC Elsewhere	P value
Attendance:		**n(%)**	**n(%)**	
Gestation at 1st ANC visit (weeks) (N=112)	< 20	10(8.9)	6(5.4)	0.005
	20 - 29	57(50.9)	83(74.1)	
	30+	45(40.2)	23(20.5)	
Number of ANC Visits (N=112)	1-2	53(47.3)	47(42)	0.490
	3-4	46(41.1)	56(50)	
	5+	13(11.6)	9(8)	
Gestation at diagnosis (weeks) (N=112)	20 - 24	11(9.8)	0(0)	0.038
	25 - 29	15(13.4)	9(8)	
	30 - 34	35(31.3)	45(40.2)	
	35-39	47(42)	55(49.1)	
	40+	4(3.6)	3(2.7)	
Treatment: Appropriate medication prescribed (N=112)		109(97.3)	94(83.9)	0.001
Patient Compliance to prescription (N=109 PMH; N=94 Non-PMH)		94(86.2)	72(76.6)	0.001

In table 2, we found that both cohorts had similar distribution of their clinic attendance practices. The peak gestation at first antenatal clinic attendance was at 20-29 weeks with peak gestation at diagnosis being at 35-39 weeks.

Patients from both cohorts were likely to receive a prescription for antihypertensives upon diagnosis, with higher prescription rates among those who attended ANC at PMH. Fewer patients from the referring facilities were compliant to their treatment.

Table 3: Investigations done at diagnosis by place of ANC attendance

Investigations done	ANC at PMH n(%)	ANC Elsewhere n(%)	P-values
Lab tests:(N=112)			
Total blood count	72(64.2)	42(37.5)	<0.001
U/E/Cs	66(58.9)	20(18)	<0.001
LFTs	51(45.5)	7(6.3)	<0.001
Coagulation Profile	-	-	-
No tests done	31(28)	56(50)	
Obstetric U/S: (N=112)	86(78)	66(59)	0.001

Table 3 shows that patients who attended ANC at Pumwani were more likely to have appropriate investigations done at diagnosis compared to those attending ANC at its referring facilities.

3.3 Maternal outcomes

Table 4: Mode of delivery by place of ANC attendance

Mode of delivery	ANC at PMH (N=112) n(%)	ANC Elsewhere (N=112) n(%)	P-value
Vaginal delivery	51(45.5)	72(64.3)	0.012
Cesarean section	61(54.5)	40(35.7)	

In table 4, the difference in distribution of mode of delivery was statistically significant across the categories of ANC attendance status (p-value=0.012) with fewer patients who attended ANC at Pumwani having vaginal deliveries (45.5%) compared to patients who attended clinic at its referring facilities (64.3%).

Table 5: Indications for Cesarean delivery by place of ANC attendance

Indication for C/S	ANC in PMH (N=61) n(%)	ANC Elsewhere (N=40) n(%)	P-value
Poor Bishop Score	4(6.6)	3(7.5)	0.855
Poor progress of labour	4(6.6)	5(12.5)	0.307
Non-Reassuring fetal status	19(31)	13(32.5)	<0.001
Previous C/S deliveries	6(9.8)	2(5)	0.428
Severe pre-eclampsia (other)	17(28)	10(25)	<0.001
Multiple gestation (other)	8(13.1)	5(12.5)	0.928
Eclampsia (other)	2(3.3)	1(2.5)	0.822
Obstructed labour (other)	-	1(2.5)	-
Abruptio placentae	1(1.6)	-	-

In table 5, the statistically significant difference of note in the indications for cesarean section deliveries was in the distribution of cases of non-reassuring fetal status and severe eclampsia (p-value=<0.001). These made up the majority of C/S deliveries in both cohorts.

Table 6: Presence of maternal Complications by place of ANC attendance

		ANC at PMH (N=112) n(%)	ANC Elsewhere (N=112) n(%)	P-value
Maternal Complications	Yes	14(12.5)	29(26)	0.011
	No	98(87.5)	83(74)	

When assessing the distribution of maternal complications based on facility where the patients attended ANC, it was found that a larger proportion of patients who attended clinic at Pumwani's referring facilities (26%) developed maternal complications compared to those who attended ANC at PMH (12.5%). (p-value=0.011). (Table 6)

Table 7: Type of maternal complications by place of ANC attendance

Maternal Complication	ANC at PMH (N=112) n(%)	ANC Elsewhere (N=112) n(%)	OR (95% CI)	P-Value
Acute Renal Failure	5(4.5)	11(9.8)	0.4 (0.1- 1.3)	0.120
Pulmonary Oedema	1(0.9)	-	2.0 (1.7 - 2.3)	0.316
Cerebral Hemorrhage	-	-	-	
Abruption Placenta	-	-	-	
HELLP Syndrome	2(1.8)	1(0.9)	2.0 (0.2 -22.6)	0.561
DIC	1(0.9)	-	2.0 (0.2 - 2.3)	0.316
Sepsis	2(1.8)	11(9.8)	0.2 (0.0 - 0.8)	0.011
PPH	6(5.4)	8(7.1)	0.8 (0.2 - 2.2)	0.581
Eclampsia	2(1.8)	6(5.4)	0.3 (0.1 - 1.6)	0.150

Table 7 shows a strong association between clinic attendance at the referring facilities and the development of maternal sepsis after delivery. [OR 0.2; 95 %(CI 0.2-0.8) p-value=0.011]

Table 8: Adverse maternal outcomes by place of ANC attendance

Adverse maternal outcomes	ANC at PMH (N=112) n (%)	ANC Elsewhere (N=112) n (%)	RR (95% CI)	P Value
ICU	5(4.5)	3(2.7)	1.1 (0.08 - 11.9)	0.471
Dialysis	4(3.6)	2(1.8)	1.1 (0.5 - 2.4)	0.408
Maternal Death	1(0.9)	1(0.9)	0.8 (0.18 - 3.28)	1

In table 8, the distribution of adverse maternal outcomes was similar across both categories of ANC attendance status.

Both groups had a single maternal mortality. The cause of death for the patient from the PMH group was eclampsia while that for the patient from the Non-PMH group was eclampsia and severe anemia.

Table 9: Maternal complications against degree of proteinuria by place of ANC attendance

Degree of proteinuria	Maternal complications		P-value
	ANC at PMH (N=14) n (%)	ANC Elsewhere (N=29) n (%)	
Trace	1(7.1)	7(24.1)	0.544
+	1(7.1)	4(13.8)	0.750
++	2(14.3)	7(24.1)	0.747
+++	10(71.4)	11(37.9)	0.0883

As can be seen in table 9, there was no statistically significant difference in the distribution of the maternal complications against degree of proteinuria in the two groups. Of note however that proteinuria of 3+ is was associated with higher occurrence of maternal complications with a P-value of 0.0883

3.4 Neonatal outcomes

Table 10: Newborn Outcomes by the place of ANC attendance

Newborn outcome	ANC at PMH (N=112) n(%)	ANC Elsewhere (N=112) n(%)	P-value
Live	94(84)	99(88.4)	0.013
Fresh still birth	8(7.1)	8(7.1)	
Macerated still birth	10(8.9)	5(4.5)	

As seen in table 10, the distribution of newborn outcomes was similar across the two groups.(p-value=0.013).

Table 11: Birth weights of babies by place of ANC attendance

Weights of baby	ANC at PMH (N=112) n(%)	ANC Elsewhere (N=112) n(%)	P value
Mean weight	2,602	2,775	
< 1500	9(8)	5(5)	
1500-1999	14(13)	8(7)	
2000 - 2499	17(16)	15(14)	0.204
2500-2999	32(28)	28(25)	
3000-3499	24(20)	39(34)	
3500+	16(15)	17(15)	

In table 11, there was no statistically significant difference in the distribution of birth weights of the newborns in both cohorts (p-value=0.204)

Table 12: Newborn Complications by place of ANC attendance

Newborn Complications	ANC at PMH n(%)	ANC Elsewhere n(%)	RR (95% CI)	P-value
APGAR score <7 at 5min	32(28.6)	34(30.4)	0.96(0.71-1.28)	0.769
Delivery Room Resuscitation	14(13.5)	11(10.8)	1.1 (0.73 - 1.60)	0.556
Admission to Newborn Unit	50(50)	43(41.7)	1.1 (0.76 - 1.53)	0.238
Perinatal Death	8(8)	11(10.6)	0.78 (0.45 - 1.35)	0.527

There was no statistically significant difference in the distribution of newborn complications across the categories of site of ANC attendance. (Table 12)

Table 13: Neonatal complications against maternal factors by place of ANC attendance

	Neonatal complications ANC at PMH (N=51) n(%)	ANC Elsewhere (N=46) n(%)	RR (95% CI)	P-values
Severity of PE				
Mild PE BP >140/90- <160/110	19(37.3)	26(56.5)	0.5 (0.43 – 0.62)	0.057
Severe PE BP >160/110)	32(62.7)	20(43.5)		
Degree of proteinuria				.
<3+	33 (64.7)	28 (60.9)	0.5 (0.43-0.62)	0.857
>3+	18 (35.3)	18 (39.1)		

In table 13, there was no statistically significant association between the severity of pre-eclampsia or degree of proteinuria with the development of neonatal complications in the two cohorts.

3.5 Factors affecting pregnancy outcomes

In table 14 below, there was no statistically significant association between employment status or severity of pre-eclampsia and the development of maternal complications. (p-value=0.319) However, there was a statistically significant trend in terms of antenatal practices in both groups. There was late diagnosis of pre-eclampsia in patients who developed maternal complications. (p-value=<0.001). With respect to timely institution of management, by prescribing appropriate medications and compliance to treatment, Pumwani performed much better than its referring facilities. Carrying out investigations in a timely manner upon diagnosis of pre-eclampsia was associated with fewer cases of maternal complications in both cohorts.

Table 14: Multivariate analysis of factors contributing to maternal complications

Maternal factors		Maternal complications ANC at PMH (N=14) n(%)	ANC Elsewhere (N=29) n(%)	Relative risk (95% CI)	P-values
Employment status	Employed	6(42.9)	8(27.6)	0.33 (0.20 – 0.48)	0.319
	Unemployed	8(57.1)	21(72.4)		
Severity of PE	Mild PE >140/90-<160/110	2(14.3)	12(41.3)	0.41 (0.25-0.59)	. 0.076
	Severe PE >160/110	12(85.7)	17(58.7)		
Antenatal practices					
Gestation at first ANC attendance	<30 wks	7(50)	23(79.3)	0.33 (0.20-0.48)	0.049
	>30 wks	7(50)	6(20.7)		
Gestation at diagnosis	<30wks	3(21.4)	-	-	<0.001
	>30wks	11(70.6)	29(100)		
Medication prescribed at diagnosis	Yes	14(100)	21(72.4)	-	<0.001
	No	-	8(27.6)		
Patient compliance to treatment	Yes	14(100)	13(44.8)	-	0.001
	No	-	16(55.2)		
Investigations:					
Lab tests	Yes	1(7.1)	11(37.9)	0.3(0.19-0.47)	<0.001
	No	13(92.9)	18(62.1)		
Obstetric Ultrasound	Yes	3(21.4)	10(34.5)	0.4(0.21-0.54)	0.038
	No	11(78.6)	19(65.5)		

4.0 DISCUSSION

This study showed that antenatal clinic attendance at Pumwani Maternity Hospital (PMH) conferred benefit over attending clinic at its referring facilities for women with pre-eclampsia, specifically in terms of better screening, investigations, diagnosis and timely institution of management. This resulted in better maternal outcomes among patients followed up antenatally at Pumwani. However there were some gaps in the service provision at Pumwani as well. Both groups showed a delay in diagnosis of patients and therefore a delay in institution of appropriate management resulting in development of severe pre-eclampsia and its complications. This delay was noted to be more prevalent among patients who attended ANC at the referring facilities compared to those who attended at PMH.

The economic status of PMH clinic attendees was higher than patients who attended clinic at its referral facilities as more patients in the PMH cohort were employed and self employed (42%) compared to those who attended clinic at its referring facilities (26%). This however did not significantly influence the pregnancy outcomes and risk of developing maternal and neonatal complications.

According to the national guidelines on the management of pre-eclampsia, the antenatal clinics at all facilities from level 1-6 are expected to be equipped to screen for pre-eclampsia and start appropriate medical management. Level 1-4 facilities are also required to identify patients who need specialist care and therefore refer them in a timely manner. (47,48) Patients attending ANC in both cohorts had a peak first clinic attendance at 20-29 weeks; 50.9% of the PMH clinic group and 74.1% of those attending clinic at its referring facilities. This is in keeping with the findings in the Kenya Demographic health survey 2008-2009 where the median number of months of pregnancy at first visit was 5.7 months.

(8) This would give the health workers at the various facilities adequate opportunity to begin screening for symptoms and signs of pre-eclampsia.

At the same time, the bulk of patients, 42% of those who attended clinic at Pumwani and 49.1% of those who attended clinic elsewhere, were diagnosed with pre-eclampsia at between 35-39 weeks gestation. This could be attributed to either patients developing symptoms and signs of pre-eclampsia later in pregnancy or, more likely, the screening done antenatally being inadequate and thus missing the diagnosis. It was noted that more patients from referring facilities did not have any laboratory tests done at diagnosis (50%) compared to those who attended ANC at PMH (26.7%). 78% of PMH clinic attendees and 59% of Non-PMH clinic attendees had an obstetric ultrasound done upon diagnosis of pre-eclampsia. More patients in the Pumwani cohort (97.3%) received prescriptions for medications at diagnosis as compared to those from the referring facilities (83.9%) p-value=0.001. Also, more patients from the Pumwani cohort were compliant to treatment prescribed (86.2%) compared to those who attended clinic elsewhere (76.6%) (p-value= 0.001). The World Health Organization found that some of the challenges in provision of focused antenatal care included low quality service provision due to poor staffing and inadequate resources allocated to programs especially those in rural and peri-urban areas and social, economic and cultural barriers affecting the women attending ANC. (57) Under the constitution of Kenya 2010, health care management functions were devolved to the Counties with the intention to confer them with increased authority over decision making, resource allocation and management of health care by coordinating delivery and monitoring of health services. However, this devolution of health care still faces serious challenges including shortage of resources, human and material (especially due to financial limitations) inadequate infrastructure and lack of essential supplies. (58, 59, 60) These shortages could explain why Pumwani's referring facilities, which are primarily

lower level facilities (level 1-4), are unable to provide quality screening and management for women with pre-eclampsia.

Another key finding was that a majority of patients who developed maternal complications were diagnosed with pre-eclampsia late in pregnancy with 70.6% of the Pumwani group and 100% of those who attended ANC at its referring facilities diagnosed at >30 weeks gestation (p-value=<0.001) This delay in diagnosis could have contributed to disease progression to severe pre-eclampsia and eclampsia leading to increased maternal complications. As a result, a large proportion of the study participants; 59% of PMH clinic attendees and 44.6% of patients who attended ANC at its referring facilities, were diagnosed with severe pre-eclampsia. Patients diagnosed with severe pre-eclampsia and eclampsia during pregnancy were associated with poorer newborn outcomes (p-value=0.003) This is similar to a case control study carried out over a 3 year period in Norway that found that severe and early onset pre-eclampsia were associated with significant fetal growth restriction resulting in poor neonatal outcomes. Pre-eclampsia was associated with a 5% (95% CI 3%-6%) reduction in birth weight, severe pre-eclampsia with a reduction of 12% (9%-15%) and in early onset pre-eclampsia, birth weight was 23% (18%- 29%) lower than expected. (54) A study in Turkey suggested that perinatal morbidity and mortality are gestational-age dependant rather than disease dependant in cases with severe pre-eclampsia. (61) This means that a delay in diagnosis results in prolonged exposure to the hostile intrauterine environment observed in patients with severe pre-eclampsia contributing to poor perinatal outcomes.

Maternal complications were found to occur more commonly in patients with proteinuria of 3+ (p-value=0.017) which is considered as a criterion for the diagnosis of severe pre-eclampsia. Mothers noted to have a proteinuria of 3+ also had babies with poor APGAR scores at birth requiring delivery room resuscitation (60%). Proteinuria of 3+ was also associated with more admissions/referrals to the new born unit (36.6%) compared to

mothers with other degrees of proteinuria. (p-value=0.037). This is in keeping with a nested case control cohort study carried out in 25 United Kingdom hospitals to determine the association of proteinuria threshold in pre-eclampsia with maternal and perinatal outcomes. This study found that severe hypertension, earlier gestation at delivery and more frequent small for gestation age babies occurred in patients with higher degrees of proteinuria. (56)

When assessing the distribution of maternal complications based on facility where the patients attended ANC, it was found that a larger proportion of patients who attended clinic at the referring health facilities (33%) developed maternal complications compared to those who attended ANC at PMH (17%). (p-value=0.011). There was a strong association between clinic attendance elsewhere and the development of maternal sepsis after delivery. (OR 0.2; 95%CI 0.2-0.8, p-value=0.011) One of the gaps that could have resulted in this difference in outcomes between the two cohorts is the possibility of inadequate health care provider knowledge and training. It was noted that the facilities assessed did not have standard operating procedures or protocols for management of pre-eclampsia or any provisions for training of staff on the key aspects of its management. A descriptive needs assessment study conducted in Afghanistan in 2009-10 found that the supplies needed to treat patients with severe pre-eclampsia were widely available at all levels of their health care facilities. However, they found that providers at lower level facilities lacked adequate knowledge in some areas of management of severe pre-eclampsia patients compared to their counterparts at larger facilities who had specialised training. The study proposed a need to clarify service delivery guidelines, offer refresher training and have provider supervision to reinforce best practices at lower level facilities. (62)

The above findings support the importance of not only timely attendance of ANC by patients but also the importance of the provision of quality care to the pregnant women attending ANC at the various facilities. Various studies have shown the benefits of quality

ANC provision. It provides an important opportunity for primary prevention of pre-eclampsia based on the timely detection of modifiable risk factors and secondary prevention based on antiplatelet aspirin therapy. It also provides an opportunity to screen patients by assessing symptoms and signs, regular blood pressure measurement and routine urinalysis for proteinuria and to initiate appropriate treatment in a timely manner to control BP and reduce the risk of end organ damage. (27, 28, 29.30, 31, 32, 33, 34) There is need to improve the health care systems to allow for provision of appropriate antenatal care. This would involve improving infrastructure and resources at all levels of the healthcare system, but especially so for the lower level facilities serving larger numbers of pregnant women. It would also involve training personnel on the screening and management of pre-eclampsia and educating the women in the community. (51)

5.0 STUDY LIMITATIONS

The biggest limitation faced was the possibility of missing files as the records office did not maintain any ledgers documenting patient diagnosis. The records office was also in disarray and it is possible that we did not find all the relevant files from the study period of interest. However, the information obtained gives us some insight as to the possible gaps in antenatal care with regards to the management of pre-eclampsia thus empowering us with the ability to better direct further research and resources with the aim of attaining Millennium Development Goal 5 on improving maternal health.

We chose to look at patients with complete records. This allowed us to compare the best practices of the different institutions in terms of screening, diagnosis and management of pre-eclampsia. However, this also meant that a lot of records were excluded resulting in selection of fewer records that may not have been fully representative of the practices of the institutions we assessed. This limitation is appreciated but found not to be as significant as the bias that would have been introduced by assessing records that were incomplete. It would have been impossible to assess such records as information not documented would have been interpreted as work not done, thus unfairly assuming poor practice at the various facilities assessed.

6.0 CONCLUSION

The findings on maternal and perinatal morbidity and mortality go further to support the need for early intervention in the management of pre-eclampsia. Pumwani had better provision of services in terms of investigations carried out at diagnosis and timely institution of appropriate medical management compared to its referring facilities. The referring facilities were level 1-4 health care facilities which cater for larger numbers of pregnant women. Improving their ability to screen for, diagnose, manage and refer patients in a timely manner would significantly improve pregnancy outcomes and reduce the complications of pre-eclampsia. However, PMH was still not ideal in its own antenatal care practices. Improvements can be made to ensure quality antenatal service provision for women at this tertiary level of health care facility.

The study also showed that a small difference in the quality of care provided results in a significant difference in pregnancy outcomes for patients with pre-eclampsia. This was demonstrated with the differences seen between PMH and its referring facilities in terms of antenatal care practices and the resultant differences in maternal complications. There is therefore a great need to train the various cadres of health care personnel on appropriate screening techniques and management of patients at risk of developing pre-eclampsia or those diagnosed with the condition. It is also important to develop standard practice protocols from the national clinical guidelines for use at each of the facilities tasked with care of pregnant women.

Patients with poor compliance to treatment once initiated developed more severe disease leading to poorer outcomes. This shows a need for increased patient education and empowerment of women in the community. This would improve their economic power, their ability to recognise the need for and ability to afford regular antenatal clinic follow up. They would also be better placed to understand the importance of compliance to medical

treatment initiated and the danger signs to look out for when diagnosed with pre-eclampsia.

Finally, the lack of adequate resources seen especially in the lower level (level 1-4) facilities needs to be assessed further to determine the specific areas of limitation they face. This will help inform future resource allocation to these facilities. Once the current challenges in infrastructure and resources is addressed, women attending ANC at their local health centers should be able to access quality individualised care and therefore issues such as pre-eclampsia can be prevented or at the very least identified early enough to institute appropriate management and prevent severe maternal and perinatal morbidity and mortality.

7.0 RECOMMENDATIONS

1. Policy on antenatal care practices should be regulated and enforced at every level of health care in the country. This would ensure quality service provision and management as well as timely referral of patients diagnosed with pre-eclampsia in accordance to the available national guidelines.
2. Train health care workers regularly on the management of pre-eclampsia. Also, develop SOPs for the individual health care facilities providing antenatal services to guide their staff on the appropriate protocols to follow for screening and management as well as timely referral of women with pre-eclampsia. This will help streamline provision of care and maximise on the limited resources available currently.
3. Promote formal education for women in the country to improve their knowledge and understanding as well as improve their economic power through employment and regular income. Also, develop focused and targeted education programs for pregnant women attending ANC on the signs and symptoms as well as danger signs of pre-eclampsia and the appropriate health care seeking actions they should take should these occur. Finally, continue to educate them on the need for early and continued regular ANC attendance during pregnancy regardless of parity.
4. Further research to determine the specific limitations faced by lower level facilities when catering for patients with pre-eclampsia to enable targeted policy changes and resource allocation to address these specific issues.

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APPENDIX 1: DATA COLLECTION TOOL: QUESTIONNAIRE

BIODATA

- Patients study number_____
- Age (completed years)_____
- Level of education [ ]

    1.None

    2.Lower primary

    3.Upper primary

    4.Secondary

    5.Tertiary

- Employment status [ ]

    1. Self employed
    2. Employed
    3. Unemployed

- Current residence [ ]

    1. Urban informal
    2. Urban low income
    3. Urban middle income
    4. Urban high income
    5. Rural informal
    6. Rural formal

- Marital status [ ]

  1.Single

  2.Married

  3.Separated

  4.Divorced

  5.Widowed

PAST OBSTETRIC HISTORY

1. Parity _____+ _____

2. Previous pregnancy/pregnancies, year, mode of delivery, sex, weight and outcome of the baby (fill the table below);

Pregnancy	**Year**	**Mode (Vaginal [1]/CS [2])**	**Sex (Male [M]/ Female [F])**	**Weight (in gms)**	**Outcome (alive = 1/dead = 2)**
1st					
2nd					
3rd					
4th					

3.

3.History of hypertensive disease in previous pregnancy/ies? [ ]

1. Yes
2. No

4.If yes, outcome of that pregnancy [ ]

1.Term live newborn

2.Pre-term live newborn

3.Fresh stillbirth

4.Macerated stillbirth

5.Early pregnancy loss

6.Termination of pregnancy due to mother's condition

5.If patient had hypertensive disease in a previous pregnancy, did she suffer any complications? (tick all that apply)

	Yes	No
None	[ ]	[ ]
Renal dysfunction	[ ]	[ ]
Pulmonary Oedema	[ ]	[ ]
Cerebral haemorrhage	[ ]	[ ]
Abruptio placenta	[ ]	[ ]
HELLP syndrome	[ ]	[ ]
DIC	[ ]	[ ]

Postpartum haemorrhage [ ] [ ]

CURRENT PREGNANCY: Antenatal care

6. Where was Antenatal clinic attended? [ ]

    1. Pumwani Maternity Hospital
    2. Other (specify)_____

7.Gestation at first ANC attendance _____

8. How many times was antenatal clinic attended? _____

9.At what gestation was the diagnosis of Pre-eclampsia made? _____

10.Was any medication prescribed once diagnosis was made? [ ]

    1. Yes (specify which)_____
    2. None

11.Was patient compliant to treatment prescribed? [ ]

    1. Yes
    2. No

12.Was patient admitted for further management or referred to another hospital and after how long? [ ]

    1. Admitted (specify where & after how long)_____
    2. Referred (specify where & after how long)_____
    3. No admission or referral

13.Were any other tests done following diagnosis? (tick and document results if available) [ ]

1. Total blood count_____

2. U/E/Cs_____

3. LFTs_____

4. Coagulation profile_____

5. None

14.If an obstetric scan was done upon diagnosis, document the findings on ultrasound below:*(tick all that apply)*

	Yes	No
§ Normal ultrasound	[ ]	[ ]
§ Poor biophysical profile (specify)_____	[ ]	[ ]
§ Resistive index of 1 or greater than 1	[ ]	[ ]
§ Abruptio placenta	[ ]	[ ]
§ Intrauterine growth retardation	[ ]	[ ]
§ Intrauterine fetal demise	[ ]	[ ]
§ Other abnormality (specify)_____	[ ]	[ ]
§ No ultrasound done		

15.Were any of the symptoms below documented during this pregnancy?*(tick all that apply)*

	Yes	No
§ Severe headaches	[ ]	[ ]
§ Blurring of vision	[ ]	[ ]
§ Epigastric/right upper quadrant pain	[ ]	[ ]
§ Abnormal bleeding	[ ]	[ ]

§ Loss of consciousness/convulsions [ ] [ ]

§ Reduced or no fetal movements [ ] [ ]

§ Oedema/Anasaka [ ] [ ]

CURRENT PREGNANCY: AT ADMISSION

16. General appearance on arrival [ ]

1.Good general condition

2.Sick looking

3.Comatose

17. Blood pressure on admission Systolic_____Diastolic_____

18.Proteinuria [ ]

1.Trace

2.+

3.++

4.+++

5.++++

19.Laboratory tests done? Tick as appropriate [Yes] [No] (document results)

1.Total blood count: WBCs_____Hb_____Platelets_____

2.Liver function tests_____

3.U/E/Cs_____

4.Coagulation profile_____

OUTCOME IN OBSTETRIC UNIT

20.Mode of delivery [ ]

1.Spontaneous vertex

2.Caesarian section

3.Other (specify)_____

21.If C/S what was the indication? [ ]

1.Poor bishop's score

2.Poor progress of labour

3.Abruptio placenta

4.Non-reassuring fetal status

5.Previous scars

6.Other (specify)_____

22.Newborn outcome [ ]

1.Live

2.Fresh still birth

3.Macerated still birth

23.Gestation at delivery (in weeks)_____

24.Weight of baby in grams_____

25.APGAR score at 5 minutes _____

NEWBORN COMPLICATIONS

26.Delivery room resuscitation [ ]

1.Yes

2.No

27.Admission/referral to newborn unit [ ]

1.Yes

2.No

28.Perinatal death [ ]

1.Yes

2.No

MATERNAL COMPLICATIONS

29. What maternal complications occurred? *(tick all that apply)*

	Yes	No
§ Acute renal failure	[ ]	[ ]
§ Pulmonary Oedema	[ ]	[ ]
§ Cerebral haemorrhage	[ ]	[ ]
§ Abruptio placenta	[ ]	[ ]
§ HELLP syndrome	[ ]	[ ]
§ DIC	[ ]	[ ]

§ Sepsis [ ] [ ]

§ Other (specify)_____ [ ] [ ]

§ None

30. Was referral for ICU required? [ ]

1.Yes (specify diagnosis)_____

2.No

31.If ARF, did the patient require dialysis? [ ]

1.Yes

2.No

32.Maternal death? [ ]

1.Yes (specify cause)_____

2.No