THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE

EPIDEMIOLOGY OF PRETERM PREMATURE RUPTURE OF FETAL MEMBRANES (PPROM) AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA.

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DISSERTATION SUBMITTED TO THE UNIVERSITY OF ZAMBIA IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY

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DEDICATION

This dissertation is dedicated to my wife, Margaret and my daughters, Tapiwa and Chatowa who have always stood by me and dealt with all of my absence from many family events while I was busy working on this piece of work. To them, I say thank you very much. The dedication also goes to pregnant women who present with PPROM at UTH. Above all, I would like to thank the almighty God for the strength and wisdom given to me to accomplish this task.

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All the clerks in the obstetrics and gynaecology wards at UTH for locating the files after patient discharge

STATEMENT

I HEREBY STATE THAT THIS DISSERTATION IS ENTIRELY THE RESULT OF MY OWN PERSONAL EFFORT. THE VARIOUS SOURCES TO WHICH I AM INDEBTED HAVE BEEN CLEARLY INDICATED IN THE BIBLIOGRAPHY AND ACKNOWLEDGEMNT.

SIGNED _____

DR. WILLIES SILWIMBA

DECLARATION

I WILLIES SILWIMBA HEREBY DECLARE THAT THIS DISSERTATION HEREIN PRESENTED FOR THE DEGREE OF MASTER OF MEDICINE IN OBSTETRICS AND GYNECOLOGY HAS NOT BEEN PREVIOUSLY SUBMITTED EITHER IN EVERY RESPECT OR IN PART FOR ANY OTHER DEGREE AT THIS OR ANY OTHER UNIVERSITY, NOR BEING CURRENTLY SUBMITTED FOR ANY OTHER DEGREE.

SIGNED

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DR. WILLIES SILWIMBA

APPROVED

BY_____

DR BELLINGTON VWALIKA (SUPERVISOR)

CERTIFICATE OF APPROVAL

THE DISSERTATION OF DR. WILLIES SILWIMBA IS APPROVED AS FULFILLING PART OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY BY THE UNIVERSITY OF ZAMBIA.

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ABSTRACT

Background: Preterm premature rupture of membranes (PPROM) is the main cause of preterm delivery and is associated worldwide with increased rates of neonatal and maternal morbidity and mortality (Parry et al 1998, Joseph et al 1998). The aim of this study was to determine the epidemiology of preterm premature rupture of membranes at UTH, Lusaka.

Methods: The study population was pregnant women admitted to the University Teaching Hospital from February 2013 to July 2013 with confirmed diagnosis of PPROM. A questionnaire was used to collect data and medical records were reviewed for extra information. In addition, sterile speculum vaginal examinations were done and endorcervical swabs were collected for microscopy and culture.

Results: Of the 100 women with PPROM that were enrolled, only data for 97 patients was analysed as three patients were lost to follow up. Of the endocervical swabs collected, 62.9% had positive cultures of which Candida sp (n=11, 18%) was the most common organism to be isolated followed by Escherichia coli (n=8, 13.1%) and enterobacter cloace (n=7, 11.5%). Multiple logistic regression analysis showed that poor fetal outcome was associated with a gestation age of <34 weeks (OR 18.77, 95% CI 1.87 -188.62) and birth weight of <1500g (OR 281.17, 95% CI 12.47 – 6338.97). A caesarean delivery had a tendency towards reducing poor fetal outcome (OR 0.01, 95% CI 2.33- 0.7 P = 0.033.)

Conclusion: Low birth weight and low gestation were associated with poor fetal outcomes in mothers with PPROM

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ABBREVIATIONS

AFI	Amniotic fluid index
BMI	Body mass index
FBC	Full blood count
GA	Gestation age
GRZ	Government Republic of Zambia
HVS	High vaginal swab
LMP	Last menstrual period
MtPPROM	Midtrimester preterm premature rupture of membranes
NICU	Neonatal intensive care unit
OBGY	Obstetrics and gynaecology
PG	Postgraduate
PROM	Premature rupture of membranes
PPROM	Preterm premature rupture of membranes
SVD	Spontaneous vaginal delivery
TPROM	Term premature rupture of membranes
UTI	Urinary tract infection
UTH	University Teaching Hospital
USA	United States of America
UNZABREC	University of Zambia Biomedical Research Ethics Committee
US	Ultrasonography

OPERATIONAL DEFINITIONS

TABLE 1: Operational definition of independent and dependent variables used in the study.

Variable	Operational definition
Lab variables	
Growth	Organism cultured from endocervical swab
No growth	Organism not cultured from endocervical swab
Organism present	Organism present on microscopic examination
Socio-demographic variables	
Age	Self- reported age of respondent at time of study: 16-19, 20-24, 25-29,30-34, 35 and above
Marital status	Self reported marital status; single, married, divorced, widowed and separated
Highest educational level	Highest educational level attained: None, primary, secondary and tertiary
Residence	Place of residence; High, Medium and Low density.
Employment status	Unemployed or Employed (formal or informal)
Total net income	Average net income from all sources per month
Smoking	The participant is a smoker or through passive smoking at home.
Clinical variables	
Duration of draining	Time of draining from onset to presenting at UTH
Gestational age	The age of pregnancy in weeks calculated from the LMP or earliest u/s scan at presentation to UTH.
Upper genital tract infection	Positive culture or presence of organisms on microscopic examination from endocervical swabs.
Clinical chorioamnionitis	The presence of maternal fever in addition to two other signs (uterine tenderness, maternal or fetal tachycardia and foul / purulent amniotic fluid)
PPROM	Rupture of fetal membranes from gestation age of 24 weeks to before 37 completed weeks before onset of labour Spontaneous or induced

Variable	Operational definition
Mode of delivery	Assisted breech, SVD, instrumental vaginal delivery or c/section
Birth weight	Weight of the baby at birth
Apgar score	Score given at 5 minutes
Cord prolapse	Cord prolapse that happened before or during admission at UTH
Mortality	Stillbirth or maternal mortality while being followed up during the study period
Twin pregnancy	Only twin 1 results were considered
Lost to follow up (LTFU)	Participant discharged after PPROM resolved and never came to the hospital for delivery and the phone was unreachable
Role of steroids	To enhance fetal lung maturity and other systems

1.0 Introduction

Premature rupture of membranes (PROM) is defined as rupture of fetal membranes before onset of labour. If it happens between 37 completed weeks and 42 weeks of gestation age, it is called term premature rupture of membranes (TPROM), while that occurring between 24 weeks and 37 completed weeks is called preterm premature rupture of membranes (PPROM). Rupture of membranes for > 24 hours before delivery is called prolonged rupture of membranes.

Fetal membranes are made of an outer four to six layered chorion attached to a collagen rich connective tissue and an inner single cell layer amnion (Kitzimiller et al 1984). Weakness in the chorioamnion membrane is the overall mechanism of PROM (Allen et al 1991), which may be due to deficiency of type III collagen (Kanayama et al 1985), reduced size of the membrane at the affected site (Artal et al 1976) and reduced collagen content (Skinner et al 1981). In addition, it may be caused by proteolytic enzymes from bacteria (McGregor et al 1987).

A number of risk factors e.g. smoking have been identified to be directly associated with PPROM. However, the cause is uncertain and it is believed to be multifactorial (Parry et al 1998).

Patients with premature rupture of membranes may present with leakage of vaginal fluid or vaginal bleeding but without contractions. If infection sets in, patients may also present with symptoms and signs of chorioamnionitis. Diagnosis of PPROM is made through history from the woman and by a sterile speculum vaginal examination. Pooling of liquor in the posterior vaginal fornix or leakage of it from the cervical os confirms the diagnosis. Ferning of liquor as observed on the microscope or change of nitrazine paper to blue because of the alkalinity of the amniotic fluid is supportive of the diagnosis of premature rupture of membranes.

In PPROM, the management involves administration of antibiotics that reduces the risk of perinatal infection and increases the latency period (Mercer et al 1995) while steroids reduce perinatal morbidity and mortality (Harding et al 2001).

Preterm premature rupture of membranes is one of the significant causes of preterm delivery and is associated worldwide with increased rates of neonatal and maternal morbidity and Mortality (Parry et al 1998, Joseph et al 1998).

This study was to ascertain the social demographic factors, clinical presentation of PPROM and highlight the microorganisms seen in PPROM at the University Teaching Hospital, Lusaka. In addition, to determine the outcome of PPROM.

2.0 Rationale for study

Sepsis is the third leading cause of maternal death in Africa, while prematurity is one of the leading causes of perinatal mortality and morbidity (Aaron et al 2008). These two are complications of PPROM. The epidemiology of PPROM at UTH is not known. Therefore, it is not clear whether PPROM contributes significantly to the cases of sepsis and prematurity seen at the University Teaching Hospital (UTH), Lusaka.

3.0 Significance

There are no national statistics available on maternal and perinatal mortality and morbidity as a result of PPROM. As such, this study will help analyze the extent of the problems caused by PPROM. It will also contribute to the epidemiological data of preterm premature rupture of membranes at UTH and serve as a base for future research. In addition, data collected would help in coming up with suitable treatment protocols for PPROM at UTH. This research has never been done in Zambia particularly at the University Teaching Hospital, hence the study.

4.0 Research question

What is the epidemiology of preterm premature rupture of membranes at UTH, Lusaka?

5.0 Overall objective

To determine the epidemiology of preterm premature rupture of membranes at UTH, Lusaka.

6.0 Specific objectives

- To determine the social demographic factors of women presenting with PPROM
- To describe the clinical presentation of PPROM.
- To highlight the microorganisms in PPROM
- To determine the fetal outcome in PPROM

7.0 Literature review

Worldwide, there is a slight difference in the prevalence of preterm premature rupture of membranes (PPROM) and this is due to the difference in the population studied.

Premature rupture of membranes (PROM) affects about 9% to 10% of all pregnancies of which 25% of premature rupture of membranes occur in preterm pregnancies and is associated with 30% of preterm deliveries (Kaltreider et al 1980).

In Europe, a study done in 1998 in England by Parry et al showed a prevalence of PPROM to be 1%, while in USA, Benitz et al in 1999 showed a prevalence of 1-2%. In Canada, the prevalence of PPROM was calculated to be 2-3% (Smith et al 2005). In Asia Punjab, Tahir et al in 2002 found the prevalence to be 5.4%, while in Pakistan the prevalence was 9.6% this was according to a study done by Shehla et al in 2005. In the Middle East, the prevalence of PPROM in Tehran, Iran was 5.86% (Nili et al 2003). In sub-Sahara Africa, a study done in Enugu Nigeria to look at the outcome of pregnancies complicated by preterm premature rupture of membranes, the prevalence of PPROM was noted to be 2.5% (Obi et al 2007). The prevalence of preterm PROM in a Ugandan study in Kampala evaluating risk factors for PPROM was 2.89% (Kaye 2001).

The study done in USA by Miller et al in 1989 showed that the incidence of premature rupture of membranes was high in pregnant mothers who smoked 1 to 60 cigarettes in a day and ended up with preterm labour with low birth weights. The study provided suggestive evidence that reducing smoking may reduce the incidence of PPROM. Harger et al in 1990 in Pennsylvania found that, smoking was one of the important risk factors in a study done to assess the predisposing factors of PPROM.

PPROM and preterm labour has been associated with an overall poor nutritional status pre-pregnancy, as reflected by a low Body Mass Index of less than 19-20 (BMI < 19-20; Li et al 2008; Mercer et al 2000; BMJ 1999; 318).In another study in Iran, Nasiri et al in 1999 showed that the prevalence of preterm premature rupture of membranes was high in women with a low body mass index as compared to those with a normal BMI.

In Enugu Nigeria, cervical incompetence among others was the most common risk factor of premature rupture of membranes. This was according to a study done by Obi et al in 2007 to evaluate the outcome of pregnancies complicated by PPROM. Kaye in 2001 in his study concerning risk factors of PPROM in Kampala Uganda, also noted cervical incompetence to be one of the significant factors associated with premature rupture of membranes. A study by Kilpatrick et al in 2006 concerning risk factors of premature rupture of membranes also found that cervical incompetence was one of the significant risks of PPROM. In Israel, Burstein et al in 2008 found cervical incompetence to be associated with PPROM. Furthermore, cervical incompetence was found to be one of the important risk factors of PPROM in Italy (Spinillo et al 1994).

A study done in Bangladesh by Akter et al in 2010 evaluating fetal-maternal outcomes in preterm premature rupture of membranes found that, women presenting with Preterm PROM among other factors were of low socioeconomic status. Preterm PROM was associated with low maternal haemoglobin and low socioeconomic status according to Ferguson et al 2001 in Canada when he was estimating if there were dietary or socioeconomic factors associated with Preterm PROM. A Swedish study to evaluate perinatal outcome according to the address of residence of mothers done by Gudmundsson et al 1997 found that PROM was associated with low-income areas. In a study to determine the prevalence and outcome of Preterm

PROM in Pakistan, more than 50% of patients presenting with PROM were noted to be of low socioeconomic status (Shehlar Noor et al 2005-2006).

PROM was associated with cervico-vaginal infections in a study done by Benedetto et al 2004 in Italy. In their study, the microorganisms associated with PROM were yeast, ureaplasma urealyticum, Group B streptococcus and bacterial vaginosis group of organisms. Bacteria vaginosis was also associated with an increased risk of preterm labour and preterm premature rupture of membranes in Iran by Azargoon et al 2006. In India, Karat et al in 2006 in his study on clinical and microbiological correlates of PPROM found that UTI, infection with E.Coli, bacterial vaginosis, staphylococcus aureus and candida albicans were significantly associated with PPROM. Group B streptococcus was the most prevalent microorganism to be isolated in Brazil in women with PPROM; this was according to a study done by Guiliane et al in 2008. A Nigerian study at one of the teaching hospitals looking at the bacteriology of premature rupture of membranes, Gardinerella vaginalis, candida and staphylococcus aureus were isolated. Gardinerella vaginalis was the most common organism isolated (Aboyeji et al 2002). PROM was noted to be one of the complications of pregnancy in women whose endocervix was colonized by ureaplasma urealyticum, mycoplasma hominis, candida albicans, Chlamydia trachomatis, N. gonorrhoea, group B streptococcus and listeria monocytogenes. This was according to a study done in South Africa by Rensburg et al in 1992.

In a study done in Kampala Uganda, a number of factors have been associated with PPROM. These factors include history of hypertension, abortion, previous premature rupture of membranes, anaemia, caesarean section and cervical cerclage (Kaye 2001).

About 50% of PPROM between 28 and 34 weeks of gestation age tend to go into labour within 24 hours, while 80-90% of the remaining half is likely to go into labour within 1 week (Mead et al 1980, Garite et al 1981). 50% of patients with PPROM below 26 weeks are likely to go into labour within 1 week (Taylor et al 1984).

In a study done in the USA looking at maternal and neonatal outcomes based on gestational age of midtrimester preterm PROM (MtPPROM), Deutsch et al 2010 showed that the survival was significantly higher with PPROM between 31weeks and 34 weeks as compared to PPROM between 26weeks and 30weeks. There was no difference in neonatal morbidity based on gestational age of MtPPROM. In Saudi Arabia a study on the outcome of pregnancy complicated by PPROM, neonatal outcomes included mortality (5.5%), respiratory distress (15.9%), sepsis (7.7%) and necrotizing enterocolitis (3.1%). Chorioamnionitis (20.9%), postpartum endometritis (6.8%), abruption placentae (4%) and septicaemia (0.5%) were noted as maternal morbidity (Khashoggi 2004).

The neonatal outcomes in a study done in 2010 in Bangladesh by Akter et al on maternal and foetal outcome of women with PPROM from 29 to 36 weeks gestation age included, average weight 2.59kg, neonatal asphyxia (2.2%), jaundice (22.2%), sepsis (6.7%) and respiratory distress syndrome (11.1%). While maternal outcomes comprised of chorioamnionitis (14%), abruption placenta (2%), endometritis (4%), puerperal sepsis (10%) and wound infection (2%).

8.0 Methodology

8.1 Study design

A prospective descriptive study.

8.2 Study site

The University Teaching Hospital, Department of Obstetrics and Gynecology, Lusaka.

8.3 Target population

All pregnant women admitted to maternity wards at UTH, Lusaka between February to August 2013.

8.4 Study population

Women with PPROM from 24 weeks to less than 37 completed weeks of gestation age and meeting the eligibility criteria.

8.5 Inclusion criteria

1. Gestation age from 24 weeks to < 37 weeks
2. Confirmed case of PPROM
3. Informed consent given (see Appendix 1, 2 and 3 for information sheet and consent form)

8.6 Exclusion criteria

1. Those in labour
2. Gestation age < 24 weeks or > 37 weeks
3. Informed consent not given
4. Unconfirmed cases of PPROM

8.7 Sample size

Using OpenEpi with an expected prevalence of 6%, an assumption from the literature review, at 95% level of confidence, the sample size was calculated to be 87 patients. With a 10% correction due to loss to follow up, the sample size came to 95 patients.

8.8 Study duration

The study was conducted from February 2013 to August 2013.

8.9 Procedures

To confirm the diagnosis of PPROM, a sterile speculum examination was done and endocervical swabs were collected for microscopy and culture. Other investigations done included FBC and US scan. The mentioned procedures and other observations e.g. monitoring of vital signs were part of the standard of care

8.10 Follow up time

The participants were followed up to the time they delivered or if they happened to develop chorioamnionitis because they needed to be delivered.

8.11 Data collection

Interviewer administered questionnaire was used to collect information (Appendix 4). The medical records of consenting participants were also reviewed for extra information.

8.12 Variables

Independent variables

Age, education, residence, income, smoking, gestation age, duration of draining, upper genital tract infection.

Dependent variables

Primary outcome: fetal outcome (stillbirth or admission to neonatal unit)

Secondary outcome: maternal outcome e.g. onset of labour, induction of labour, clinical chorioamnionitis, mode of delivery, abruption placentae, Mortality.

8.13 Data analysis and management

Data was entered in Excel spreadsheet and exported to SPSS version 20 for analysis.

A univariate analysis was done, the exposures were pregnancy and labour factors and the outcome was fetal condition. P values were calculated using chi square for categorical variables (Fisher exact test if values <5). Multivariate logistic regression was used to control for confounders and determine factors independently associated with fetal outcome in those with PPROM.

8.14 Consent

Information was given and explained in a language that the patient could understand using the information sheet. Concerns and questions that the patient had were answered and clarified. Consent form was administered to patients who were 18 years and older. For patients younger than 18 years, they signed the assent form and consent was sort from their parents or guardian.

8.15 Ethical considerations

Ethical approval was obtained from the University of Zambia Biomedical Research Ethics Committee (UNZABREC), while informed consent was obtained from eligible participants. Furthermore, permission was also obtained from the Medical Superintendent UTH and Head Department of Obstetrics and Gynaecology (UTH). It was made clear to the patients that their participation in the study was voluntary and that they were free to withdraw from the study at

any time without any prejudice to further medical care. Furthermore, participant confidentiality was maintained throughout the study. The risk to participants in this study was less than minimal risk, because all the procedures that were done are part of the standard of care and were done under aseptic conditions.

9.0 Results

A total of 100 women with preterm premature rupture of membranes (PPROM) were enrolled into the study from February to August 2013. Of these, 3 (3 %) were lost to follow up as they never returned to the hospital for delivery. As such, results for 97 (97 %) patients were analysed. In case of twin pregnancy, only data for twin one was included in the analysis. The available data of 97 patients was stratified depending on the fetal outcome being good or poor. All stillbirths and admissions to neonatal intensive care unit were defined as poor outcome while the opposite was defined as good outcome.

Socio-demographic factors

The age range of women with PPROM was from 17 – 39 years. However, preterm premature rupture of membranes was more frequent in women aged between 25-29 (n=30, 30.9 %) and those less than 19 years were less affected (n=9, 9.3%). The mean age was 27.5 years. Out of 97 women affected, 90.7% were married. In terms of education, 71.1% affected went up to secondary school. The majority of patients were unemployed (n=74, 76.3%) with a Christian background (n=95, 97.9%) who resided in high-density areas (n=64, 66 %). All the women were non-smokers but some had husbands who were smokers (n=22, 22.7%). 43.3 % of women were from a family with a low monthly income of less or equal to K1, 000.00

Table 2: Socio-demographic factors

Variable	Fetal outcome poor n (%)	Fetal outcome good n(%)	All n (%)	P Value
Age				
16-19	1 (3.8)	8(11.3)	9 (9.3)	P = 0.52
20-24	6 (23.1)	17(23.9)	23 (23.7)	
25-29	7 (26.9)	23(32.4)	30 (30.9)	
30-34	8 (30.8)	11(15.5)	19 (19.6)	
>35	4 (15.4)	12(16.9)	16 (16.5)	
Mean (SD)	28.4 (5.6)	27.2(6)	27.5 (5.9)	P=0.19
Median (Min-Max)	28.5 (18-37)	26 (17-39)	27 (17-39)	
Marital status				
single	1 (3.8)	7(9.9)	8 (8.2)	P = 0.591
married	25 (96.2)	63(88.7)	88 (90.7)	
divorced	0 (0)	0(0)	0 (0)	
widowed	0 (0)	0(0)	0 (0)	
separated	0 (0)	1(1.4)	1 (1.0)	
Education				
none	0 (0)	1(1.4)	1 (1.0)	P = 0.613
primary	8 (30.8)	17(23.9)	25 (25.8)	
secondary	17 (65.4)	52(73.2)	69 (71.1)	
tertiary	1 (3.8)	1(1.4)	2 (2.1)	
Employment				
not employed	20 (76.9)	54(76.1)	74 (76.3)	P > 0.999
informal	3 (11.5)	8(11.3)	11 (11.3)	
formal	3 (11.5)	9(12.7)	12 (12.4)	

Variable	Fetal outcome poor n (%)	Fetal outcome good n(%)	All n (%)	P Value
Religion				
Christian	26 (100)	69(97.2)	95 (97.9)	P > 0.999
Muslim	0 (0)	2(2.8)	2 (2.1)	
Residence (density)				
high	17 (65.4)	47(66.2)	64 (66)	P = 0.882
medium	7 (26.9)	16(22.5)	23 (23.7)	
low	2 (7.7)	8(11.3)	10 (10.3)	
Smoker				
Yes	0 (0)	0(0)	0 (0)	N/A
No	26 (100)	71(100)	97 (100)	
Any smoker in the house				
Yes	5 (19.2)	17(23.9)	22 (22.7)	P = 0.623
No	21 (80.8)	54(76.1)	75 (77.3)	
Monthly Income				
0 – 1,000	10 (38.5)	32(45.1)	42 (43.3)	P = 0.145
1,001 - 1,735	9 (34.6)	10(14.1)	19 (19.6)	
1,736 – 4,200	4 (15.4)	8(11.3)	12 (12.4)	
> 4,200	0 (0)	3(4.2)	3 (3.1)	
Don't know	3 (11.5)	18(25.4)	21 (21.6)	

Pregnancy factors

Women with a gestation age from 24 weeks to 36.7 weeks presented with PPROM. The mean gestation age was 32 weeks. However the majority were between the gestation age of 29-33 weeks (n=48, 49.5%). Out of those affected with PPROM 28.9% were HIV positive while 2.1% had syphilis and were treated antenatally.

Table 3: Pregnancy factors

Variable	Fetal outcome poor n (%)	Fetal outcome good n (%)	All N (%)	P-Value
Gestation Age				
24 - 28	11 (42.3)	6(8.5)	17 (17.5)	P = 0.005
29 - 33	13 (50.0)	35(49.3)	48 (49.5)	
34 - 37	2 (7.7)	30 (42.3)	32 (33.0)	
Mean (SD)	29.5 (2.96)	32.9(2.44)	32.0 (2.97)	P < 0.001
Median (Min-Max)	29 (24-35)	33(27-36.7)	33 (24-36.7)	
HIV Status				
Positive	10 (38.5)	18(25.4)	28 (28.9)	P = 0.276
Negative	15 (57.7)	52(73.2)	67 (69.1)	
Unknown status	1 (3.8)	1(1.4)	2 (2.1)	
Syphilis status				
Reactive	1 (3.8)	1(1.4)	2 (2.1)	P = 0.39
Non-reactive	8 (30.8)	30(42.3)	38 (39.2)	
unknown	17 (65.4)	40(56.3)	57 (58.8)	

PROM and maternal condition

The majority of patients (n=68, 70.1%) presented to the hospital within 24 hours of draining and only 4.1% of those draining presented with a foul smelling discharge. 96% of patients presented with a normal temperature and no abdominal tenderness on admission except for 1% who had a temperature > 38^{o}c and abdominal tenderness. The maternal pulse rate and fetal heart rate was high on admission in 4.1% and 1% of those affected respectively.

Table 4: PROM and maternal condition

Variable	Fetal outcome poor n (%)	Fetal outcome good n (%)	All n (%)	P-Value
Hours of draining from onset to presentation				
< 24 hours	16 (61.5)	52(73.2)	68 (70.1)	P = 0.458
24 48 hours	5 (19.2)	8(11.3)	13 (13.4)	
> 48 hours	5 (19.2)	11(15.5)	16 (16.5)	
Draining smell				
Yes	4 (15.4)	0(0)	4 (4.1)	P = 0.004
No	22 (84.6)	71(100)	93 (95.9)	
Temperature on admission				
>38^{o}C	1 (3.8)	0(0)	1 (1.0)	P = 0.268
<38 ^{o}C	25 (96.2)	71(100)	96 (99.0)	
Abdominal Tenderness on Admission				
Yes	1 (3.8)	0(0)	1 (1.0)	P = 0.268
No	25 (96.2)	71(100)	96 (99.0)	
Maternal pulse on admission				
60 to 100	23 (88.5)	67(94.4)	90 (92.8)	P = 0.418
> 100	2 (7.7)	2(2.8)	4 (4.1)	
not recorded	1 (3.8)	2(2.8)	3 (3.1)	
FHR on admission				
< 120	0 (0)	0(0)	0 (0)	P = 0.466
120 to 160	25 (96.2)	70(98.6)	95 (97.9)	
> 160	0 (0)	1(1.4)	1 (1.0)	
Not done	1 (3.8)	0(0)	1 (1.0)	

Dexamethasone, antibiotics use and endocervical swab collection

Upon admission, 72.2% of patients with PPROM were put on amoxicillin and metronidazole, while 86.6% received dexamethasone. Endocervical swabs were collected from all women on admission.

Table 5: Dexamethasone, antibiotics use and endocervical swab collection

Variable	Fetal outcome poor n (%)	Fetal outcome good n (%)	All n (%)	P-Value
Dexamethasone given				
Yes	25 (96.2)	59(83.1)	84 (86.6)	P = 0.084
No	1 (3.8)	12(16.9)	13 (13.4)	
Antibiotics given				
Amoxicillin	0 (0)	0(0)	0 (0)	
Metronidazole	0 (0)	0(0)	0 (0)	
Erythromycin	4 (15.4)	11(15.5)	15 (15.5)	
X-pen	0 (0)	0(0)	0 (0)	
Gentamicin	0 (0)	0(0)	0 (0)	
Cefotaxime	1 (3.8)	0(0)	1 (1.0)	
Ceftriaxone	0 (0)	0(0)	0 (0)	
Ciprofloxacine	0 (0)	0(0)	0 (0)	
Amoxicillin and Metronidazole	16 (61.5)	54(76.1)	70 (72.2)	
Erythromycin and Metronidazole	5 (19.2)	5(7)	10 (10.3)	
Amoxicillin, Metronidazole and Erythromycin	0 (0)	1(1.4)	1 (1.0)	
Endocervical swab collected				
Yes	26 (100)	71(100)	97 (100)	
No	0 (0)	0(0)	0 (0)	

Endocervical swab results

Of the endocervical swabs collected, 62.9% had positive cultures and microscopic examination of which Candida sp was the most common organism to be isolated (n=11, 18%), followed by Escherichia coli (n=8, 13.1%) and enterobacter cloace (n=7, 11.5%).The least isolated were enterobacter aerogenes and staphylococcus viridans, alpha-hem each 1.6%.

Table 6: Endocervical swab results

Variable	Fetal outcome poor n (%)	Fetal outcome good n (%)	All n (%)	P-Value
Endocervical swab results				
Growth	16 (61.5)	45(63.4)	61 (62.9)	P = 0.865
No growth	10 (38.5)	25(35.2)	35 (36.1)	
Sample missing	0 (0)	1(1.4)	1 (1.0)	
Organism isolated				
Candida sp	1 (6.3)	10(22.2)	11 (18.0)	
Citrobacter koseri (diversus)	0 (0)	5(11.1)	5 (8.2)	
Corynebacterium sp.(diphtheroids)	1 (6.3)	1(2.2)	2 (3.3)	
Enterobacter aerogenes	0 (0)	1(2.2)	1 (1.6)	
Enterobacter cloace	2 (12.5)	5(11.1)	7 (11.5)	
Enterobacter sp.	1 (6.3)	2(4.4)	3 (4.9)	
Escherichia coli	3 (18.8)	5(11.1)	8 (13.1)	
Klebsiella pneumoniae	2 (12.5)	1(2.2)	3 (4.9)	
Pantoea agglomerans	2 (12.5)	4(8.9)	6 (9.8)	
Pseudomonas sp.	0 (0)	2(4.4)	2 (3.3)	
Salmonella sp.	1 (6.3)	1(2.2)	2 (3.3)	
Staphylococcus aureus	1 (6.3)	4(8.9)	5 (8.2)	
Staphylococcus viridans, alpha-hem	1 (6.3)	0(0)	1 (1.6)	
Streptococcus pneumoniae	1 (6.3)	3(6.7)	4 (6.6)	
Mixed bacterial species present	0 (0)	1(2.2)	1 (1.6)	
Sample missing	0 (0)	1(2.2)	1 (1.6)	

Maternal condition after PROM

After admission, PPROM resolved in 6.2% of patients and they were discharged. In addition, 2.1% and 1% had raised temperature and tachycardia respectively. Of those who had a full blood count, 11.3% had raised white blood cell count.

Table 7: Maternal condition after PROM

Variable	Fetal outcome poor n (%)	Fetal outcome good n (%)	All n (%)	P-Value
Did PPROM resolve and patient got discharged?				
Yes	2 (7.7)	4(5.6)	6 (6.2)	P = 0.512
No	24 (92.3)	67(94.3)	91 (93.8)	
Symptoms and signs of chorioamnionitis after admission				
maternal fever	2 (7.7)	0(0)	2 (2.1)	P = 0.07
maternal tachycardia	0 (0)	1(1.4)	1 (1.0)	
Foul smelling discharge	0 (0)	0(0)	0 (0)	
none	24 (92.3)	70(98.60	94 (96.9)	
White blood cell count				
> 11 x 910/L	3 (11.5)	8(11.3)	11 (11.3)	P = 0.786
< 11 x 910/L	4 (15.4)	7(9.9)	11 (11.3)	
Not done	19 (73.1)	56(78.9)	75 (77.3)	

Delivery after PROM

The majority of cases (n=86, 88.7%) went into spontaneous labour, of which 60.8% delivered after 72 hours post admission and only a few 3.1% within 24 hour of admission.Vaginal vertex deliveries accounted for 86.6% ,while 6.2% had c/section. Breech deliveries were 6 (6.2%) and the remainder was instrumental delivery.

T**able 8:** Delivery after PROM

Variable	Fetal outcome poor n(%)	Fetal outcome good n (%)	All n (%)	P-Value
Onset of Labour				
spontaneous	23 (88.5)	63(88.7)	86 (88.7)	P > 0.999
induced	2 (7.7)	5(7)	7 (7.2)	
(Elective CS)	1 (3.8)	2(2.8)	3 (3.1)	
(CS after APH for placenta praevia)	0 (0)	1(1.4)	1 (1.0)	
Hours from PPROM to spontaneous onset of labour, induction, or elective c/section				
< 24 hours	0 (0)	3(4.2)	3 (3.1)	P = 0.485
24 -48 hours	8 (30.8)	14(19.7)	22 (22.7)	
48-72 hours	2 (7.7)	11(15.5)	13 (13.4)	
> 72 hours	16 (61.5)	43(60.6)	59 (60.8)	
Mode of Delivery				
vaginal vertex	20 (76.9)	64(90.1)	84 (86.6)	P = 0.241
vaginal assisted breech delivery	3 (11.5)	3(4.2)	6 (6.2)	
instrumental	0 (0)	1(1.4)	1 (1.0)	
caesarean section	3 (11.5)	3(4.2)	6 (6.2)	

Fetal and Maternal outcome

The outcome of babies was good in 73.2% of women who presented with PPROM while 23.7% were sent to neonatal intensive care unit for prematurity, asphyxia etc. Stillbirths accounted for 3.1%. The majority of babies were of low birth weight 1500-2499 (n=44, 45.4%) and 51.5% were females. The mean birth weight was 2176g. 88.7% of babies had a good Apgar score at 5 minutes, however out of those sent to neonatal intensive care unit 73.9% were due to prematurity. Concerning maternal outcome, one had clinical features of chorioamnionitis on admission. No woman developed clinical chorioamnionitis after admission.

Table 9: Fetal and Maternal outcome

Variable	Fetal outcome poor n (%)	Fetal outcome good n (%)	All n (%)	P-Value
Fetal outcome				
alive and well		71	71 (73.2)	
alive and admitted to NICU	23		23 (23.7)	
stillbirth	3		3 (3.1)	
Birth weight				
<1000g	2 (7.7)	1(1.4)	3 (3.1)	
1000 - 1499g	12 (46.2)	1(1.4)	13 (13.4)	
1500 - 2499g	11 (42.3)	33(46.5)	44 (45.4)	P < 0.001
> 2500g	1 (3.8)	36(50.7)	37 (38.1)	
Mean (SD)	1486 (459)	2427(470)	2175 (625)	P = 0.012
Median (Min-Max)	1445 (400 -2600)	2500 (900-3400)	2175 (400-3400)	
Sex				
Male	14 (53.8)	33(46.5)	47 (48.5)	P = 0.679
Female	12 (46.2)	38(53.5)	50 (51.5)	
Apgar score (5mins)				
0	3 (11.5)	0(0)	3 (3.1)	
1 - 3	1 (3.8)	0(0)	1 (1.0)	
4 - 6	7 (26.9)	0(0)	7 (7.2)	P < 0.001
7 - 10	15 (57.7)	71(100)	86 (88.7)	
Mean (SD)	6 (3)	8(2)	8 (2)	P = 0.001
Median (Min-Max)	7 (0-9)	8(8-9)	9 (0-9)	

Variable	Fetal outcome poor n (%)	Fetal outcome good n (%)	All n (%)	P-Value
Indication for admission to NICU				
prematurity and asphyxia	2 (8.7)		2 (8.7)	
prematurity	17 (73.9)		17 (73.9)	
grunting respirations	2 (8.7)		2 (8.7)	
asphyxia	1 (4.3)		1 (4.3)	
atresia of the upper GI	1 (4.3)		1 (4.3)	
Maternal complications				
chorioamnionitis	1 (3.8)	0(0)	1 (1.0)	P=0.134
none	25 (96.2)	71(100)	96 (99.0)	

Multivariate Logistic Regression

What factors are independently associated with a bad fetal outcome (i .e. stillborn or admission to NICU)

Parameter	Odds Ratio	95% CI	P-Value
gestation <34	**18.77**	**1.87 to 188.62**	**P = 0.013**
No Dexamethasone	0.64	0.05 to 8.57	P = 0.737
Endocervical growth	3.29	0.57 to 19.05	P = 0.183
PPROM to lab/induc >48 hr	0.25	0.05 to 1.13	P = 0.072
Male baby	2.08	0.53 to 8.16	P = 0.294
Birth weight <1500	**281.17**	**12.47 to 6338.97**	**P < 0.001**
Caesarean	**0.01**	**2.33E-04 to 0.7**	**P = 0.033**

The multivariate logistic regression analysis shows that a poor outcome is independently associated with a gestation age of <34 weeks and birth weight of <1500grams. Caesarean birth appeared to be protective but with wide 95% confidence interval.

Furthermore, a poor outcome was not associated by whether dexamethasone was given or not, a positive endocervical result, the duration of PPROM to onset of labour/induction was >48hrs or sex of the baby.

10. Discussion

The demographic profile of PPROM patients in our study such as low social economic status, unemployment, low income and residing in high-density areas was similar to those reported in other areas (Shehlar 2005, Akter et al 2010, Gudmundsson et al 1997).

It was noted in a study done by Mead et al in 1980 and Garite et al in 1981 that about 50% of PPROM between 28 and 34 weeks of gestation age tend to go into labour within 24 hours. This was different in our study were 62% of patients between 29 -33 weeks of gestation age went into spontaneous labour after 72 hours.This increase maybe was due to the antibiotics given that led to an increase in the latency period in our study. This increase in latency period was also noted in a study done by Mercer et al in 1995. The majority of fetal outcome in our study was good up to the time of follow up as shown by the number of babies who were alive and well (73.2%), despite the majority of babies (61.9%) being premature .

The number of premature babies in our study was low (61.9%) as compared to 62.3% by Shehlar in 2005. This may be attributed to the fact that all those who were < 34 weeks on admission were given broad-spectrum antibiotics, which increased the latency period. However, in our logistic regression caesarean section showed a tendency to reduce perinatal morbidity and mortality. 23.7% of babies were admitted to neonatal intensive care unit. Out of this number, 73.9% of admissions were due to prematurity. In our study, it is not known whether the babies later developed sepsis, jaundice, necrotizing enterocolitis or intracranial haemorrhage because the end point for follow up was delivery.

In our study 1.03% of patients presented with features of clinical chorioamnionitis on admission. In our study, no woman developed this complication after admission. In other areas 20.9% and 14% of patients developed clinical chorioamnionitis after admission according to Khashoggi et al in 2004 and Akter et al in 2010 respectively. Stillbirths

accounted for 3.1% in our study, which was low as compared to 5.9% (shehlar Noor et al 2005). Other maternal complications, which were present in other studies, like endometritis, wound infection and puerperal sepsis, were not known in this study because follow up was up to delivery.

In this study escherichia coli, candida sp, and staphylococcus aureus were isolated. These microorganisms were also isolated in PPROM patients in similar studies in other parts of the world (Rensburg et al 1992, Aboyeji et al 2002, Karat et al 2006). Caesarean section rate in our study was 6.2% which was low as compared to 14% (Shehlar Noor 2005).

The microorganisms isolated regardless of the type, did not have a bearing on the poor fetal and maternal outcome. The probable explanation could be that the antibiotic cover instituted upon admission was adequate to treat the possible pathogen. However, a follow up study is needed on the sensitivity patterns of the microorganisms isolated in order to promote evidence based use of antibiotics to avoid unnecessary drug resistance in patients with PPROM that may arise as a result of injudicious use of antibiotics as noted in this study.

In our study, the logistic regression revealed that the poor fetal outcome in women with preterm premature rupture of membranes was associated with a gestation age of less than 34 weeks and an extremely low birth weight. As such, more efforts have to be made to improve our neonatal intensive care unit so that they become better equipped to deal with such kind of complications to improve the outcomes.

11.0 Conclusion

Low birth weight and low gestation were associated with poor fetal outcomes in mothers with PPROM

12.0 Study limitations

It was difficult to following up those discharged after PPROM resolved, hence later neonatal outcome could not be determined. The gestational age based on last period is subjective. Some babies may not have been preterm and similarly some preterm babies could have been excluded as term babies.

13. Recommendations

1. There is need to improve neonatal intensive care in UTH in order to take better care of preterm babies resulting from PPROM

2. The role that caesarean delivery may play in improving fetal outcome in patients with PPROM needs to be investigated further preferably in a bigger study.

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15. Appendices

Appendix 1: **Participant information sheet**

TITLE: Epidemiology of Preterm Premature Rupture of Membranes (PPROM) at UTH, Lusaka.

My name is Dr.Willies Silwimba a postgraduate student at the University of Zambia School of Medicine. I am conducting a research on the above subject at the University Teaching Hospital (UTH), Obstetrics and Gynaecology department, as part of the requirement for the award of a Masters Degree in Medicine. As such, I am here by inviting you to take part in this study.

PURPOSE: At the end of this study, I would like to find out the social demographics, the clinical presentation, maternal and neonatal outcomes and the germs seen in those affected with early breakage of water in a preterm pregnancy. Furthermore, the information collected will help us manage cases of this nature adequately at UTH. In addition, the data collected will serve as a base for future research on early breakage of water in preterm pregnancies.

EXPLANATION OF THE PROCEDURE: You have been invited to this study because your water has broken before 37 completed weeks of gestational age. If you agree to take part in the study, you will be asked some questions to help us know you better while some other information concerning you, will be extracted from your medical records. Samples will be collected from the mouth of your womb to help us ascertain the germs associated with early breakage of water in preterm pregnancies. Other investigations e.g. full blood count and ultrasonography scan of the baby will be done were necessary to help us manage you

accordingly. I wish to state that there is nothing new that will be administered to you, everything that will be done is the standard of care for the condition that you have. In addition, participation is voluntary and you are free to withdraw from this study at any time and you will still receive the standard medical care. Moreover, the information obtained from you will not be shared with anyone not involved in the study.

BENEFITS: There is no direct benefit to the participant by virtue of participating in this study because everything done is part of standard of care for early breakage of water in preterm pregnancy. We hope that the information gathered at the end of this study will help in managing such cases adequately at UTH.

RISKS: The risk to participants in this study is less than minimal risk, because all the procedures that will be done are part of the standard of care and will be done under clean conditions. Also, nothing new will be administered to participants.

If you agree to take part, please sign the consent form which will allow us to enrol you in this study. If you have any questions please contact us on the addresses below.

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Appendix 2: **Participant consent form**

TITLE: Epidemiology of Preterm Premature Rupture of Membranes (PPROM) at UTH, Lusaka.

I wish to inform you that there is no direct benefit by virtue of participating and the risk involved is less than minimal risk, because everything done is part of standard of care for PPROM and nothing new is going to be administered to you. Participation is voluntary and you are free to withdraw from the study at anytime. We hope the information gathered will help us manage PPROM adequately.

I have read and understood all the information concerning PPROM and what this study is all about is clear to me. I therefore voluntarily consent to take part in this study.

Name: _____

Signature: _____ Date: _____

Right Thumb Print: _____ Date: _____

Witness /Parent/Guardian

Name: _____

Signature: _____ Date: _____

Right Thumb Print: _____ Date: _____

Name of person taking consent: _____

Signature: _____ Date: _____

Appendix 3: **Assent form for participants under 18 years**

My name is Dr Willies Silwimba and I am from the University of Zambia School of Medicine. I am conducting a study entitled Epidemiology of Preterm Premature Rupture of Fetal Membranes (PPROM) at UTH, Lusaka. I am asking you to take part in this research because I am trying to learn more about epidemiology of early breakage of water in preterm pregnancy at UTH.

If you agree to be in this study, you will be asked to complete a survey. Some of the questions ask on sensitive issues, and may make you feel upset. You are free not to answer questions you are not comfortable with. Furthermore, no one will be able to know how you responded to the questions.

Please talk about this study with your parents before you decide whether or not to participate. I will also ask your parents to give their permission for you to participate. Even if your parents give consent, you can still decide not to participate. You may also change your mind before or during the survey. No one will be upset with you if you don't want to participate or if you change your mind later and want to stop.

You may ask me any questions about this study and feel free to call me at any time on 0976 939330 or talk to me the next time you see me.

By signing below, you are agreeing to participate with the understanding that your parents have given permission for you to take part in this study. You are participating in this study because you want to. You and your parents will be given a copy of this form after you have signed it.

Name: _____

Signature: _____ Date: _____

Right Thumb Print:_____ Date:_____

Appendix 4: **Questionnaire**

TITLE: Epidemiology of Preterm Premature Rupture of Membranes (PPROM) at UTH, Lusaka.

Initials: _____ File #:_____ Firm: ____ Ward: _____ Age: _____
Marital Status: _____ LMP: _____ GA: _____ Cell #: _____

Please tick or enter in the appropriate space.

SOCIO-DEMOGRAPHICS

1. *Education Level*

0. None ( )
1. Primary ( )
2. Secondary ( )
3. Tertiary ( )

2. *Are you employed?*

0. Formal ( )
1. Informal ( )
2. Not employed ( )

3. *What religion are you?*

0. Christian ( )
1. Muslim ( )
2. Hindu ( )
3. Other ( )

4. *Residence (write name of place of stay)* _____

0. High density ( )
1. Medium density ( )
2. Low density ( )
3. Rural ( )

5*. What is your total net monthly income in Zambian Kwacha?*

0. 0 - 1,000 ( )
1. 1, 001 - 1, 735 ( )
2. 1, 736 - 4, 200 ( )
3. > 4, 200 ( )
4. Don't know ( )

ANTENATAL CLINIC

6. *What is your HIV Status (from antenatal card)? If negative or unknown go to question 11.*

0. Reactive (R) ( )
1. Non reactive (NR) ( )
2. Unknown status ( )

7*. Are you on HAART? If yes, for how long have you been on HAART?* _____

0. Yes ( )
1. No ( )
2. N/A ( )

8*. Was HAART started before pregnancy?*

0. Yes ( )
1. No ( )
2. N/A ( )

9*. Are you on Zidovudine (AZT) only? If yes, at what gestation age did you start taking AZT?*

0. Yes ( )
1. No ( )
2. N/A ( )

10. *What is your latest CD_4 Count (if available)? When was it done? _____*

0. < 350 ( )
1. > 350 ( )
2. Not available ( )
3. N/A ( )

11. *What is your syphilis status (from antenatal card)? If negative or unknown go to question 13.*

0. Reactive (R) ( )
1. Non-Reactive (NR) ( )
2. Unknown status ( )

12*. If RPR (syphilis test) reactive, was it treated?*

0. Yes ( )
1. No ( )
2. Don't know ( )
3. N/A ( )

HISTORY-SYMPTOMS

13*. For how long have you been having the watery vaginal discharge?*

0. < 24 hours ( )
1. 24 hours to 48hours ( )
2. > 48 hours ( )

14*. Does the watery vaginal discharge smell bad?*

0. Yes ( )
1. No ( )

HISTORY-SIGNS

15*. Body temperature on admission*

0. < 38^{o}C ( )
1. > 38^{o}C ( )
2. Not done ( )

16. *Abdominal tenderness on admission*

0. Yes ( )

1. No ( )

17. *Maternal pulse on admission*

0. < 60 bpm ( )

1. 60 to 100 bpm ( )

2. > 100 bpm ( )

3. Not recorded ( )

18. *Fetal heart rate on admission*

0. < 120 bpm ( )

1. 120 to 160 bpm ( )

2. > 160 bpm ( )

3. Not done ( )

HISTORY-SOCIAL

19. *Have you been smoking in this pregnancy?*

0. Yes ( )

1. No ( )

20. *Do you live with someone who smoke in your home?*

0. Yes ( )

1. No ( )

POST ADMISSION DRUGS

21. *Has the patient been given dexamethasone?*

0. Yes ( )
1. No ( )

22. *What antibiotics has the patient been given?*

0. Amoxycillin ( )
1. Metronidazole ( )
2. Erythromycin ( )
3. X-pen ( )
4. Gentamicin ( )
5. Cefotaxime ( )
6. Ceftriaxone ( )
7. Ciprofloxacine ( )
8. Amoxycilline and Metronidazzole ( )
9. Erythromycin and Metronidazole ( )
10. Amoxycilline, metronidazole and erythromycin ( )

OUTCOME

23. *Was endocervical swab for microscopy and culture taken in this Pregnancy after PPROM occurred?*

0. Yes ( )
1. No ( )

24. *What were the findings (indicate)?* _____

25. *Did PPROM resolve and patient got discharged?*

0. Yes ( )
1. No ( )
2. LAMA ( )

26. *Any symptoms and signs of chorioamnionitis present after admission?*

0. Foul smelling PV discharge ( )
1. Maternal fever (Temp. > 38^{o}C) ( )
2. Abdominal tenderness ( )
3. Raised maternal pulse (> 100 bpm) ( )
4. Raised fetal heart rate (> 160 bpm) ( )
5. None of the above ( )

27. *If symptoms and signs present, what is the white blood cell (WBC) count?*

0. > 11 X 9^{10} /L ( )
1. < 11 X 9^{10} /L ( )
2. Not collected ( )

28. *Labour*

0. Spontaneous ( )
1. Induced ( )
2. N/A ( )

29. *Time interval from rupture of membranes to onset / induction of labour*

0. < 24 hours ( )
1. 24 to < 48 hours ( )
2. 48 to < 72 hours ( )
3. > 72 hours ( )

30. *Mode of delivery*

0. Vaginal vertex ( )
1. Vaginal assisted breech delivery (ABD) ( )
2. Instrumental vaginal delivery ( )
3. Caesarean section ( )
4. Twins, T1 vaginal vertex and T2 vagina ABD ( )

31. *Indications for emergency c/sections*

0. Transverse lie ( )

1. Placenta previa ( )

2. N/A ( )

32. *Indications for elective c/sections*

0. Transverse lie ( )

1. Previous myomectomy ( )

2. N/A ( )

33. *Fetal wellbeing after birth*

0. Stillbirth ( )

1. Alive and well ( )

2. Alive and sent to NICU ( )

3. One twin alive and sent to NICU the other stillbirth ( )

34. *Birth weight*

0. Less or equal to 1000g ( )

1. 1001g to 1499g ( )

2. 1500g to 2499g ( )

3. Greater or equal to 2500g ( )

35. *Sex of the baby*

0. Female ( )

1. Male ( )

2. Twins T1 female and T2 male ( )

36. *Apgar score at 5 minutes*

0. 0-3 ( )

1. 4-6 ( )

2. 7-10 ( )

37. *Reasons for admission to NICU*

0. Asphyxia ( )
1. Prematurity ( )
2. Congenital malformations ( )
3. Sepsis ( )
4. Grunting ( )
5. Asphyxia and prematurity ( )
6. Other ( )
7. N/A ( )

38. *Cord prolapse*

0. Yes ( )
1. No ( )

39. *Maternal wellbeing after delivery*

0. Alive and well ( )
1. Alive with complications ( )

40. *Maternal complication after delivery*

0. Maternal mortality ( )
1. Chorioamnionitis ( )
2. Abruptio placentae ( )
3. Other ( )
4. None ( )