Profile of Neonatal Deaths at Gitwe District Hospital in Southern Province, Rwanda

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Abstract- **Introduction:** The aim of this present study was to determine the prevalence of early neonatal death at Gitwe hospital and identify associated factors. **Objectives:** The present study had the main purpose to determine the prevalence of early neonatal deaths at Gitwe Hospital and to describe early neonatal deaths and identify associated factors. *Methods:* The Retrospective present study was conducted using quantitative during a three years' period whereby 92 cases includes only early neonatal mortality cases that occurred at Gitwe Hospital from 1st January 2008 to 31st December 2010 (3 years) were selected and interviewed. The Chi-square and Logistic regression were used for data analysis using SPSS 17.0 whereby the statistical significance was set at p<0, 05. **Results:** The socio demographics characteristics shows that the prevalence of early neonatal mortality were 23.96 ‰ (or 2.3%) at Gitwe Hospital. 79.9% of women was farmers and 81.5% have primary education. 67.4% was the Eutocic delivery mode occupies the 1st place and 84.8% of mothers with HIV negative. 71,7% was the Children who died with APGAR scoring of 0 and 5 and weight of 2500g to 3600g (67.4%). Majority of gestational age was 36 and 39 weeks of amenorrhea (60.9). Death age of the child: the majority of children died before 2 days of life (85.9%). According to the mode of childbirth the parity and the score of APGAR, statistical logistic regression analysis shows that 87.5% of the children dying before 2 days of age were born from HIV negative mother while 74,3% children of the same group were born between 36 and 39 weeks. Statistical analysis shows a very highly significant association between the age of death of the child and the serologic status of the mother (P=0.003), and gestational age of the mother (P = 0,001). The prevalence of early neonatal mortality statistic logistic regression shows that 84.8% of mothers are HIV negative while 85.9% are the majority of children died before 2 days of life. **Conclusions:** The levels of early neonatal death are improving gradually with the quality delivery of management of new-borns resulting from a bad APGAR score and acute foetal distress

Index Terms- Profile, Neonatal and Death

I. INTRODUCTION

Pregnancy and delivery are the main sources of joy for parents and family in general. However, in a number of countries, they are sources of serious risks for women and new-born. It is within the first days of life that a child is the most vulnerable. Nearly 40% of children deaths under 5 years of age that is a total of 3.7 millions in 2004; the most recent year for which estimations are available, occurred during the first 28 days of life, called prenatal period. Three fourth of these new-born deaths occurred in the beginning of neonatal period, usually during the first seven days following Childbirth. The day after delivery is the most risk with 25 to 45% neonatal deaths. The gap between industrialized countries and developing countries is still very large as far as neonatal mortality is concerned: one child born in developing countries is as much as 14 times at risk of dying during the first 28 days of life than a baby born in an industrialized country [1, 2].

Regarding childhood mortality, Africa and Asia are 2 continents the most affected; with 95% of maternal deaths and 90% of neonatal death. Disparities among social classes within countries are still deep in term of poverty. Demographic and sanitation investigations carried out in 1995 and 2002 revealed that within regions, neonatal mortality rate is 20 to 50% higher for 20% of poorest families than 15% the richest [1, 3, 4].

Majority of these health problems could be avoided or treated by basic intervention such as access to quality health care services, neonatal care, availability of qualified medical personnel for delivery, accessibility of emergency care for women and new-borns in need, and education that encourages safe practice for women and new-born [5]. In Gitwe hospital, the situation in terms of early neonatal mortality is not known due to the lack of studies conducted on this topic. The present survey aims at documenting the current situation by determining the prevalence of early neonatal mortality at Gitwe hospital and identifying the associated factors.

II. METHODS

a) Study interests

Early neonatal mortality as global concern (mother, family, society and medical personnel as well) it is of great importance that some health personnel get interested in order to understand the magnitude and the reasons to why this situation and prevent it whenever possible. It is worthy mentioning that problem is rarely investigated in our country (there are not many publications on the subject available in our country) and to our knowledge there is no study that has been conducted on the subject at Gitwe hospital.

b) Literature Review

We have to understand the literature review According to WHO, 8.1 million of childhood deaths occur each year with almost a half occurring during antenatal period. For 4 millions of neonatal deaths, three fourths occur during the first week of life. Regarding childhood mortality, Africa and Asia are 2 continents the most affected [4, 16]. According to HMIS of Gitwe Hospital, early neonatal mortality in 2008 was up to 82/1000 L.B and

71/1000 L.B in 2009. These statistical data are still high compared to other developing countries and to the national average of 28/1000. However, so far there is no study that investigated into the problem and the causes of the situations are not yet known.

In the worldwide according to WHO, 8.1 million of childhood deaths occur each year with almost a half occurring during antenatal period. For 4 millions of neonatal deaths, three fourths occur during the first week of life. Regarding childhood mortality, Africa and Asia are 2 continents the most affected [6, 7]. In all developing countries, ANC has been recognized to be great importance of the wellbeing of the mother when pregnancy is suspected. However, many developing countries have been able to put knowledge into action by improving education and health services in isolating communities. In developing countries coverage of at least one ANC visit is relative high at 69% in sub-Saharan Africa, compared to 54% in Asia. A Memorandum from the British Ministry of Health in 1929 outlined the principles and details of ANC, including timing and content of the visits. It prescribed a number of visits, starting as early as possible in pregnancy, continuing at 4-week intervals until the 28th week, then every two weeks until the 36th week, and then weekly until the onset of labor [8-9,10]

A research conducted by A. Bezzaoucha ·A. El Kebboub · A.Aliche, (1999-2006) in Blida Teaching Hospital Algeria, indicated that the evolution of epidemiology service on hospital mortality and evolution of neonatal mortality in teaching hospitals as well as the causes of neonatal deaths. A total of 2167 neonatal deaths were recorded in teaching hospitals during the study period, that is a mortality proportion of 25.4%. Early neonatal mortality represented 83.4% of whole neonatal mortality nearly two thirds of early neonatal deaths occur during the first three days of life [11].

A study conducted by Hill K, Choi Y (2006) indicated that infant mortality trends of early neonatal deaths shows a significantly high tendency in the study period (p<0.005) without evidence of seasonal effect. Male ratio was practically the same for early and late neonatal mortality, 1.4 and 1.5 respectively. Prematurity represented 42.1% of death causes of early neonatal mortality, followed by respiratory distress syndrome and infections, 17 and 14% respectively [12].

A study conducted by Kouakou K.P., Djanhan Y., Doumbia Y, (2006) and YAO Atteby J.J., Cisse L., Orega M., Attimere Y., Oulaï S, (2003) indicated that in ivory Cost, the 1st May 2003 to 29 February 2004 Childbirths outside maternity represented 11.94% of recorded deliveries. Maternal morbidity was the highest in a group of patients who delivered outside. Maternity, represented mainly by placental retentions (28.6%) and delivery hemorrhages (25%). Neonatal morbidity was dominated by neonatal distress (43.3%) [6, 9].

In Rwanda the trends of childhood mortality rate have been highly dramatically reduced. However, the indicators shows that the rates in the below graphs indicated that infants and infants-youthful mortality for four 5 years' periods that preceded DHS-I of 1992, DHS-II of 2000, DHS-III of 2005 and DHS 2007-2008, the results of this investigation indicated that the downward trend of mortality that had started before 1990's and was interrupted by the 1994 genocide, continued since then.

Indeed, the rate of childhood mortality that was estimated at 85% for the period of 1987-1991 had increased to reach 107‰ over the period of 1995-1999. This consecutive increase during genocide period followed by a resumption of the fall with childhood mortality reaching; around year 2002, the pre-genocide prevalence of 86‰ to reach 62‰ around year 2005 [13]. Infanto-youthful mortality rate follows the same tendency. Therefore, it seems after tragic events that took place in Rwanda in 1994 that had negatives impact on mortality in mid and late 1990's, the situation clearly improved during the last years. [14]

Fig. 1. Trends of childhood mortality in Rwanda

Trends in Early Childhood Mortality Rates
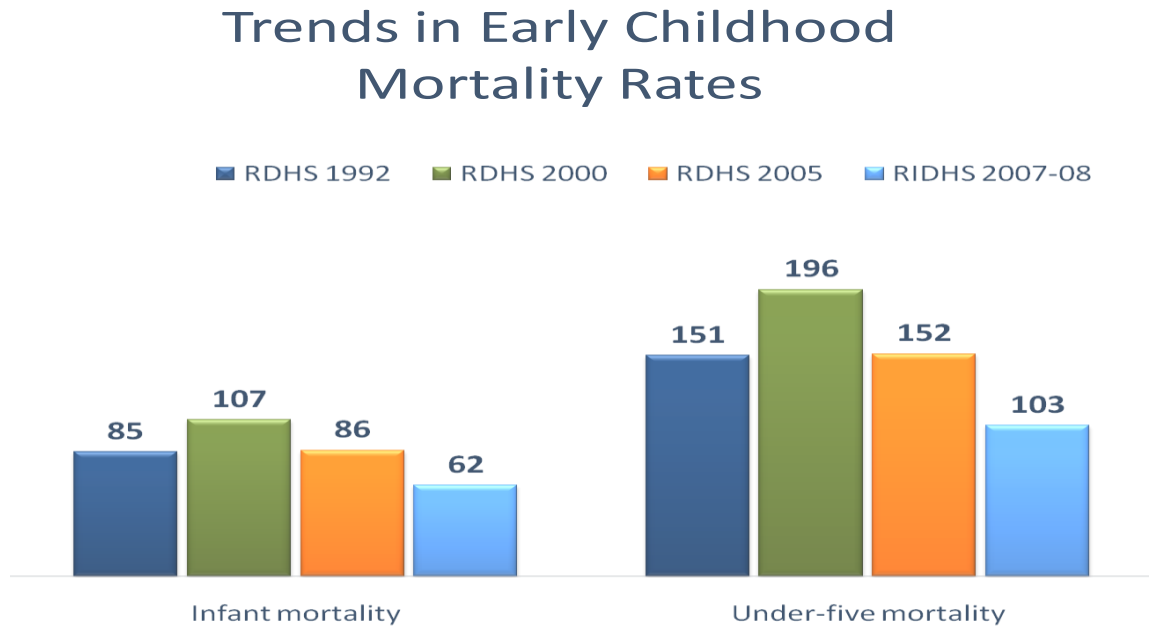
Fig.2. Mortality per children age level

The graph below indicated that the overall neonatal mortality rose to 28 deaths per 1000 live births in Rwanda **[4].**
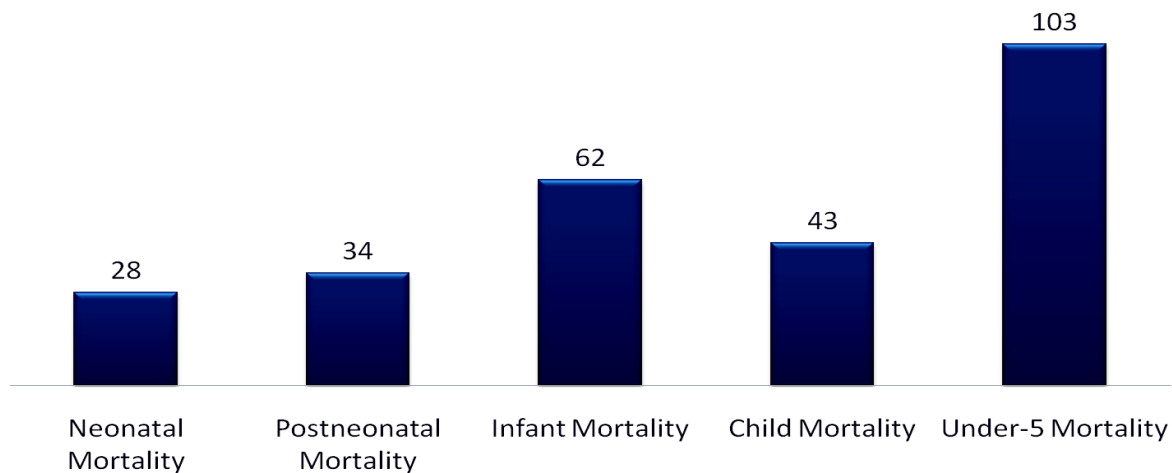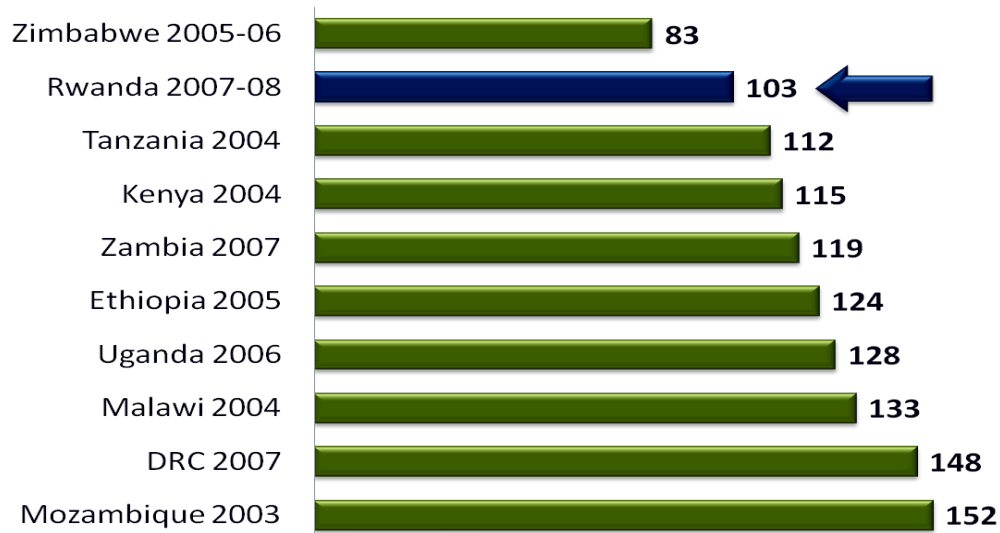
Childhood Mortality Levels

Fig.3. Situation of childhood mortality in certain African countries [4, 15].

How Does Rwanda Compare?
Under-five Mortality

c) **Sample size**

The present study consisted of all the cases of early neonatal deaths occurred at Gitwe hospital between the 1/1/2008 and 31/12/2010 (3 years), and is an exhaustive sample for this period (92 cases) **[17]**.

d) **Study Area and Study Population**

The Gitwe Hospital is one of the Hospitals of the Southern Province, which is located in the District of Ruhango, Bweramana Sector, Murama Cell. It is located at nearly 18 km of Nyanza Hospital, at approximately 25 km of Kirinda Hospital and at more or less 40 km of Kabgayi Hospital. The Gitwe hospital serves a target population of 262 821 people who are currently set out into 13 health centers as stated above **[17]**.

e) **Data Collection**

Data were collected using a grid of data-collection which allowed us to collect data on demographic, clinical and prognostic aspects of mothers and new-borns in particular. Maternity records and reference sheets from Health centres as well as portogram were consulted to provide us with information necessary to our present study.

f) **Data entry and data analysis**

The input of the text was made out using the Microsoft Word
2007 and tables were made using Microsoft Excel 2007. After data collection, these data were entered using Epi Info and then analysed by use of SPSS version 17.0 The comparison between the variables was made using Test of x^2, and difference is regarded as significant if the value of $p \leq 0.05$.

g) **Ethical Considerations**

The protocol of the present study was reviewed and approved by the school of public health. We protected the confidentiality and privacy of the subjects under the present study. Data collection and data entry have been done in confidentiality and privacy. The results are presented as aggregated data; no personal information is given.

III. RESULTS

a) Socio-demographic characteristic

The table below indicates that in total, 92 children were dead in the early neonatal period between 1/1/2008 and 31/10/2010. There were no twins. The majority of the mothers investigated are aged between 21 and 30 years (48.9%), 79.3% are farmers and 81.5% have primary education level. The table below gives more details.

Table 1: Socio-demographic Characteristics of study population

Characteristics of mother-child couples	Frequency	Percentage(%)
Age of the mother		
Inferior to 20 years	19	20.7%
Between 21 and 30 ans	45	48.9%
Between 31 and 40 ans	27	29.3%
Total	92	100%
Profession of the mother		
Government official	3	3.3%
Commercial/Trader	1	1.1%
Farmer	73	79.3%
Teacher	12	13.0%
Student	3	3.3%
Total	92	100%
Marital status of the mother		
Single	3	3.3%
Divorced	2	2.2%
Maried	87	94.6%
Total	92	100%
Education level of the mother		
Illiterate	1	1.1%
Primary	75	81.5%
Secondary	12	13.0%
Tertiary	4	4.3%
Total	92	100%

b) Characteristics of study population according to mode of childbirth, HIV status of the mother and sex of the child.

According to the table below, normal delivery mode of childbirth occupies the first place (67.4%), and 84,8% of mothers are HIV negative. Female sex occupies 62% of all new-born babies.

Table 2: Characteristics of study population according to mode of childbirth, HIV status of the mother and sex of the child.

Mode of childbirth	Prequency	Percentage(%)
Dystocic	23	25.0%
Eutocic	62	67.4%
Suction cup	7	7.6%
Total	92	100%
HIV Status of the mother		
Discordant	6	6.5%
Negative	78	84.8%
Positive	8	8.7%
Total	92	100%
Sex of the child		
Female	57	62.0%
Male	35	38.0%
Total	92	100%

c)Characteristics of the mothers according to the circumstances of death, mother related pathology, gravida, parity and antenatal care.

According to the results of our present study shows that neonatal infection occupies 38% while foetal distress accounts for 56.5% of the aetiologies of all death. Early neonatal death occurred in 39.1% for mothers with gravida between 1 and 2.

Table 3: Characteristics of mothers according to the circumstances of death, mother related pathology, gravida, parity and antenatal care

Characteristics of mother-child couples	Frequency	Percentage(%)
Circumstances of death		
Neonatal Infection	35	38.0%
Congenital malformation	1	1.2%
Prematurity	4	4.3%
Acute fetal distress	52	56.5%
Total	94	100%
Mother related pathology		
Consumption traditional herbs	2	2.2%
Eclampsia	1	1.1%
Sexually Transmitted Disease	2	2.2%
Late medical consultation	1	1.1%
Without disease	86	93.5%
Total	92	100.1%
Gravida		
Between 1 and 2	36	39.1%
Between 3 and 4	38	41.3%
Between 5 and 6	13	14.1%
Others	5	5.5%
Total	92	100%
Parity		
Between 1 and 2	52	56.5%
Between 3 and 4	20	21.7%
Others	20	21.8%
Total	92	100%
Antenatalcare(number of consultations)		
Between 0 and 2	65	70.7%
Between 3 and 4	27	29.3%
Total	92	100%

d)   Description of the early neonatal deaths and associated factors

d.a) Characteristics of new born deceased

As shown in the table below, deceased children had an APGAR between 0 and 5 in 71.7% of cases, and weight ranging between 2500g and 3600g in 67.4% of cases. For gestational age, the majority of mothers (60.9%) ranges between 36 and 39 week of amenorrhoea. For the age of death of the child: the majority of the children deceased (85.9%) are less than 2 days of life.

Table 4: Characteristics of new born deceased

Characteristics mother-child couple	Frequency	Percentage(%)
APGAR score		
Between 0 and 5	66	1.7%
Between 6 and 7	20	1.7%
Between 8 and10	6	.6%
Total	92	00%
Weight at Birth (grams)		
Inferieur to 2500	10	0.9%
Between 2500 and 3500	62	7.4%
Between 3600 and 4500	20	1.7%
Total	92	00%
Gestational Age (weeks of amenorrhea)		
Inferior to 36	19	0.7%
Between 36 and 39	56	0.9%
Superior to 39	17	8.5%
Total	92	00%
Death age of the child (days)		
Inferior to 2	79	5.9%
Between 2 and 4	12	3.0%
Between 5 and 7	1	.1%
Total	92	100%

d.b) Prevalence of early neonatal mortality

The early neonatal death rate is the number of infantile death within 7 days divided by the number of live births multiplied by 1000.

Table 5: Early neonatal mortality

Health Status	Frequency	Percentage (‰)
Deceased within 7 days	92	23,96‰
Alive (Number of live new borns)	3938	

Early neonatal mortality is 23,96‰ at Gitwe Hospital , that is 2,3%

d.c. Age of the death according to socio-demographic characteristics

The table below, 70,9% of children who died before 2 days of age had mothers who had underwent between 0 and 2 antenatal care visits and 66,7% of Children who died at the age of 2 to 4 days had mothers who had made between 0 et 2 ANC visits. There is no significant association between age of death and the number of antenatal care visits that the mother had made (*P*=0.775). As far as gravida is concerned; 40,5% of Children dying before 2 days of age have mother s with a gravida of 1or 2; and 41,8% of children dying before 2 days of age have mothers with a gravida of 3 or 4. Thus, there is no significant association between gravida of the mother and death age of the child. (*P* =0.799). In connection

with the sex, 64, 6 % of the children dying before 2 days of age are of female sex while 36.4 % of the children dying before 2 days of age are of female sex. There is no significant association between the age of death and the sex (*P*=0.2).

Table 6: Age of the death according to socio-demographic characteristics

Variables	Age of death (days)			Total	*P-value*
	Less than 2	Between 2 and 4	Between 5&7		
ANC (number of visits)					
Between 0 and 2	56(70.9%)	8(66.7%)	1(100.0%)	65(70.7%)	0.775
Between 3 and 4	23(29.1%)	4(33.3%)	0(0%)	27(29.3%)	
Total	79 (100%)	12 (100%)	1(100%)	92(100%)	
Gravida					
Between 1 and 2	32(40.5%)	4(33.3%)	0(0%)	36(39.1%)	0.799
Between 3 and 4	33(41.8%)	4(33.3%)	1(100.0%)	38(41.3%)	
Between 5 and 6	10(12.7%)	3(25.0%)	0(0%)	13(14.1%)	
Others	4(5.1%)	1(8.3%)	0(0%)	5(5.5%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	
Sex					
Female	51(64.6%)	5(41.7%)	1(100.0%)	57(62.0%)	0.230
Male	28(35.4%)	7(58.3%)	0(0%)	35(38.0%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	
Profession of the mother					
Government official	3(3.8%)	0(.0%)	0(0%)	3(3.3%)	0.883
Commercial/Trader	1(1.3%)	0(.0%)	0(0%)	1(1.1%)	
Farmer	64(81.0%)	8(66.7%)	1(100.0%)	73(79.3%)	
Teacher	9(11.4%)	3(25.0%)	0(0%)	12(13.0%)	
Student	2(2.5%)	1(8.3%)	0(0%)	3(3.3%)	
Total	92(100%)	12(100%)	1(100%)	92(100%)	
Marital status of the mother					
Single	2(2.5%)	1(8.3%)	0(0%)	3(3.3%)	0.835
Divorced	2(2.5%)	0(.0%)	0(0%)	2(2.2%)	
Married	75(94.9%)	11(91.7%)	1(100.0%)	87(94.6%)	
Total	79(99.9%)	12(100%)	1(100%)	92(100%)	
Education level of the mother					
Illiterate	1(1.3%)	0(.0%)	0(.0%)	1(1.1%)	0.843
Primary	66(83.5%)	8(66.7%)	1(100.0%)	75(81.5%)	
Secondary	9(11.4%)	3(25.0%)	0(0%)	12(13.0%)	
Tertiary	3(3.8%)	1(8.3%)	0(0%)	4(4.4%)	
Total	73(100%)	12(100%)	1(100%)	92(100%)	

The Table-7: The Table below shows that 87.5% of the children dying before 2 days of age were born from HIV negative mother while 5,1% of children who died before 2 days of age; were born from discordant couple. There is a significant association between the age of death of the child and the serologic status of the mother (*P*=0.003).

Table 7: Age of the death according to socio-demographic characteristics

Variables	Age of death (days)			Total	*P-value*
	Inferieur to 2	Between 2&4	Between 5& 7		
Mode of childbirth					
Dystocic	20(25.3%)	3(25.0%)	0(0%)	23(25.0%)	0.716
Eutocic	54(68.4%)	7(58.3%)	1(100.0%)	62(67.4%)	
Suction cup	5(6.3%)	2(16.7%)	0(0%)	7(7.6%)	
Total	72(100%)	12(100%)	1(100%)	92(100%)	
HIV Status of the mother					
Discordant	4(5.1%)	1(8.3%)	1(100.0%)	6(6.5%)	0.003
Negative	69(87.3%)	9(75.0%)	0(0%)	78(84.8%)	
Positive	6(7.6%)	2(16.7%)	0(0%)	8(8.7%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	
Age of the mother(years)					
Inferior to 20	17(21.5%)	2(16.7%)	0(0%)	19(20.7%)	0.237
Between 21 and 30	39(49.4%)	5(41.7%)	1(100.0%)	45(48.9%)	
Between 31 and 40	23(29.1%)	4(33.3%)	0(0%)	27(29.3%)	
Superior to 40	0(0%)	1(8.3%)	0(0%)	1(1.1%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	
Parity					
Between 1 and 2	44(55.7%)	7(58.3%)	1(100.0%)	52(56.5%)	0.906
Between 3 and 4	17(21.5%)	3(25.0%)	0(0%)	20(21.7%)	
others	18(22.8%)	2(16.7%)	0(0%)	20(21.7%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	
APGAR score					
Between 0 and 5	57(72.2%)	8(66.7%)	1(100.0%)	66(71.7%)	0.702
Between 6 and 7	16(20.3%)	4(33.3%)	0(0%)	20(21.7%)	
Between 8 and 10	6(7.6%)	0(0%)	0(0%)	6(6.5%)	
Total	92(100%)	12(100%)	1(100%)	92(100%)	

The results contained in this table below shows that there is a significant association between the age of death and the weight of The child at birth (*P*= 0,001) and again between the gestational age and the age of death of the child (*P*= 0,005). Children dying before the two days of age (2.5%) had mothers with STDs. There is a significant association between the death age of the child and STDs (*P* = 0.041).

e) Age of death according to the mode of childbirth, HIV status, age of the mother, the parity and the score of APGAR

The Table below shows that 87.5% of the children dying before 2 days of age were born from HIV negative mother while 5,1% of children who died before 2 days of age; were born from discordant couple. There is a significant association between the age of death of the child and the serologic status of the mother (*P*=0.003).

Table 8: Age of death according to the weight at birth, gestational age and mother related disease

Variables	Age of death (days)			Total	P-value
	Inferior to 2	Between 2&4	0.005Between 5&7		
Weight at birth (grams)					
Inferior to 2500	8(10.1%)	2(16.7%)	0(0%)	10(10.9%)	0.001
Between 2500 and 3500	53(67.1%)	8(66.7%)	1(100.0%)	62(67.4%)	
Between 3600 and 4500	18(22.8%)	2(16.7%)	0(0%)	20(21.7%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	
Gestational age (weeks of amenorrhea)					
Inferior to 36	16(20.3%)	3(25.0%)	0(0%)	19(20.7%)	0.005
Between 36 and 39	47(59.5%)	8(66.7%)	1(100.0%)	56(60.9%)	
Superior to 39	16(20.3%)	1(8.3%)	0(0%)	17(18.5%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	
Mother related disease					
STDs	2(2.5%)	0(0%)	0(0%)	2(2.2%)	
Consumption of traditional herbs	2(2.5%)	0(0%)	0(0%)	2(2.2%)	0.041
Eclampsia	1(1.3%)	0(0%)	0(0%)	1(1.1%)	
Late antenatal care visits	1(1.3%)	0(0%)	0(0%)	1(1.1%)	
Without disease	73(92.4%)	12(100.0%)	1(100.0%)	86(93.5%)	
Total	79(100%)	12(100%)	1(100%)	92(100%)	

f. Circumstances of death according to various variables

The table below shows that 46.2% of children dying of the acute foetal distress had been born from mothers aged 21 years to 30 years while 30.8% of the children dying of acute foetal distress had mothers of age ranging between 31 and 40 years. There is no significant association between studied circumstances of death and age of the mother (P=0.721), profession of the mother (p=0.964), marital status of the mother (p=0.668) and her education level (p=0.807).

Table 9: Circumstances of death according to various variables

Variable	Circumstance of death				Total	P-value
	AFD	Neonatal infection	Congenital malformation	Prematurity		
Age of the mother						
Inferior to 20 years	11(21.2%)	7(20%)	1(100%)	0(0%)	19(20.7%)	0.721
Between 21 and 30 years	24(46.2%)	18(51.4%)	0(0%)	3(75.0)	45(48.9%)	
Between 31 and 40 years	16(30.8%)	10(28.6%)	0(0%)	1(25.0%)	27(29.3%)	
Superior to 40 years	1(1.9%)	0(0%)	0(0%)	0(0%)	1(1.1%)	
Total	52(100%)	37(100%)	1(100%)	4(100%)	92(100%)	
Profession of the mother						
Government official	2(3.8%)	1(2.9%)	0(0%)	0(0%)	3(3.3%)	0.964
Commercial/Trader	1(1.9%)	0(0%)	0(0%)	0(0%)	1(1.1%)	
Farmer	40(76.9%)	28(80.0%)	1(100%)	4(100%)	73(79.3%)	

Teacher	6(11.5%)	6(17.1%)	0(0%)	0(0%)	12(13.0%)	
Student	3(5.8%)	0(0%)	0(0%)	0(0%)	3(3.3%)	
Total	52(99.9)	35(100%)	1(100%)	4(100%)	92(100%)	
Marital Status of the mother						
Single	3(5.8%)	0(0%)	0(0%)	0(0%)	3(3.3%)	0.668
Divorced	2(3.8%)	0(0%)	0(0%)	0(0%)	2(2.2%)	
Married	47(90.4%)	35(100.0%)	1(100.0%)	4(100.0%)	87(94.6%)	
Total	52(99)	35(100%)	1(100%)	4(100%)	92(100%)	
Education level of the mother						
Illiterate	1(1.9%)	0(0%)	0(0%)	0(0%)	1(1.1%)	0.807
Primary	41(78.8%)	29(82.9%)	1(100.0%)	4(100.0%)	75(81.5%)	
Secondary	6(11.5%)	6(17.1%)	0(0%)	0(0%)	12(13.0%)	
Tertiary	4(7.8%)	0(0%)	0(0%)	0(0%)	4(4.4%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100%)	

AFD **:** Acute Fœtal Distress.

g. Circumstances of Death according to HIV status of the mother, age of the mother and Sex child

As shown in the table below, 85.7% of children dying of neonatal infection had been born from HIV negative mothers while 8,6% of the dead children had been born from HIV positive mothers. There is no significant association between circumstances of death and the mother's serology of HIV (P= 0.833), sex of the child(p=0.810) and age of the mother (p=0.721).

Table 10: Circumstances of death according to HIV status of mother, sex of the child and age of the mother

variables	Circumstance of death				Total	*P*-value
	AFD	Neonatal infection	Congenital malformation	Prematurity		
HIV status of the mother						
discordant	3(5.8%)	2(5.7%)	0(0%)	1(25.0%)	6(6.5%)	0.833
Negative	44(84.6%)	30(85.7%)	1(100.0%)	3(75.0%)	78(84.8%)	
Positive	5(9.6%)	3(8.6%)	0(0%)	0(0%)	8(8.7%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100%)	
Sex of the Child						
Female	33(63.5%)	21(60.0%)	1(100.0%)	2(50.0%)	57(62.0%)	0.810
Male	19(36.5%)	14(40.0%)	0(0%)	2(50.0%)	35(38.0%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100%)	
Age of the mother						
Inferior to 20 years	11(21.2%)	7(20.0%)	1(100.0%)	0(0%)	19(20.7%)	0.721
Between 21 and 30 years	24(46.2%)	18(51.4%)	0(0%)	3(75.0%)	45(48.9%)	
Between 31and 40 years	16(30.8%)	10(28.6%)	0(0%)	1(25.0%)	27(29.3%)	
Superior to 40 years	52(1.9%)	0(0%)	0(0%)	0(0%)	1(1.1%)	
Total	103(100%)	35(100%)	1(100%)	4(100%)	92(100%)	

AFD : Acute Fœtal Distress

The table below shows that 11,4% of children who died following early neonatal infection were born at 36 weeks while 74,3% children of the same group were born between 36 and 39 weeks. There is a significant association between circumstances of death and gestational age of the mother ($P = 0,001$)

Table 11: Circumstances of death gravida, parity, weight at birth, gestational age and death age of the child

variable	Circumstance of death				Total	p-value
	AFD	Neonatal infection	Congenital malformation	Prematurity		
Gravida						
Between 1 and 2	19(36.5%)	14(40.0%)	1(100.0%)	2(50.0%)	36(39.1%)	0.886
Between 3 and 4	20(38.5%)	16(45.7%)	0(.0%)	2(50.0%)	38(41.3%)	
Between 5 and 6	9(17.3%)	4(11.4%)	0(.0%)	0(.0%)	13(14.1%)	
Others	4(7.7%)	1(2.9%)	0(.0%)	0(.0%)	5(5.5%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100%)	
Parity						
Between 1 and 2	27(51.9%)	22(62.9%)	1(100.0%)	2(50.0%)	52(56.5%)	0.131
Between 3 and 4	12(23.1%)	7(20.0%)	0(.0%)	1(25.0%)	20(21.7%)	
Others	13(25.0%)	6(17.1%)	0(.0%)	1(25.0%)	20(21.7%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100%)	
Weight at Birth(grams)						
Inferior to 2500	2(3.8%)	4(11.4%)	0(.0%)	4(100.0%)	10(10.9%)	0.051
Between 2500 &3500	38(73.1%)	23(65.7%)	1(100.0%)	0(.0%)	62(67.4%)	
Between3600 & 4500	12(23.1%)	8(22.9%)	0(.0%)	0(.0%)	20(21.7%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100%)	
Gestational Age						
Inferior to 36	10(19.2%)	4(11.4%)	1(100.0%)	4(100.0%)	19(20.7%)	0.001
Between 36 and 39	30(57.7%)	26(74.3%)	0(.0%)	0(.0%)	56(60.9%)	
Superior to 39	12(23.1%)	5(14.3%)	0(.0%)	0(.0%)	17(18.5%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100.1%)	
Death Age of the child						
Inferior to 2 days	45(86.5%)	29(82.9%)	1(100.0%)	4(100.0%)	79(85.9%)	0.870
Between 2 and 4 days	7(13.5%)	5(14.3%)	0(.0%)	0(.0%)	12(13.0%)	
Between 5 and 7 days	0(.0%)	1(2.9%)	0(.0%)	0(.0%)	1(1.1%)	
Total	52(100%)	35(100%)	1(100%)	4(100%)	92(100%)	

IV. DISCUSSION

a.1. The prevalence of early neonatal mortality

The prevalence of early neonatal mortality is of 23.9‰ of our present study entitled the profile of early neonatal death at Gitwe hospital. Our results are lower compared to those of a study done at Muhima hospital on factors of neonatal mortality in 2006 whereby it was found that early neonatal mortality was 156‰. This is probably due to the fact that Muhima Hospital is a referral Hospital. [19,20]. A study done in Tunisia from January 2007 to December 2008 at hospital Charles Nicole de Tunis on evolution of the incidence of neonatal mortality had shown an early neonatal death rate of 10.8 ‰.This is lower than our results (23.9‰) for several reasons including among others modern medicine, sufficient personnel and better management of new-born babies etc. [21]

In Nepale; early neonatal mortality is of 28.6‰. This arises from a study entitled Risk factors of early neonatal mortality in Sarlihi District [22]. This result is higher than those found by our present study.

b.2.Description of deaths and associated factors
b.2.1. Principal pathologies associated with neonatal mortality
c.3. Description of deaths and associated factors

Our present study results show that foetal distress (56.5%) neonatal infection (38.0%) and prematurity (4.3%) are the principal causes of death. In majority of developing countries causes of deaths are almost the same: Alihonou E, (1991) in his study done at Cotonou, quotes prematurity, foetal distress and materno-foetal infection as the direct causes of neonatal mortalities [23, 24].

4.4.Weight at Birth

Accord Our results show that 10.1% of the children who died before the age of 2 days, had weight lower than 2500g and 73,1% of the children had 2500g and 3500g (P = 0.001).Thus , it was shown that there is a significant association between the weight of birth and early mortality (see Table N°. 8).

According to Alihonou (Bénin, 1991), weak birth weight is a risk factor of neonatal mortality. The frequency of death of the new-borns having a weight lower or equal to 1500 g is 80.6%, and it is of 7.9% in new-borns having a birth weight ranging between 1500 and 2500 g. It is 2.2% in new-born babies whose birth weight is higher than 2500 g [23]. BOBOSSI (Central Africa, 1999) states that neonatal mortality at small birth weights are of 34.88% [25]. According to study done by Diallo S. (Guinea,1998), 60.19% of death had a weight lower than 2500g [22].

Mutombo K. (Ivory Cost, 1993), indicates that 35.6% of new-born babies with a birth weight lower than 2500 gr died [24]. In the study of CISSE CT, 52.2% of deaths had a weight lower than 2500 gr [18]. The study of BOBOSSI S G (Bangui RCA, 1999) indicates that weak birth weight is 52.5%. The frequency of death is of 41.3% in new-born babies whose birth weight is lower than 2500 g, and that it is 63.13% in the new-borns whose birth weight is lower than 1500 g [23]. In the United States of America, more than 50% of neonatal deaths occur among new-borns weighting less than 1500 g [16].

d.5. APGAR Score

Our present study results shows that early neonatal mortality is not associated with APGAR Score (P=0.702). Death Frequency is of 72.2% in children who died at the age of 0 and 2 days with an APGAR score of 0 and 5 (see Table 7).

According to CISSE C.T, 94% of early neonatal death had an APGAR score inferior or equal to 7. These results are higher than those found by our work. This could be explained by a bad monitoring of the women during work and during the childbirth. This could also be due to pulmonary immaturity related to prematurity [27].

d.4. Antenatal Care

Our present study results show that 70.9% of children who died before 2 days of age, had mothers having made between 0 and 2 antenatal visits (P = 0.775)[Table 7].This is almost similar to a study done by MAH, LD and Coll on neonatal mortality at UTH Kara (TOGO) whereby it was found that mothers whose children died, had underwent at least 3prenatal care visits [28].

V. CONCLUSION AND RECOMMENDATIONS

a.1. Conclusion

Early neonatal mortality still remains high (2.3%) in Gitwe hospital. The principal causes of early neonatal mortality deaths at Gitwe hospital are acute foetal distress, neonatal infection and prematurity and congenital malformation. The factors associated to early neonatal mortality (p≤ 0.05) are: weight at birth, gestational age, mother related disease and HIV status of the mother. In order to reduce early neonatal mortality in Gitwe hospital, it would be necessary:

- To improve the quality of management of new-borns
- To improve the management of childbirth so as to reduce neonatal deaths resulting from a bad APGAR score and acute foetal distress.

To create and equip a neonates unit for better management of new-borns.

b.2. Recommendations
b.2.1. To authorities of Gitwe Hospital

- To equip maternity and paediatry departments with incubators, material of reanimation of the new-born baby.
- To hire mid-wives so as to improve quality of the care exempted to the new-born babies who present difficulties at birth.

c.3. To healthcare providers

Educate pregnant women during consultations in Health centers on adhering to antenatal care recommendations, (at least 4 standard visits),

Ensure women are provided with information on risk factors,

For a more comprehensive documentation of the subject, we would recommend a complementary study on early neonatal mortality in the catchment area of Gitwe hospital.

g.6. Authors 'Contributions

- Ndagijimana Samuel, MD. MPH, participated in the data collection, took part in the analyses and interpretation the first draft of the paper.
- Tegera Mpamya Frederic B.Sc. MPH, conceived, participated in the design and coordinated and critically revised and reviewed and wrote the first manuscript and corresponding author.
- Nzayirambaho Manassé MSc. PhD, participated in the designing of the study and statistical analysis, critically revised the paper and analytically reviewed the study for significant intellectual contents. All authors read and approved the final paper.

h.7.Competing Interest

The authors declare that they have no competing interest

i.8.Ethics approval and consent to participant
Not applicable

j.9. Funding
Not applicable

REFERENCES

[1] G. O. Young, "Synthetic structure of industrial plastics (Book UNICEF, Maternal and Newborn Health United Nations Plaza, New York, NY 10017, United States, 2008.

[2] Raatikainen K, et al., Under-attending free antenatal care is associated with adverse pregnancy outcomes. BMC Public Health 2007; 7: 268.

[3] AO Atteby JJ, et al.,(2016), Mortality and morbidity of premature infants at the Treichville University Hospital (Abidjan) RCI Médecine d'Afrique Noire Volume 50 - n ° 3 - March 2003 - pages 136-138.

[4] Enoh Jes et al.(2004), Mortality and morbidity of preterm infants at Treichville University Hospital (Abidjan) RCI Médecine d'Afrique Noire 2003; 50: 137.

[5] Otchere S et al.,(2001), Bringing Care Closer to Mothers and Newborns: using the Gap Analysis Tool to develop a home to hospital continuum of care. Washington, DC, Save the Children; 2005.

[6] Kouakou K.P. et al., 2006)Fetal-maternal prognosis of non-maternity births: about 124 cases collected at the Regional Hospital Center of Aboisso (Côte d'Ivoire) in Rev. Int. Sc. Med. Vol.8, No., p. 33-39.

[7] Lawn J E,et al., (2005). 4 million neonatal deaths: When? Where? Why? Lancet 2005; 365:
891-900.

[8] Muhima Hospital (Kigali) 2006 Annual Report.

[9] ONAPO, NISR [MOH, MINICOFIN, ORCMICS-USA] (1993,2001,2006,2009, -20011),
RDHS of 1992, RDHS of 2000, RDHS of 2005, RDHS of 2007-2008, RDHS of 2010.

[10] Ornella L. Seipati M. Patricia G. and Stephen M. (1999), Antenatal care in: Opportunity for Arica's newborn.WHO publication, p.51-62.

[11] A. Bezzaoucha · A. El Kebboub · A. Aliche: - Evolution of neonatal mortality at the Blida University Hospital (Algeria) from 1999 to 2000,

[12] Hill K, ei al.,(2006): Neonatal mortality in the developing world. Demographic Research ,14: 429-452.

[13] Muhima Hospital (Kigali) Annual Report 2006.

[14] MINISANTE, Demographic and Health Survey, Rwanda 2007-2008,1doc.334p.

[15] Brown CA, et al.,(2008) Antenatal care and perinatal outcomes in Kwale district, Kenya. BMC Pregnancy and Childbirth.

[16] Gitwe District Hospital Strategic Plan, 2013-2018.

[17] MUTOMBO T. (1993), Neonatal Mortality in a Rural Hospital: Case of the Dabou Protestant Hospital (Ivory Coast).

[18] Neonatal mortality factor at the hospital of MUHIMA, KIGALI / RWANDA (January 2006 - December 2006).

[19] Muhima Hospital (Kigali) 2006 Annual Report.

[20] United Nations Mellenium development goals, visit www.unmillenniumproject.org/goals, on 25th, May 2012.

[21] Joanne Katz et al (2003), Risk for eary infant mortality in Sarhali Distict, Nepal

[22] Alihonoue E. et al. (1991), Neonatal Mortality in the National Hospital and Hospitals and University of Contonou; Incidence, cause and means of illness.

[23] Lansac J, et al.,(1992) practice of delivery, paris, SIMEN, P349.

[24] A. Bezzaouchaet et al., (2008), Evolution of neonatal mortality at the Blida University Hospital (Algeria) from 1999 to 2000.

[25] Åhman, et al (2004) Neonatal and Perinatal Mortality: World Health Organization-Geneva, Department of Making Pregnant Safer 2005.

[26] Cisse.CT et al. (1996), Early neonatal mortality in Dakar CHU maternity; Current situation and trends between 1987 and 1994.

[27] Agbere A.D. et al (1998), Neonatal Mortality in the Pediatric Department at the Sokode Regional Hospital (Togo) in 1984-1985 and 1994-1995. Medicine of black Africa.

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