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MATERNAL AND FETAL OUTCOME AMONG OBSTETRIC REFERRALS: A CASE STUDY OF THE BAMENDA REGIONAL HOSPITAL, BAMENDA, CAMEROON

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Abstract: **Background: maternal/foetal mortality and morbidity could be reduced by making use of timely consultations, an efficient referral system, basic and comprehensive emergency obstetric care to pregnant women and their new-borns. This study was carried out in other to compare maternofoetal outcome and to evaluate the types of delays experienced by women.**

The main objective was to evaluate maternal and foetal outcome of obstetric referrals.

Method: A case control study was carried out. All pregnant women that were referred, consented and met with the inclusion criteria were recruited as cases, while those who came to deliver on their own were recruited as the controls. Data were collected on pretested questionnaires. The chi square test was used as nonparametric test.

Result: Most of the participants 75.4% (n=49) were found between 15-30 years. The majority (n=35, 53.8%) of pregnant women were referred from health centres. Cases with at least one delay was twice that of the controls (cases 42, 64.6% controls 22, 33.8% p value =0.00). 6.2 %and 9.8 %babies delivered from cases and control group respectively were born dead. Admission in the Neonatal intensive care unit was in greater proportion for the babies delivered from cases than the controls (cases 15, 23.1% controls 9, 13.8% p value=0.175). Most of the women delivered through ceserian section (cases 27, 41.5% controls 32, 49.2% p value =0.378). No maternal mortality was recorded. 60% of the women spent 7-14days in the hospital.

Conclusion: for non-referred pregnant women, maternal outcome is poor but foetal outcome is better.

Keywords: **Obstetrics, Referrals, Haemorrhage, Infection, Outcome.**

1. INTRODUCTION

Maternal/neonatal mortality and morbidity is a challenge to the health systems all over the world with the developing countries being the most affected. In the 2000 millenium summit, reducing maternal mortality ratio by 75% between 1990 and 2015 was the Fifth Millenium Development Goal (MDG-5) now called Sustainable Development Goals [1]. Recent data reports global Maternal Mortality Ratio (MMR) in 2010 as 210 maternal deaths per 100000 live births as compared to

430 and 400 maternal deaths per 100000 live births in 1990 and 2005 respectively. The United Nations (UN) reports a progress towards achieving MDG-5 but much was still to be done as Maternal Mortality (MM) remains the leading cause of death among females aged 15-49 years [2, 3].

Obstetric emergencies are life threatening conditions that occur in pregnant women before, during or after delivery necessitating immediate action to save life [4]. Obstetric emergencies are the most important causes of maternal mortality in the world and in the developing countries in particular where poor transport facilities, inadequate equipment and staff, poor ANC (Antenatal Clinic), poverty, iliteracy all combine to amplify this problem [5,6]. This could be prevented by applying the signal functions under the Emergency Obstetric and Care (EmONC) which comprises of the use of antibiotics, use of parenteral anti convulsants, administration of parenteral uterotonics, manual removal of placenta, removal of retained placenta products of conception, assisted vaginal delivery resuscitation of new-born, emergency surgery and blood transfusion during obstetric emergencies[5].Various strategies have been put in place to reduce MMR but figures are still elevated especially in developing countries.

In Cameroon, an increase in MMR was observed with 430 deaths per 100000 live births recorded in 1991,430 in 1998, 669 in 2004, 782 in 2011, 669 in 2015 [7]. In 2018, the MMR in Cameroon dropped to 467 per 10000 life birth [8]. Globally, it is estimated that 7.6million children die under the age of five. Around 40% of the deaths were during the first 28days of life with approximately one half of the neonatal deaths occurring within the first 24 hours. Most of these neonatal deaths happen in low in-come and middle-income countries [7]. Pregnancy related complications that necessitate access to advanced care are estimated to occur in about 15% of all pregnancies [4]. Life threatening crises occur during or immediately after delivery [9]. These obstetric emergencies therefore require availability of emergency obstetric services and timely referral from low level of health facility to higher level of health facility [10].The most common obstetric emergencies are haemorrhage (antepartum and postpartum), hypertensive disorders in pregnancy, obstructed labours, uterine rupture, cord prolapse, shoulder dystocia and foetal distress [11,12].The World Health Organisation (WHO) attributes obstetric emergency referrals to account for more than 20% of pregnancy related morbidity seen under the maternal health and safe motherhood program and obstetric evacuations from peripheral health structures represent 3 to 66% of the activities of the receiving hospitals and are associated with a high maternal and foetal morbi-mortality [1,13].

A referral is a process in which a health worker at one level of health system, having insufficient resources (drugs, equipment, skills) to manage a clinical condition, seeks the assistance of a better or differently resourced facility at the same or higher level to assist in or take over the management of the client's case. The health system in Cameroon is structured according to administrative boundaries. It is a pyramidal system comprising 3 levels: the central level, represented by the Ministry of Health; the intermediate level, consisting of Regional Health Directorates situated in the 10 capitals of the Regions; and the peripheral level, composed of health districts, which includes medicalised health centres (managed by a physician) and health centres (managed by a qualified nurse) [13]. According to the health system structure, tertiary level maternity centres are defined as a facility with all elements of EmOC. Referring a patient is a medical decision and depends on factors such as skills of referring staff, the tools for diagnosis, the availability of a health institution with specialised facilities, the quality of care at the referral institution, the cost of care, distance, transportation, communication, someone to travel with the patient and feasibility of travel by patients [14]. Referral could be self-induced or recommended by a medical practitioner. A good maternal and foetal outcome is connected between all levels of health care system through a well-structured and functioning referral system [14]. It therefore plays an important role in preventing adverse outcomes. The association between a malfunctioning maternal referral system and most adverse obstetric outcome has been highlighted by other studies [10, 15]. In this study, determining the type of delay observed by pregnant women and comparing maternofoetal outcome will be our main focus.

Over the past two decades, the international community has repeatedly declared its commitment to reduce the high levels of MM in developing countries, stating with the 1987 safe motherhood conference in Nairobi, Kenya, followed by the 1990 World Summit for children at the United Nation headquarters[14]. The 1994 International Conference on Population and Development in Cairo, Egypt, the1995 Fourth World Conference on Women in Beijing, China, Nairobi 10 Years On in SriLanka in1997, and the SDG established by the United Nations in2000. In 2007, a number of events marked the 20th anniversary of the launching of the Safe Motherhood Initiative, including the Women Deliver Conference in London, England, at which calls were made for renewed commitment, programmes and monitoring. Most importantly, over the past 20years, consensus has been reached on the interventions that are priorities in reducing maternal mortality [3,37].

Stakeholders agree that good-quality EmOC should be universally available and accessible, that all women should deliver their infants in the presence of a professional, skilled birth attendant, and that these key services should be integrated into health systems[14].

For the purposes of assessing and monitoring the level of care that a facility is actually providing, it is helpful to use a short list of clearly defined 'signal functions'.

These are key medical interventions that are used to treat the direct obstetric complications that cause the vast majority of maternal deaths around the globe. The list of signal functions does not include every service that ought to be provided to women with complicated pregnancies or to pregnant women and their newborns in general [22,23].The signal functions are indicators of the level of care being provided. Furthermore, some critical services are included within these signal functions. For example, if caesarean sections are performed in a facility, this implies that anaesthesia is being provided. While the signal functions are used to classify facilities on the basis that these functions have been performed in the past 3months.

Maternal mortality is unacceptably high globally. Estimates for 2017 show that some 810 women die every day from pregnancy or childbirth related complications around the world. In 2017, 295 000 women died during and following pregnancy and childbirth. The vast majority occurred in low-resource settings, and most could have been prevented [18,41,42]. In Progress towards achieving the SDG, improving maternal health is one of the thirteen targets on health adopted by the international community in 2015. Whilst the SDGs include a direct emphasis on reducing maternal mortality they also highlight the importance of moving beyond survival. Countries committed to ending preventable maternal mortality and to reaching a global maternal mortality ratio of less than 70 deaths per 100 000 live births. Meeting this target will require average reductions of about three times the annual rate of reduction achieved during the MDG era. At the current pace of progress the world will fall short of meeting the SDG-3 at a cost of more than 1 million lives [18,41].The high number of maternal deaths in some areas of the world reflects inequities in access to health services, and highlights the gap between rich and poor. Almost all maternal deaths (94%) occurred in low-income and lower-middle-income countries, and almost two thirds (65%) occurred in the WHO African Region [18].The maternal mortality ratio in the least developed countries is as high as 415 per 100 000 births versus 12 per 100 000 in Europe and Northern America and 7 in Australia and New Zealand. There are large disparities between countries, with 11 countries having extremely high maternal mortality ratios of 600 or more per 100 000 live births in 2017[13,18].

Among adolescent girls aged 15-19 years, pregnancy and childbirth complications are the leading cause of death globally. Several countries, particularly those in Latin America and the Caribbean, and in South-East Asia, have already begun reporting data for women and girls outside the standard 15–49 year age interval, documenting the disturbing fact that maternal deaths are occurring among girls even younger than 15[24,43] . Women in the least developed countries have on average many more pregnancies than women in developed countries, and their lifetime risk of death due to pregnancy is higher [19]. A woman's lifetime risk of maternal death (the probability that a 15-year-old woman will eventually die from a maternal cause)is 1 in 37 in sub-Saharan Africa versus 1 in 6500 in Europe and 1 in 7800 in Australia and New Zealand [19, 39). Women and newborns die as a result of complications during pregnancy, childbirth and postpartum. Most of these complications develop during pregnancy. Other complications may exist before pregnancy but are worsened during pregnancy. The major complications that account for 80% of all maternal deaths are: severe bleeding (mostly bleeding after childbirth), infections (usually after childbirth), high blood pressure during pregnancy (preeclampsia and eclampsia), unsafe abortion [25,36,37]. The remainder of maternal deaths are known as "indirect maternal deaths". These occur when a pregnancy is aggravated by another condition or disease such as malaria, diabetes, or heart disease.

Maternal health and newborn health are closely linked. Nearly 2.5 million children die in the first month of life every year, and an additional 2.6 million babies are stillborn [26]. Maternal and fetal lives can be saved by applying all the signal functions of EmONC seen above. Most women do not get the care they need especially in remote areas where are low numbers of skilled health professionals such as sub-Saharan Africa and South Asia. While levels of antenatal care have increased in many parts of the world during the past decade, Coverage of deliveries by a skilled birth attendant ranges from 59% in the WHO African Region to over 90% in the Region of the Americas, and in the European and Western Pacific regions [25,40]. This means that millions of births are not assisted by a midwife, a doctor or a nurse with specific competencies to manage labour and childbirth. In high-income countries, virtually all women have at least four antenatal care visits, are attended by a skilled health worker during childbirth and receive postpartum care. Other factors that prevent

women from receiving or seeking care during pregnancy and childbirth are: poverty, distance, lack of information, inadequate services, and cultural practices[20,41].To improve maternal health, barriers that limit availability and access to quality maternal health services must be identified and addressed at all levels of the health system.

2. METHOD

Study design: This was a hospital-based prospective case control study.

Study Settings: The study was carried out in the Obstetrics and Gynaecology Units and Intensive Care Unit ICU of the BRH where all obstetric emergencies were admitted. The BRH is located in the Northwest Region of Cameroon, Mezam division, Bamenda 2 Subdivision, Mankon village, Nitop II quarter. Bamenda is the capital of the Northwest region of Cameroon and has an estimated population of 394000 inhabitants. The BRH is the main referral hospital of the region with a total bed capacity of about 400 beds. It is made up of an imagery centre; medical laboratory; a blood bank; international tuberculosis laboratory; two pharmacies; ICU; theatre; Internal medicine units; surgical units; paediatric unit, obstetrics/gynaecology units. The latter being divided into 4 units: gynaecology unit, an antenatal care unit, a labour room (1nusing station, 3 delivery rooms with 8 beds,) and a postnatal unit. The obstetric/gynaecology units are supervised by three obstetricians/gynaecologists, one general practitioner, twelve midwives, five nurses and one homemade. Medical and nursing students are also part of the team since BRH is a university affiliated hospital of the FHS UBa.

The BRH was chosen because being the main referral, university affiliated and state owned hospital in the NWR, with its services being relatively more accessible and affordable, most pregnant women prefer to come and deliver here even after attending antenatal visits elsewhere. The BRH conducts more deliveries (300/month averagely) than other health facilities in the region, giving a good sample for our study.**This study was conducted from April 2021 to June 2021, a duration of three months.**

Study Population/ Participants : All pregnant women received by referral at the BRH during the study period (65 control and 65 cases).

For cases, **all pregnant women independent of the gestational age that were referred from another health facility to the BRH were included.**

For the controls, all pregnant women independent of the gestational age that came on their own to deliver at the BRH were included.

The following patients wer excluded: -all self-referred patients**,** -all pregnant women that consulted at the BRH but refused to participate in the study.

Sample size estimation:

Sampling method: Patients were enrolled consecutively as they were admitted in the hospital.

Sample size calculation: The sample size was obtained by using Schlesselman's formula:

$$n = \frac{r+1}{r} * \frac{\left[p*(1-p)*\left(zb+\frac{za}{2}\right)^2\right]}{(p1-p0)^2}$$

n = Sample size

r = Ratio of controls to cases (1:1 in our study)

P = (P1+P0)/ 2

Zb: desired power (typically .84 for 80% power)

Za/2; level of statistical significance typically 1.96

P1; estimate of proportion of individual among cases who were exposed, P1=50 percent= 0.5

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P0; the proportion of individuals among the controls who exposed, P0= 25percent=0.25

$$n = \frac{1+1}{1} * \frac{[0.375 * (0.625) * (7.84)\ ]}{(0.0625)}$$

n=58 in each group.

Therefore, a minimum of 65 cases and 65 controls were recruited.

Study variables: All referred cases were received daily and considered as cases and the controls were women who came on their own to deliver immediately after the case. The two groups were matched for age gravidity, parity and gestational age +|- one. Referred case were looked to get necessary information as per objective.

1. To describe the sociodemographic and obstetric characteristics of women referred wit obstetric complications.

This information was obtained from the pregnant women themselves, accompanying family members, hospital books, hospital files and ANC cards in other to know the age, residence, and profession, level of education, marital status, gravidity, parity and gestational age.

2. To identify the reasons of referral for obstetric referrals.

This information was obtained from their hospital books, hospital files or referral notes.

3. To identify maternal and foetal complications of obstetric referrals.

This was done by physically examining the women and their babies at delivery and at discharge to identify complications.

4. To compare maternal and foetal complications amongst referred and non-referred pregnant women at the BRH.

Comparisms were done according to complications obtained on physical examination.

All the above information was recorded on a pre-tested questionnaire and analysed accordingly

Study instruments:

Human resources

- Principal investigators
- Statistician

Materials for data collection

- Questionnaires, consent form, information sheet.
- Pens, pencils, calculator, eraser.

Materials for data analysis

- A laptop top with typing software notably Microsoft Office Word 2013, and Statistical software installed: the software statistical package for social sciences (SPSS) version 27.0.
- USB flash drive.

Data Analysis :Data were collected on pretested questionnaires designed for this purpose. On completion of data collection per patient, the questionnaires were checked, edited for completeness and legibility of the data collected.

All data collected were coded and stored on a computer. Data were entered into the software statistical package for social sciences (SPSS) version 27.0.Results were represented on tables and figures (pie charts, bar charts, frequency polygons, histograms and scatter plots), to ease organization and comprehension. $P<0.05$ was considered statistically significant.

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To ease organization and comprehension, categorical variables presented as frequencies or proportions on tables and figures, while continuous variables will be displayed using pie charts and bar charts.

Ethics and permission: In order to carry out our study we obtained ethical approval from the IRB FHS-UBa and administrative clearance from the Delegation of health and Director of BRH. Informed consent was obtained from the participants. The administrative clearance letter with reference no :67/ATT/NWR/RDPH/BRIGAD was signed by Dr Ambe Lionel Neba, on the 9th of May, 2021, and the the authorization letter with reference no: ROD5/MPH/RDPH/RHB /458 was signed by Akoko Elizabeth Alondi, the general supervisor of RHB, on the 15th of July, 2021. The above letters were signed for Midjane Ewane Aristide-Flore (now known as: Aristide-Flore Gabriel Jeremiah) one of the authors.

3. RESULT

Sociodemographic charactetristics of the study population:

Table I : Distribution of the general population according to maternal age, the level of education, residence, profession, marital status.

Variable	Cases	Control	Odds ratio	P-value
Age distribution	n=65	n=65		
15-30yrs	49(75.4)	49(75.4)	1.085 [0.49-2.39]	0.840
31-45yrs	16(24.6)	16(24.6)	1.085 [0.49-2.39]	0.840
Level of education				
No formal education	1(1.5)	1(1.5)	2.032 [0.18-22.9]	1.00
Primary education	5(7.7)	1(1.5)	4.197 [0.45-38.6]	0.36
Secondary education	52(80.0)	48(73.8)	1.532 [0.67-3.46]	0.30
University education	7(10.8)	15(23.1)	0.402 [0.15-1.06]	0.06
Marital status				
Single	20(30.8)	22(23.8)	0.86 [0.41-1.81]	0.70
Married	33(50.8)	34(52.3)	0.884 [0.44-1.75]	0.72
Cohabitating	12(18.5)	9(13)	1.409 [0.54-3.61]	0.47
Residence				
Urban	50(76.9)	60(92.3)	0.255 [0.87-0.74]	**0.01**
Rural	15(23.1)	5(7.7)	3.294 [1.11-9.77]	0.25
Profession				
Formal employment	3(4.6)	7(10.8)	2.49 [0.61-10.1]	0.30
Self employed	41(63.1)	39(60)	1.13 [0.56-2.31]	0.71
House wife	15(23.1)	13(20)	1.22 [0.35-4.21]	0.71
Student	6(9.2)	6(9.2)	1.2 [0.51-2.73]	0.67

Out of the 65 cases and 65 controls, most of the participants 75.4% (n=49) in each group were found between the age range15-30 years. At least half of the participants in both groups were married (cases 33, 50.8% controls 34, 52.3%). Majority of them lived in urban areas (cases 50, 76.9% controls 60, 92.3% p-value 0.01).

Obstetrical characteristics of the study population:

Table II: Distribution of the population according to gestational age, ANC attendance, gravidity and parity, risk factor detected during pregnancy.

Variable	Cases	Control	0dds ratio	p-value
Gestational age	n=65	n=65		
Less than 28 weeks	9(13.8)	9(13.8)	1[0.305-3.28]	1.00
28-36 weeks	17(26.2)	17(26.2)	1[0.305-3.28]	1.00
37-40weeks	33(50.8)	33(50.8)	1[0.305-3.28]	1.00
41-42weeks	4(6.2)	4(6.2)	1[0.305-3.28]	1.00
Greater than 42weeks	2(3.1)	2(3.1)	1[0.305-3.28]	1.00
Gravidity and parity				
Primigravida	6(9.2)	6(9.2)	1[0.305-3.28]	1.00
Primipara	21(32.3)	21(32.9)	1[0.305-3.28]	1.00
Multipara	4(6.2)	4(6.2)	1.13 [0.56-2.27]	0.72
Multips	6(9.2)	6(9.2)	1 [0.23-4.18]	1.00
Grand multips	28(43.1)	28(43.1)	0.82 [0.23-2.83]	0.75
ANC attendance				
Not attended	10(15.4)	8(12.3)	0.78 [0.30-2.05]	0.62
Less than 4	17(25.6)	17(26.2)	0.92 [0.41-2.03]	0.84
4 7	36(55.4)	39(60)	1.13 [0.56-2.27]	0.72
8	1(1.5)	1(1.5)	1 [0.61-16.33]	1.00
More than 8	1(1.5)	//	2.02 [1.64-2.39]	1.00

In both study groups, most pregnancies were term pregnancies (33, 50.8%) with almost half being grand multips (28, 43.1%). Most pregnant women attended 4-7 ANC (cases 36, 55.4% controls 39, 60%). (See Table II above).

Referral characteristics of the study population:

Table III: Distribution of the population according to the level of referring health facility, medical records brought, treatment received before referral, exhort by medical personnel.

Variable	Case	Percentage
Level of referring health facility	**n=65**	**%**
Private hospital or clinic	13	(20.0)
Health centre	35	(53.8)
District hospital	17	(26.2)
Did they come immediately as referred		
Yes	52	(80.0)
No	13	(20.0)
Medical records brought on referral		
Referral note	23	(35.4)
Hospital book	36	(55.4)
ANC card	1	(1.5)
None	5	(7.7)
Did they receive treatment before referral		
No	40	(61.5)
Yes	25	(38.5)
Where they accompanied by a medical personnel		
Yes	6	(9.2)
No	59	(90.8)

In this study, the majority (n=35, 53.8%) of pregnant women were referred from health centres. Very few referred cases were exhorted by a medical (6, 9.2%)

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Table IV: Distribution of the population according to the reason of referral

Variable	Case n=65	Percentage %
Non obstetrical Reasons for referral		
Lack of expertise	55	(83.6)
Lack of equipment	3	(4.6)
Lack of drugs	1	(1.5)
Obstetric reasons of referral		
Before labor		
PPROM	9	(13.8)
PROM	2	(3.1)
Preterm labor	2	(3.1)
Ectopic pregnancy	1	(1.5)
PV bleeding	3	(4.6)
Hypertensive disothers	5	(7.7)
Infections		
Malaria in pregnancy	3	(4.6)
Malaria in peuperium	1	(1.5)
Anemia in ID	1	(1.5)
Endometriris	1	(1.5)
During labor		
obstructed labor	7	(10.8)
AFD	6	(9.2)
Cord prolapse	1	(1.5)
Abortion	1	(1.5)
Labor pains	2	(3.10
IUFD	3	(4.6)
APH and PPH	6	(9.2)
Others		
macrosomia on scared uterus	1	(1.5)
postdate pregnancy	5	(7.7)
Reason not stipulated	12	(9.2)

Table V : Distribution of the population according to the reason of consultation and the mode of transportation

Variable	Case n=65	Control n=65
Reason for consultation		
Appointment with the Doctor	//	7(10.8)
Routine ANC	9(13,8)	1(1.5)
Labour pains	19(29.2)	20(30.8)
Loss of liquor	13(20)	13(20)
LAP	11(16.9)	11(16.9)
PV bleeding	8(12.3)	8(12.3)
Fever	5(7.7)	4(6.2)
Dizziness	//	1(1.5)
Mode of transportation		
Public transportation	55(84.6)	52(80)
Private transportation	5(7.7)	7(10.8)
Ambulance	2(3.1)	//
Walking	3(4.6)	6(9.2)

Before referral, more than half of pregnant women did not receive any treatment (40, 61.5%), 55.4 %(n=33) brought their hospital books as document of referral with little or no information written. 7.7 %((n=5) had no medical records with which they were referred. 34.2 %(n=23) brought referral notes. The most recurrent reason of referral varied from lack of expertise in case of non-obstetrical reasons (55, 83.6%), to PPROM in case of obstetric reasons (9, 13.8%). Out of 65 referred cases, 20 %(n=13) did not come immediately as referred. The most recurrent reason of consultation for both study groups was labor pains (cases 19, 29.2% controls 20, 30.8%) and almost all participants used public transportation as mode of transportation (cases 55, 84.6% controls 52, 80%). (See Table IV and V).

Table VI: Distribution of the population according to the type of delay identified.

Delays	Cases n=65	Control n=65	Odds ratio (95% CI)	P-value
Primary delay			1.703 [0.83-3.49]	0.15
Yes	28(43.1)	20(30.8)		
No	37(56.9)	45(69.2)		
Secondary delay			3.813 [1.17-12.40]	**0.01**
Yes	13(20)	4(6.22)		
No	52(80)	61(93.8)		
Tertiary delay			6.508 [0.76-55.6]	0.12
Yes	6(9.2)	1(1.5)		
No	59(90.8)	64(98.5)		
At least one delay			3.569 [1.732-7.35]	**0.00**
Yes	42	22(33.8)		
No	23	43(66.2)		

In this study, the primary delay was the most common in the study groups (cases 28, 43.1% controls 20, 30.8% p value =0.147). The secondary delay was statistically significant (p value=**0.01**) being three times more common than the third delay in both groups with three times the number of cases (13, 20%) than controls (4, 6.22%), giving a 3.823 risk CI [0.83-3, 49] of having a case with a secondary delay than a control. The number of cases with tertiary delay were six times common than the controls (cases 6, 9.2% controls 1, 1.5% p value =0.147)

So, the number of cases with at least one delay was statistically significant with being two times that of the controls (cases 42, 64.6% controls 22, 33.8% p value =**0.00**) with a 3.569 risk CI [1.73-7.35] of a case to have at least one delay than a control. (See Table VI above).

Table VII : Distribution of the population according to the action time.

Delays	Cases n=65	Control n=65	Odds ratio (95% CI)	P-value
Action time				
Less than 30mins			4.05 [2.79-5.86]	**0.00**
Yes	44(67.7)	50(76.9)		
No	21(32.3)	15(23.1)		
30mins to 1hr			2.12 [1.75-2.56]	0.06
Yes	8(12.3)	6(9.2)		
No	57(87.7)	59(90.8)		
1-2hours			2,07 [1.72-2.47]	0.58
Yes	5(7.7)	//		
No	60(92.3)	65(100)		
More than 2 hours				
Yes	9(13.8)	6(9.2)	2.143 [1.77-2.59]	**0.04**
No	56(86.2)	59(90.8)		

The action time for the control group was better than the cases. More than half of participants had an action time of less than 30mins (cases 44, 67.7% controls 50, 76.9% p value =**0.00**) with a 4.048 risk CI [2.73-5.86] of a case to have at least one delay than a control. (See Table VII above).

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Fetal outcome of the study population:

Table VIII: Distribution of the population according to the fetal complications

Variable	Cases n=65	Control n=65	Odds ratio (95% CI)	P-value
Fetal outcome				
Still pregnant	5(7.7)	7(10.8)	NA	NA
Born alive				
Yes	49(75.4)	46(70.8)	2.032 [1.704-2.42]	0.496
No	4(6.2)	6(9.8)		
Type of still birth				
Fresh			0.312 [0.061-1.608]	0.273
Yes	2(3.1)	6(9.2)		
No	63(96.9)	59(89.2)		
Macerated			2.032 [1.704-2.423]	0.489
Yes	2(3.1)	//		
No	63(96.9)	65(100)		
Early neonatal death			0.312 [0.061-1.608]	0.273
Yes	2(3.1)	1(1.5)	0.30 [0.061-1.508]	0.203
No	63(96.9)	54(98.5)		

6.2 %(n=4) babies delivered from the cases were born dead. Half were fresh still births, while the other half were macerated. On the other hand, 9.8 %(n=6) of babies delivered from the control group were all fresh still births. Following delivery, 3.1 %(n=2) cases experienced early neonatal dead than the control group1.5 %(n=1).

Table IX: Distribution of the population according to the fetal complications

Variable	Cases n=65	Control n=65	Odds ratio (95% CI)	P-value
Birth weight				
Less than 1500g			1.355 [0.291-6.309]	1.00
Yes	4(6.2)	3(4.6)		
No	61(93.6)	62(95.4)		
1500-less than 2500g			4.186 [1.297-13.51]	**0.01**
Yes	14(21.5)	4(6.2)		
No	51(78.5)	61(93.8)		
2500-less than 4000g			0.502 [0.249-1.012]	0.05
Yes	30	41(63.1)		
No	35(53.8)	24(36.9)		
Greater then 4000g			2.102 [0.502-8.791]	0.49
Yes	6(9.2)	3(3.6)		
No	59(90.8)	62(95.4)		
Primaturity			1.761 [0.684-4.641]	0.23
Yes	13(20)	8(12.3)		
No	52(80)	57(87.7)		
Admission in NICU			1.867 [0.751-4.638]	0.17
Yes	15(23.1)	9(13.8)		
No	50(76.9)	56(86.2)		

A greater proportion of babies born of the control group had birth weight between 2.5kg-4kg. Those born with birth weight between 1.5kg to less than 2.5kg were four times more common amongst cases as compared to the control group (cases 14, 21.5% controls 4, 6.2% p value=**0.01**) with 4.20 risk CI [1.3-13.5] of having a case delivering a baby with birth weight between 1.5- and 2.5kg than the control and the p value was statistically significant. Admission in the NICU was in greater proportion for the babies delivered from cases than the controls (cases 15, 23.1% controls 9, 13.8% p value=0.175

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Table X: Distribution of the population according to the fetal complications

Reason for admission to NICU	Cases n=65	Control n=65	Odds ratio (95% CI)	P-value
Primaturity			1.995 [0.773-5.148]	0.15
Yes	15(23.1)	8(13.8)		
No	51(76.9)	57(87.7)		
Birth asphyxia			2.625 [0.492-14.05]	0.44
Yes	5(7.7)	2(3.1)		
No	59(90.8)	63(96.9)		
Neonatal sepsis			1.00 [0.137-7.322]	1.00
Yes	2(3.1)	2(3.1)		
No	63(96.5)	63(96.5)		
Duration of stay				
less than 3days			1.131 [0.427-2.997]	0.80
Yes	10(15.4)	9(13.8)		
No	55(84.6)	56(86.2)		
3- less than 7 days			0.873 [0.315-2.425]	0.79
Yes	27(41.5)	25(38.5)		
No	38(58.4)	40(61.5)		
7-14 days			0.873 [0.315-2.425]	0.80
Yes	8(12.5)	21(31.9)		
No	57(87.7)	40(61.5)		
Total	65(100)	65(100)		
14-28 days			2.066 [1.725-2.474]	0.11
Yes	4(6.2)	9(13.8)		
No	61(93.8)	56(86.2)		
More than 28 days			1.00 [0.61-1633]	1.00
Yes	1(1.5)	1(1.5)		
No	64(98.5)	64(98.5)		

A greater proportion of babies spent 7-14days in the hospital (cases 27, 41.5% controls 25, 38.5%) (See Table **X).**

Maternal outcome of the study population:

Table XI : Distribution of the population according to the maternal complications

Variable	Cases n=65	Control n=65	Odds ratio (95% CI)	P-value
Mode of delivery				
Spontaneous/induced vaginal delivery			1.480 [0.711-3.08]	0.293
Yes	25(38.5)	19(29.2)		
No	40(61.5)	46(70.8)		
Assisted vaginal delivery			2.032 [1.704-2.42	0.496
Yes	//	2(3.1)		
No	65(100)	63(96.9)		
Ceserian section			0.777 [0.367-1.46]	0.378
Yes	27(41.5)	32(49.2)		
No	38(58.5)	33(50.8)		
Laparotomy			2.016 [1.694-2.39]	1.00
Yes	//	1(1.5)		
No	65	64(98.5)		
Laparoscopy			2.031 [1.704-2.42]	0.496
Yes	2(3.1)	//		

No	63(96.9)	65(100)		
D/C			1.220 [0.353-4.21]	0.753
Yes	6(92)	5(7.7)		
No	59(90.8)	60(92.3)		

In both groups, most of the women delivered through ceserian section, but the controls registered a greater number of ceserian sections than the case group but was not statistically significant (cases 27, 41.5% controls 32, 49.2% p value =0.378).This was followed by vaginal delivery (spontaneous/induced) where there was no statistically significant difference between both groups (cases 25, 38.5% controls 19, 29.2% p value =0.293). No case had an instrumental vaginal delivery as compared to the control group (2, 3.1%).

Table XII: Distribution of the population according to the reasons for ceaserian section

Variable	Cases n=65	Control n=65
Indications of caesarian section		
Severe preeclampsia	3(4.6)	3(4.6)
CPD	8(12.3)	8(12.3)
Macrosomia on previous scar	2(3.1)	1(1.5)
APH	3(4.6)	6(9.2)
AFD	8(12.3)	9(13.8)
Cardiomyopathy in pregnancy	1(1.5)	//
Complete placenta previa	1(1.5)	1(1.5)
Cord prolapse	1(1.5)	2(3.1)

The most common indication for ceaserian was Acute Foetal Distress (AFD) in both study groups (cases 8, 12.3% controls 9, 13.8%), followed by obstructed labor (cases 8, 12.3% controls 8, 12.3%), and then by hypertensive disorders (cases3, 4.6% controls 6, 9.2%).

Table XIII: Distribution of the population according to the maternal complications

Variable	Cases	Control	Odds ratio (95% CI)	P-value
Admission in ICU			1 [0.13-7.32]	1.00
Yes	2(3.1)	2(3.1)		
No	63(96.9)	63(96.9)		
Blood transfusion			1 [0.33-3.03]	1.00
Yes	7(10.8)	7(10.8)		
No	58(89.2)	58(89.2)		
Genitourinary injury			1 [0.06-16.3]	1.00
Yes	1(1.5)	1(1.5)		
No	64(98.5)	64(98.5)		
Pelvic infections				
Yes	1(1.5)	1(1.5)	1 [0.06-16.3]	1.00
No	4(98.5)	4(98.5)		
PPH			2.03 [1.70-2.42]	0.496
Yes	//	2		
No	65(100)	63(96.9)		
Sepsis			1 [0.06-16.3]	1.00
Yes	//	1		
No	(65)(100)	64(100)		
HELLP syndrome			1 [0.06-16.3]	
Yes	//	1		1.00
No	65(100)	64		

No maternal mortality was recorded during our study period. 7.7% of participants were discharged while being pregnant. Some maternal morbidity recorded were blood transfusion with 10.8% (n=7) for both study groups, followed by dilatation and curettage (cases 6, 9.2% controls 5, 7.7% p value =0.753) with 1.220 risk CI [0.353-4.2.1] of having a case going through D/C than a control. There was no difference in both groups as regards admission to the NICU 3.1% (n=2).

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Table XIV: Distribution of the population according to the maternal complications

Duration of hospital stay	Cases	controls	Odds ratio (95% CI)	p-value
less than 3days			1.16 [0.54-2.47]	0.7
Yes	20(30.8)	9(13.8)		
No	45(69.2)	56(86.2)		
3 to less than 7 days			1 [0.49-2.01]	1.00
Yes	39(60)	39(60)		
No	26(40)	26(40)		
7-14 days			0.032 [1.70-2.42]	0.545
Yes	7(10.8)	5(7.7)		
No	58(89.2)	60(92.3)		
More than 14days			2.03 [1.70-2.42]	0.496
Yes	//	2(3.1)		
No	65(100)	63(96.9)		

Most of the women spent 7-14days in the hospital 39(60%) in both groups followed by less than 3days (cases 20, 30.8% controls 9, 13.8%).1.5 %(n=1) had genitourinary injury and pelvic infections in both study groups. 3.1 %(n=2) of controls had PPH while 1.5 %(n=1) of control developed HELLP syndrome. (See Table XIV above)

4. DISCUSSION

A functional referral system is an integral component of making sure pregnant women and their unborn babies receive optimal care and chance of survival [30]. In a referral system, patients are being referred from a lower level of health care to a higher one [30]. In this study, many patients were referred from health centers (35, 53.8%). This was also reported by other studies where 96 %(n=403) where referred from health centers [31]. This was followed by referral from district hospitals (17, 26.2%). These results could have been obtained due to lack of specialists in such health facilities such as obstetricians/ gynaecologists, lack of blood bank or NICU and others. Moreover, the BRH is closer to many of these referring hospitals, it has services that are affordable, equipped and has a higher level of expertise to handle obstetric emergencies and complications. The rest of the patients were referred from private hospitals (13, 20%).The mode of transportation and various routes taken to reach the receiving health facility greatly influences maternofetal outcome especially in cases of obstetric emergencies [4]. Almost all pregnant women referred or not to the BRH used public transportation (cases 55, 84.6% controls 52, 80%), others used private transportation (cases 5, 7.7% controls 7, 10.8%) or walked to the hospital (cases 3, 4.6% controls 6, 9.2%). Only 2 (3.1%) referred patients used the ambulance as mode of transportation. This is because the ambulance was not always available. Also, some pregnant women could not afford transportation through an ambulance and preferred taking public transportation. Others had no knowledge that transportation could be done through an ambulance. These results obtained are in contrast to those obtained by *Asseffa et al* 2020 in Addis Abeba were they reported that more than half (72%) of all referred pregnant women rather used the ambulance as mode of transportation ensuring that all referred pregnant women arrive the receiving facility on time and adequate measures were equally taken in the ambulance by the accompanying health personnel [31]. A retrospective study conducted at the Douala General Hospital by *Ekane et al* 2015 reported that only 4 (25%) of the referred pregnant women used an ambulance as mode of transportation to reach the receiving health facility [35].

In this study, the majority of the pregnant women in both study groups consulted for labor pains (cases 19, 29.2% controls 20, 30.8%). This is because most of the pregnant women were at term. The next most recurrent reason of consultation was loss of liquor and lower abdominal pains with 20 %(n=13) and 16.9 %(n=11) respectively in both groups. Other reasons of consultation were per vaginal bleeding 8(12.3%), fever (cases 5, 7.7% controls 4, 6.2%) while others came for routine ANC or for an appointment with their treating physician. (Cases 1, 1.5% controls 9, 13.8%). *Ekane et al* reported similar reasons of consultation in a retrospective study [35]

The various reasons of referral obtained were grouped as obstetrical and non-obstetrical reasons of referral. For non-obstetric reasons of referral, we recorded lack of expertise (55, 83.6%) for almost all the cases. Other reasons where lack of equipment/theatre (3, 4.3%), lack of drugs in certain cases (1, 1.5%) while for some, no reason was stipulated (2, 3.1%).

For obstetric reasons of referral, PPROM (9, 13.8%) was the most frequent. Other frequent obstetric reasons of referral were hypertensive disorders (5, 7.7%), AFD (6, 9.2%). Obstructed labor, breech presentation, IUFD, blood transfusion, APH, PPH, postdates, cord prolapse, malaria in pregnancy and others were equally recorded as reasons of referral. In other studies, a greater sample size and different study designs were used and revealed more diverse reasons of referral [31].

All three forms of delay were common in this study as reported by other similar studies [32]. Amongst these three types of delay, the primary delay was the most common in both groups with 43.1 %(n=28) cases against 30. 8 %(n=20) with a p value=0.147 which is not statistically significant and a 1.7 risk CI [0.83-3.49] of having primary delay with a case than a control. These results were in contrast to those obtained in other studies where the most common type of delay was tertiary delay [31]. Majority of the pregnant women (cases 43, 66.2% controls 45, 69.2%) decided to stay home following the beginning of symptoms, others decided to come immediately (cases 8, 12.3% controls 6, 9.2%) while some went to the drug store. This could be due to little or no knowledge on consequences of delay on outcome, poor ANC attendance, poverty and others. The secondary delay was three times more common than of the tertiary delay in both groups with three times the number of cases (13, 20%) than controls (4, 6.22%), and a p value=**0.01** being statistically significant, giving a 3.823 risk CI [0.83-3, 49] of having a case with a secondary delay than a control. This would have been because some of the referred cases decided to go home following referral before going to the receiving facility. In other similar studies, results contrary to these were obtained as most of the cases were referred from rural to urban areas, thus needing a longer time to arrive the receiving facility [35]. This is equally in accordance with a study carried out on maternal deaths and the referral system by *Ekane et al* 2015 where some women referred to the Douala General Hospital didn't reach on time because of the distance between referring and receiving health facility [8]. In this study, there was very little barrier in accessing the receiving health facility as most of the referring health facility are located around the BRH. Also, referred cases from rural areas to BRH could have been limited because of the socio-political climate in the Northwest region that still makes transportation difficult and caused some occupants to move out of North West region reducing the number of patients consulting or referred to the BRH. The number of cases with tertiary delay were six times more common than the controls (cases 6, 9.2% controls 1, 1.5% p value =0.147) but was not statistically significant. So, the number of cases with at least one delay were two times that of the controls (cases 42, 64.6% controls 22, 33.8% p value =**0.00**). The p value being **less than 0.05** is statistically significant with a 3.569 risk CI [1.73-7.35] of a case with at least one delay than a control.

STUDY LIMITATIONS AND STRENGTHS

- **LIMITATIONS**

We had a small sample size, hence results from this study may not be generalised to the entire population of pregnant women referred or not to the BRH.

- **STRENGTHS**

Although similar studies have been done in this domain, to the best of our knowledge, none has been done with this study design.

5. CONCLUSION

After this study, we can conclude that maternal outcome is poor for non-referred obstetric cases while the foetal outcome is rather poor for referred obstetric cases. The most common form of delay amongst pregnant women referred or not to the BRH is the primary delay.

6. RECOMMENDATIONS

1. To the patients:

Consult at a heath facility as soon symptoms develop or immediately as referred to avoid delay

2. To Clinicians:

Timely referral of patients with obstetric complications

3. To policy makers:

Strategies should be put in place to reduce action time in other to ameliorate maternal and foetal complications.

4. To the scientific professional bodies:

This study should be done with a larger sample size and other study designs to verify these results obtained.

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