

## The Risk Factors Of Neonatal Mortality In The Neonatology Unit Of The North Kivu Provincial Hospital In Eastern Democratic Republic Of Congo Etude Des Facteurs Des Risques De La Mortalite Neonatale Au Sein De L'unité De Neonatologie De L'hôpital Provincial Du Nord-Kivu A L'est De La Republique Democratique Du Congo

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**Résumé :** La mesure du taux de la mortalité néonatale est un indicateur sensible, fiable de l'efficacité et qualité des soins obstétricaux et néonataux ainsi qu'au progrès réalisé en matière de réduction de décès néonataux dans un établissement sanitaire surtout dans les pays à ressources limitées dans le domaine de la santé. L'objectif de notre étude était d'identifier et analyser les différents facteurs des risques des décès néonataux dans notre milieu d'étude. Cette recherche est transversale et couvre la période allant du 1<sup>er</sup> Janvier 2010 au 31 décembre 2013. Elle se déroule à l'unité de néonatalogie de l'hôpital provincial du Nord-Kivu qui est une institution sanitaire du niveau intermédiaire. Cette étude révèle une fréquence de mortalité néonatale de 19,7 % due à la prématurité à 51,9% et favorisée par un jeune âge des nouveau-nés inférieur à 34 semaines (OR : 2.11 ; IC 95 % : 0.59 – 7,75) et chez les mères par leur jeune âge inférieur à 25 ans (OR : 1.460 ; IC 95 % : 0.55 – 2.78), Les CPN inférieures à 4 (OR : 9,630 ; IC 95% : 1,89-59,76) une IUG récente avant accouchement (OR : 3,85 ; IC 95% : 0,82-20,11) et l'indigence des parents (OR : 2.11 ; IC 95 % : 0.59 – 7,75). Accorder les soins de qualité obstétricaux prénatals, natals et post-natals réduirait le taux de décès néonataux.

**Mots Cles:** Facteursrisques, Nouveau-né, Décès Néonatal.

### Abstract:

The neonatal mortality rate is an indicator of the quality of the obstetrical and neonatal care and as well as progress realized in reducing neonatal deaths in resource limited countries. The objective of our study was to identify and analyze the different risk factors for neonatal deaths in our study environment. This research is cross-sectional and covers the period from 1 January 2010 to 31 December 2013. It is conducted at the Neonatology Unit of the North Kivu Provincial Hospital, which is an intermediate-level health institution. This study revealed a neonatal mortality rate of 19.7% due to prematurity at 51.9% and favored by a young infant age of less than 34 weeks (OR: 2.11, 95% CI: 0.59-7, 75), and in mothers by their young age less than 25 years (OR: 1.460, 95% CI: 0.55-2.78), poor antenatal care more less than 4 (OR 9.630, 95% CI 1.89-59.76) (OR: 3.85, 95% CI: 0.82-20.11) and poverty (OR: 2.11, 95% CI: 0.59 - 7.75).

According quality prenatal, natal and postnatal obstetric care would reduce the rate of neonatal deaths.

**Key Words:** Risk factors, newborn, neonatal death

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## I. Introduction

Neonatal mortality remains a public health problem and a major concern of the pediatrician worldwide [1]. It accounts for over 60% of the deaths of children who die before their first birthday [2]. Of the 130 million newborns recorded in 2013, 4 million died of preventable causes in the neonatal period; 75% of this death occurs during the first week of life [3-7]. 98% of these neonatal deaths are observed in developing countries where the neonatal mortality rate is greater than 45 deaths per 1000 live births compared to 4 deaths per 1000 live births in developed countries [8].

In sub-Saharan Africa, 1.6 million newborns die each year during their first month of life and an additional one million are stillbirth[9]. Neonatal mortality in sub-Saharan Africa is one of the highest in the world and it represents up to 40% of infantile deaths. The majority of newborn deaths occur in developing countries where access to health care is low. Most of these newborns die at home, without skilled care that could greatly increase their chances for survival in African continent [10]. The neonatal mortality rate in Africa varies from 7 deaths per 1000 live births in Egypt to 50 deaths per 1000 live births in Somalia in 2013 [11].

The Democratic Republic of Congo (DRC) ranks third among African countries with a high neonatal mortality rate more than 45 deaths per 1000 live births [11]. In 2010, Kateng G. and al [12], reported 36.9% incidence of neonatal deaths related to late transfers of neonates from peripheral maternity hospitals to 53.3% compared with 26.6% for newborns in the institution. These authors identify the prematurity followed by neonatal infections respectively at 57.8% and 18.1% as causes of neonatal deaths in Lubumbashi. In the same city of Lubumbashi, Katamea T and al. [13]; in a similar study; found an extra-hospital neonatal transfer rate of 12.9%. In this study, neonatal mortality is significantly related to the profession or mother-worker, at the high level of education; at gestational age <37S and vaginal delivery vaginally. On the other hand at the newborn, at the male sex of the newborn; birth weight <1500grams and prematurity. These authors conclude that newborns die from avoidable causes in more than 70% of cases if special attention is given to pregnant women [14] In 2014, at the North Kivu Provincial Hospital in a Mashako R.M et al. [15] report in their study a frequency of neonatal intra-hospital mortality of 28.6%, mainly due to the complications of low birth weight at 69.5% and neonatal infections at 18.6%. Some risk factors have been identified but not analyzed. One of the eight millennium development goals (MDGs) fixed by the United Nations in 2005, was to reduce the mortality rate of children under five by 2/3 by the year 2015. Such reduction can only be possible through the reduction of neonatal mortality which represents up to 40% of infantile deaths. The present study conducted in an aims to analyze the different risk factors determining neonatal deaths related to newborns and their mothers in our environment.

## II. Patients And Methods

Our study is transversal, it focuses on the analysis of risk factors for neonatal deaths during our period from January 1, 2010 to December 31, 2013. It takes place in the east of the Democratic Republic of Congo, North Kivu province, Goma city to the neonatology unit of the North Kivu Provincial Hospital), which is one of the reference health facilities for mother and child health care in North Kivu. It receives patients from other general hospital in this party of Democratic Republic of Congo; the neonatology unit is divided into two sections; one section for preterm infants with 11 incubators and the other section for term neonates with a capacity of 10 cots. The service is taken care of by 2 pediatricians, 6 general practitioner, and 18 nurses.

Enrolled in this study were all newborns admitted in the neonatal unit of this hospital, and who died during hospitalization within 28 days of life. Newborns admitted in this unit and discharged alive after management were the controls. The cases and controls were matched for gestational age  $\pm 2$  weeks of amenorrhea. Excluded from the study were neonates admitted during the study period but who died or were discharged alive after 28 days of life, and also files with insufficient data

Exhaustive and of convenience was being our collected technical. We included in these study 183 neonatal deaths (Cases) and 366 survivors newborns and their mothers. Inclusion criteria for the cases were singleton newborn infants who died in the neonatal period (1–28 days after birth) in our study period. Two controls were matched for each case on the basis of sex, locality, and nearest 1 week of childbirth. Exclusion criteria were twins, stillbirths, infants born after 28 days

The variables collected data collected from medical records of newborns admitted in the neonatal unit were for the mother: maternal age, infectious urogenital history during pregnancy, past history of urogenital infection during pregnancy, socio-economic level and for the newborn: age, sex, birth weight and Apgar the age at admission, the sex, Apgar score at the 5th minutes. Data were entered and saved on Excel 2010 word, processing was done on Microsoft world 2010 and analyzed in the IBM SPSS version 20.0 software. The statistical significance level was  $P$  value <0.05 for the Odds ratio (OR) with its confidence interval (CI) at 95% were used to assess the risk of an association. The factors significantly associated with neonatal mortality in the bivariate analysis further underwent multivariate analysis with logistic regression.

Ethical clearance was obtained from the Ethics Committee of the hospital, and the data were kept confidential.

### III. Findings

**Table N° I : Newbornriskfactors**

<b>Factors</b>	<b>Cases</b>	<b>Survivors</b>	<b>newborns</b>	<b>OR IC 95%</b>
N=183(100%) N=366				
<b>Years (weeks) :</b>				
<=33	118(64,5)	169	2,11	(0,59-7,75)
>33	65 (36,5)	197		
<b>Sex :</b>				
Males	107(58,5)	197	1,23	(0,52-2,71)
Females	76 (41,5)	171		
<b>Weights (grammes) :</b>				
<=1500	67(36,6)	121	1,17	(0,58-2,77)
>1500	116 (63,4)	245		
<b>Score Apgar :</b>				
<7	24(13,1)	45	1,07	(0,40-2,59)
>=7	159 (86,9)	321		

An analysis of this table revealed that the age of the newborn inferior to 33 weeks OR = 2.11 (0.59 - 7.55), low birth weight OR=1,17(0,58-2,77) and male sex OR=1,23(0,52-2,71) was risk factors associated with newborns

**Table N°II Maternalfactors distribution associatedwithneonatalmortality**

<b>Factors</b>	<b>Cases</b>	<b>Survivor</b>	<b>OR IC a 95%</b>
<b>Age(Years)</b>			
<=18	114	194	1,460(0,55-2,78)
>18	69	172	
<b>Antenatal care</b>			
<=3	129	73	9,630(1,89-59,76)
>3	54	293	
<b>UGI(*) :</b>			
Yes	107	98	3,85(0,82-20,11)
No	76	268	
<b>Poverty</b>			
Yes	36	43	1,83(0,56-4,17)
No	147	323	

The application of the odds ratio in our research found that maternal **age <25**, OR = 1.46 (0.55 - 2.78) the number of antenatal care ≤ 4 OR = 9.630 (1,89-59,76), urogenital infection during the third trimester of pregnancy OR = 3.85 (0.82-20.11) and poverty OR = 1.83 (0.56-4 , 7) was strongly associated to the risk of death in our series.

### IV. Discussion

To address UN Millennium Development Goal 4 on reducing childhood mortality, there is a need for better population-based data on the rates and causes of neonatal death. Our population-based study provided a rare opportunity to obtain reliable information on the rate, timing and direct cause of neonatal death. Despite the progress made in neonatology today [16], the frequency of neonatal mortality observed at the North Kivu provincial hospital remains significant during our study period 183 deaths out of 927 neonates admitted to the neonatology unit , In this study the intra-hospital neonatal mortality was 19,3 %. However, it is low than the University Clinics of Lubumbashi rate where it is 36.9% [12]. Low rates were noted in sub-Africans countries by Kouate and al. [17] 15,3 %, Kisito N and al. [18] 13,1 % ; Mah and al [19] 10% and Chiabi and al. [20]9,8 %.the reasons for this difference in frequency have not been established in this study. True, it is related to sample variability, size, and location of study that differs. Nevertheless, it is important to note that the 19.7% incidence of neonatal death recorded in our study is underestimated and does not necessarily reflect reality as our study does not take into account neonatal deaths at home after release of newborns from the North Kivu Provincial Hospital. This could be due to poverty and ignorance prevailing in these countries which limit access

to antenatal, intra-partum and postnatal care. The majority of the dead babies were of the male sex 58,5 % with a sex ratio of 1.4. Haon et al, and Ndiaye and al had similar results respectively 1.05 and 1. The male predominance amongst the dead neonates has also been described by several authors[38,397]

Various causes of neonatal death were identified in our study, including preterm birth 51.9%, neonatal infections 27.9%; asphyxiation 7.7%; congenital malformation 7.7% and other causes in 4.8% of cases. These results are consistent with WHO reports on the causes of neonatal death in developing countries and also with other reports from Sub-African countries[21-24]. In Cameroon, at a level-one maternity hospital in Yaoundé; Chelo and col. [25] identify 75% neonatal asphyxia and 25% prematurity as causes of neonatal death. This order of causes is close to that reported by Hafizur et al. [26] in Bangladesh in 2010. These authors noted in their study that 45% asphyxia, 20.5% neonatal infections and 15% prematurity were the most implicated causes in neonatal deaths. These authors assert that the low rate of prematurity observed in their study is related to the intubation respiratory support made according to the degree of prematurity but also the decrease in the frequency of neonatal infections due to the prevention of tetanus during the pregnancy. The high frequency of asphyxia would translate into insufficient practice of monitoring labor and even during pregnancy, but also the poor neonatal resuscitation technique. These same explanations can be valid in our circles. Mah and al. [19] and Chiabi and al. [20] in 2014, report the same causes of neonatal deaths in different proportions but identical to the causes described in our study. They found neonatal infections at 16% and birth defects at 10.5% for the first authors as neonatal deaths, while neonatal infections at 60.2%, preterm birth at 42.6%, and neonatal infections at 60%. asphyxia at 37.4% and congenital malformations at 11.8% similar to the findings of Froen et al. [27] on the other hand Tachiweyika et al [28] in Zimbabwe blame the complications of home birth work and prematurity as causes of neonatal deaths in their study. The early neonatal period is a delicate period because it is a period of transition between the intra-uterine and extra-uterine environment. At this age, the neonate is fragile with a weak immune status and body systems not quite adapted to the extra uterine environment, and therefore very susceptible to infections which can be fatal.

#### **Risk factors associated with newborn:**

An analysis of the various risk factors associated with newborns revealed that the age of the newborn inferior to 33 weeks OR = 2.11 (0.59 - 7.55), low birth weight OR=1,17(0,58-2,77) and male sex OR=1,23(0,52-2,71) was a risk factor. This observation has also been noted by several authors' these neonates are at higher risk of asphyxia, sepsis, hypothermia and feeding problems. Besides, common diseases tend to be more severe and long-lasting in these neonates than in those with normal birth weights' Other studies in Africa[29-31] Iran[39],Brazil[40]and the Palestine[41]also noted that low birth weight was a risk factor for neonatal mortality. Prematurity is one of the main causes of low birth weight, but in this study it was not found to be a risk factor for neonatal deaths. A likely explanation for this could be due to the fact that the cases and controls were paired for gestational age plus or minus one week.

#### **Maternal risk factors associated with neonatal death:**

The application of the odds ratio in our research found that maternal **age <25**, OR = 1.46 (0.55 - 2.78) the number of antenatal care  $\leq 4$  OR = 9.630 (1,89-59,76), urogenital infection during the third trimester of pregnancy OR = 3.85 (0.82-20.11) and poverty OR = 1.83 (0.56-4 , 7) was strongly associated to the risk of death in our series. A similar finding has been noted by other authors.[13],Katamea T and al. identifies maternal age below 25 as a maternal factor significantly ( $p < 0.05$ ) associated with neonatal death; with an average maternal age of  $25.5 \pm 6.6$  years close to that of  $28.2 \pm 5.4$  years observed in Vietnam [32] which is the same as that of  $28.3 \pm 5.9$  years reported by Nagalo K. col [18]. This age difference observed is probably due to the mix of samples studied by the above-mentioned authors and the study environments. As for the number of antenatal cares less than 4, KedyKoum et al [2] and Mohammad et al [6] recorded similar results in our study with a statistically significant difference ( $P < 0.05$ ); This is an irrefutable proof of the importance of the sufficient number followed-up pregnancies, which is essential for the harmonious growth of the fetus. Several authors [33, 34] report that an average of 4 well-structured antenatal care is sufficient and effective in improving the obstetric and neonatal outcome of the mother-child relationship in underdeveloped countries [35]. It is difficult in our study to certify the regularity of women reporting an antenatal care number greater than 3 because there is a significant number of deliveries that took place outside the North Kivu Provincial Hospital. Sometimes without antenatal care records. Maternal urogenital infection during the last trimester of pregnancy significantly influences neonatal death. Habzi A. and al. [36] records the same observations in their study. Indeed, maternal genital infection during pregnancy would increase the risk of premature rupture of membranes and premature labor, one of the major causes of neonatal mortality. It should be noted that neonatal mortality in our study is also influenced by the low socio-economic level (indigence) of parents. This factor is often associated with maternal undernutrition, micronutrient deficiency and various obstetrical complications that justify an unfavorable neonatal prognosis [37] as we note in our study.

## V. In Conclusion,

This study noted that neonatal mortality was influenced by maternal factors (Maternal age, number of antenatal care; urogenital infection and poverty) and neonatal factors (low birth weight, sex and newborn age). Sensitization of pregnant women, through information-education-communication, on the importance of antenatal care for early detection and appropriate management of high-risk pregnancies could help reduce neonatal mortality. The technical platform for proper management of congenital malformations in this setting should be improved, and as well as building capacity of health personnel to adequately manage high risk neonates with infections, prematurity, asphyxia and low birth weight of Congolese children in general and particular at North Kivu provincial Hospital.

### Conflicts of interest and authors' contributions:

The authors of this article do not declare any conflict of interest, all participated in the collection, analysis of data and writing or correction of the manuscript.

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