JMS 2020;3(3):3-12
UDC:618.39-036.88(497.7)"2011/2017"

PREMATURITY AND LOW BIRTH WEIGHT PARTICIPATION IN NEONATAL DEATHS AT GYNAECOLOGY AND OBSTETRICS CLINIC IN SKOPJE IN THE PERIOD OF SEVEN YEARS

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Abstract

Most of the neonatal deaths at NICU, in the neonatal period of life 0-28 days after delivery are results of preterm births and complications from prematurity. Preterm birth is a birth before 37 g.w. of pregnancy. Neonatal mortality is a death among live- born new-borns in the first four weeks of life after delivery. Prematurity and low birth weight significantly participate in neonatal deaths at NICU.

The purpose of the study is to show the participation of prematurity and low birth weight in neonatal mortality, between new-borns admitted and treated at NICU at the GOC-Skopje, in the period of seven years.

The retrospective analysis showed the participation of prematurity and low birth weight in neonatal mortality at NICU, at GOC- Skopje in the period of seven years- 2011-2017. The data was collected from the Data basis of NICU and medical histories of new-borns at NICU, during this period.

In the period of seven years there were 36706 live-born new-borns at GOC-Skopje. 4810 of them or 13.18% were admitted and treated at NICU. Neonatal mortality at NICU in the seven years period was 912 new-borns, or 19% from all neonates admitted at NICU. Most of them 867, or 95% of neonatal deaths were preterm births or new-borns delivered before 37 g.w. of pregnancy. The leading causes for neonatal death in new-borns treated at NICU were complications due to prematurity and low birth weight in new-borns, in the period of seven years 2011-2017.

Prematurity and low birth weight participate in the most of neonatal deaths at NICU and should be prevented in the future.

Key words: low birth weight, prematurity, preterm birth, neonatal mortality, GOC-Skopje, NICU

Introduction

More than 15 million new-borns are born preterm in the world, before 37 weeks of gestation, every year. It is more than 10% of all new-borns worldwide [1]. Preterm birth is a significant factor in mortality among children who are under five years of age, and the leading cause of neonatal mortality in first four weeks of life, due to the complications associated with preterm births [2].

Preterm birth has an essential role in the mortality and morbidity among new-borns. In 2015, the World Bank reported that 85% of the neonatal mortality occurring globally, is contributed by preterm births [3].

Preterm birth is a major cause of mortality, but also a major contributor to neonatal morbidities and morbidities late through live [4]. There is significant morbidity among some survivors including brain and nervous system problems, problems with behaviour, learning, understanding and social skills, visual and hear disorders, lung and kidney problems , digestive problems and secondary effects in long term health [5,6,7]. These morbidities have substantial consequences to the families, society and the health system [8].

Preterm birth can be classified based on gestational age as extremely preterm birth (less than 28 weeks of pregnancy), very preterm (between 28 and 32 weeks), moderate (between 32 and 34 weeks), and late preterm (34 to 36 weeks) [9]. Almost one million children die every year from the complications of preterm birth [1].

Prematurity and preterm birth complications are the leading cause for neonatal deaths in the neonatal period and in children under 5 years of age.

The number of preterm births is increasing in almost all countries, especially in low-income and developing countries, where more than 60% of preterm births occur. 12% of babies are born preterm in low-income countries, compared to higher-income countries, where 9% are born as preterm.

The difference in survival of premature babies in low and high-income countries is significant. More than 90% of extremely preterm new-borns (born before 28 weeks) die in the first few days of live in low-income countries, while only about 10 % of extremely preterm new-borns die in high-income countries [1, 2].

Infections during pregnancy, multiple pregnancies, chronic conditions in pregnant women such as high blood pressure and diabetes are the common causes of preterm birth. Sometimes no causes are identified. Premature births before 37 weeks of pregnancy and foetal growth restriction are the most common causes for low birth weight in new-borns.

Due to the fact that many premature babies are born with low birthweight, many risk factors for preterm labour and premature birth are the same, as for having a low birthweight baby: preterm labour; chronic health conditions of the mother (high blood pressure, diabetes, heart, lung, kidney problems); age of the mother; some medicines used during the pregnancy; infections in pregnancy; placental problems; multiple pregnancies; low socio-economic status; smoking; drinking alcohol [10].

These babies have more health problems and need special care in hospital intensive care units (NICU). They suffered from breathing problems such as respiratory distress syndrome (RDS); intracranial haemorrhage; patient ductus arteriosus; necrotizing enterocolitis (NEC); retinopathy (ROP); jaundice and neonatal infections and sepsis [11].

Consequences from those conditions later in live are intellectual disabilities, metabolic syndrome, obesity, high blood pressure, compromised immunity.

The association between neonatal mortality and new-borns birth weight is inversely proportional and the probability of death decreases as the weight increases. New-borns due to birth weight on delivery are divided into: neonates with extremely low birth weight <1000 gr.; very low birth weight 1000-1499 gr.; low birth weight 1500-2499 gr. and birth weight with more than 2500 gr.

The risk of death among new-borns of very low birth weight (less than 1500 gr.) is 30 times higher when compared to those born with 2500 gr. or more [10,11].

The aim of the study is to show the prematurity and low birth weight participation in neonatal mortality at NICU at GOC-Skopje in the seven years period.

Material and Methods

The retrospective analysis showed the participation of prematurity and low birth weight in neonatal mortality at NICU at GOC- Skopje in the period of seven years, from 2011-2017.

Neonatal mortality is neonatal death between live-born neonates, in the period of 0-28 days after delivery. It includes died new-borns, born alive, after 22 g.w. of pregnancy and with birth weight over 500 g. The data is collected from the Data basis at NICU at GOC- Skopje and the medical histories of new-borns treated at NICU. The prematurity and low birth weight participation in total neonatal mortality and its movement during these 7 years will be processed for each year and in total for the whole period of these 7 years.

The number of deceased live-born babies in the neonatal period, will be processed and divided into two categories:

1. live-born neonates who died as a consequence of preterm birth < 37 g.w. divided in 4 groups: extremely preterm new-borns born 22-27 g.w.; very preterm new-borns- born 28- 32 g.w.; moderate and late preterm new-borns- born 33-36 g.w. and term new-borns born after 37 g.w.

2. live- born neonates who died as a result of low birth weight: with extremely low birth weight < 1000 gr.; very low birth weight 1000-1499 gr.; low birth weight 1500- 1999 gr.; low birth weight 2000-2499 gr. and birth weight on delivery with more than 2500 gr.

Inclusion criteria include: Neonatal death in live- born neonates in the period of 0-28 days after delivery admitted and treated at NICU, born at GOC- Skopje in the period of 2011-2017. Neonates with birth weight over 500 gr. and full 22 gestational week on the day of delivery, were included in the study.

Exclusion criteria include: Death of new-borns after 28 day of delivery, in the post-neonatal period.

Results

Table 1: In the period of 7 years at GOC-Skopje, there were 36706 live- born new-borns. From them 912 new-borns died in the neonatal period 0-28 days after delivery. 4810 new-borns were admitted at NICU after delivery in the seven years period, or 13.18% from all live-born new-borns at Gynaecology and Obstetrics Clinic in Skopje.

Most of them 17.14% were admitted at NICU in 2017 and lowest 10.58% in 2012. From all 4810 new-borns who were admitted and treated at NICU at GOC- Skopje in seven years period, 912 or 19% died in the neonatal period from 0-28 days after delivery. Most of them 24% died in 2016 and the lowest percentage 14.5% died in 2015.

Premature died neonates, or born before 37 g.w. were 867 of them or 95.06% of all neonates who died in neonatal period after delivery, in the seven years period.

Table 1. Live born new-borns at GOC- Skopje, new-borns admitted at NICU and neonatal mortality and premature deaths at NICU/ GOC- Skopje/2011-2017

Year	2011	2012	2013	2014	2015	2016	2017	Total
Total births GOC- Skopje	4885	4930	5613	5632	5644	5445	4557	36706
Newborns admitted atNICU	517 10,58%	692 14,03%	744 13,25%	665 11,8%	669 11,85%	742 13,63%	781 17,14	4810 13,18%
NNM at NICU	115 22,24%	109 15,75%	123 16,53%	135 20,3%	97 14,5%	178 24%	155 19,85%	912 19%
Prematurity deaths at NICU	110 95,65%	105 96,33%	117 95,12%	128 94,81%	90 92,78%	170 95,5%	147 94,84%	867 95,06%

Table 2: The results show that the number of preterm new-borns transferred at NICU in the period of seven years, or born before 37 g.w. were 4473, or almost 93% from all new-borns admitted. The association between neonatal mortality and gestational week of new-borns is inversely proportional, so probability of death decreases as the gestational week increases.

Neonatal mortality is higher and is especially significant in the group of premature deliveries with extremely premature new-borns- born from 22-27 g.w., with mortality of 91% in the group and participation of 45% in the total neonatal mortality at NICU.

The number of neonatal deaths decreases in early premature group of new-borns- born from 28-32 g.w., with 20% of deaths in the group and significantly falls in the group of late preterm new-borns- born in 33-36 g.w., with participation of 5.22%. The total number of neonatal deaths as a consequence of preterm births before 37 g.w. at NICU, was 95% and in the group of mature new-borns- born after 37 g.w.; mortality is only 5%.

Table 2. Admitted at NICU and neonatal mortality by gestational periods-weeks/ NICU, GOC-Skopje/2011-2017

Gestational week	22-27 g.w.	28-32 g.w.	33-36 g.w.	>37 g.w.	Total
Transferred at NICU by g.w. 2011-2017	452 9,4%	1664 34,6%	2357 49%	337 7%	4810 100%
NNM by g.w. 2011-2017	411 45%	333 36,51%	123 13,49%	45 4,93%	912 100%
NNM % in the group B/A	411/452 91%	333/1664 20%	123/2357 5,22%	45/337 13,6%	912

Neonatal mortality is higher and is especially significant in the group of premature deliveries with extremely premature new-borns- born in the period from 22-27 g.w. with neonatal death of 91 % in the group.

The number of neonatal deaths decreases in the group of early premature new-borns- born in the period from 28-32 g.w. where 20% of deaths are recorded and significantly falls in the group of late preterm new-borns- born from 33-36 g.w. with participation of 5.22% (Fig.1).

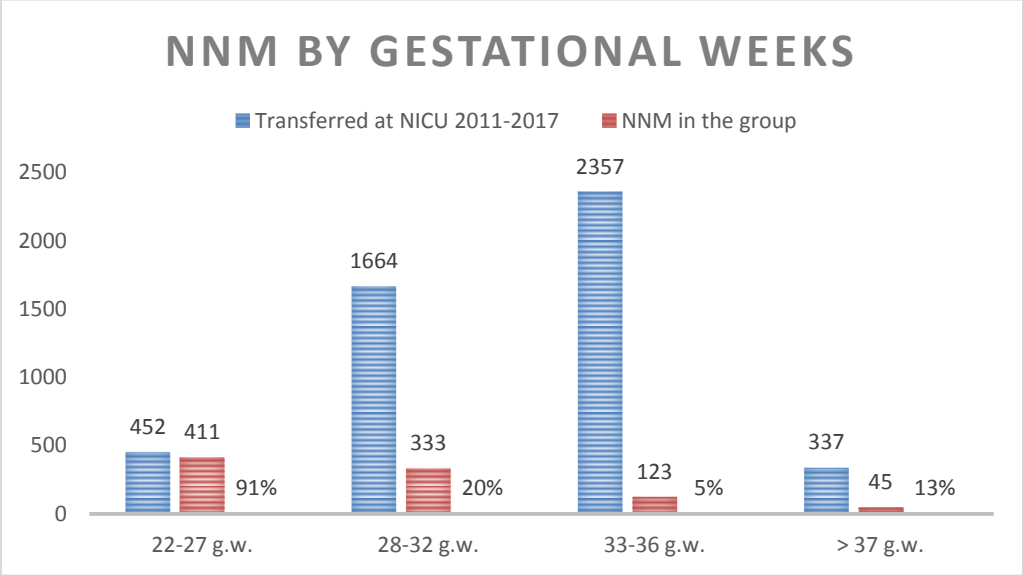

Fig. 1. Presentation of neonatal mortality by gestational periods at NICU/ GOC-Skopje/2011-2017

Table 3: The most common causes for neonatal mortality in new-borns admitted at NICU were complications due to preterm birth, before 37 gestational weeks, which later develop respiratory distress syndrome and neonatal infections and sepsis as a complication from prematurity. 95% of all neonatal deaths were from preterm births before 37 g.w. of pregnancy.

Table 3 shows the movement of neonatal mortality at NICU, divided in groups by gestational periods-weeks, in extremely preterm, very preterm, moderate and late preterm neonatal deaths and term neonatal deaths in the seven years period 2011-2017.

Table 3. Neonatal mortality at NICU by gestational periods/ GOC- Skopje/2011-2017

Year NNM-g.w.	2011	2012	2013	2014	2015	2016	2017	Total NNM
22-27 g.w. NNM	59 51,3%	39 35,8%	56 45,52%	68 50,37%	46 47,42%	63 35,4%	80 51,61%	411 45,06%
28-32 g.w. NNM	32 27,82%	50 45,9%	46 37,4%	43 31,85%	37 38,14%	77 43,26%	48 31%	333 36,51%
33-36 g.w. NNM	19 16,52%	16 14,7%	15 12,2%	17 12,6%	7 7,22%	30 16,9%	19 12,3%	123 13,5%
>37 g.w. NNM	5 4,3%	4 3,7%	6 4,88%	7 5,18%	7 7,22%	8 4,5%	8 5,16%	45 4,93%
Total NNM in 7 years	115 100%	109 100%	123 100%	135 100%	97 100%	178 100%	155 100%	912 100%

867 new-borns or 95% of neonatal deaths, were from preterm births, delivered before 37 gestational week of pregnancy in the seven years period. Only 45 or 5% were mature new-borns delivered after 37 g.w. Neonatal mortality in extremely premature new-borns born from 22-27 g.w., participated with 45.06% in all neonatal deaths, while neonatal mortality of mature new-borns participated with only 5% in all neonatal deaths in this period at NICU.

Table 4: By WHO a low birth weight new-born is an infant who was born with weight less than 2500 gr. Causes that lead to LBW are prematurity and foetal growth restriction. Results show that the association between mortality and birth weight is inversely proportional and the probability of death decreases as the weight increases.

The risk of death among extremely low birth weight < 1000 gr. and very low birth weight new-borns < 1500 gr., is especially significant. In this period of 7 years there were almost 50% of neonatal deaths in the group with extremely low birth weight < 1000 gr. and together with neonates, who died with a very low birth weight < 1500 gr. they make 2/3 of all deaths in live- born new-borns admitted at NICU.

Table 4. Birth weight and neonatal mortality at NICU/GOC- Skopje /2011-2017

Year Birth weight	2011 NNM	2012 NNM	2013 NNM	2014 NNM	2015 NNM	2016 NNM	2017 NNM	Total NNM B.W.
<1000 gr.	52 45,22%	39 35,77%	66 53,66%	68 50,37%	47 48,5%	75 42,13%	84 54,19%	431 47,26%
1000- 1499 gr.	30 26,08%	35 32,11%	29 23,58%	29 21,48%	23 23,7%	55 30,9%	32 20,64%	233 25,55%
1500- 1999 gr.	20 17,4%	19 17,43%	18 14,6%	22 16,3%	13 13,4%	27 15,16%	21 13,5%	140 15,35%
2000- 2499 gr.	6 5,2%	9 8,26%	4 3,25%	12 8,9%	7 7,22%	11 6,18%	10 6,45%	59 6,47%
>2500 gr.	7 6%	7 6,42%	6 4,9%	4 3%	7 7,22%	10 5,61%	8 5,16%	49 5,37%
Total NNM in 7 years	115 100%	109 100%	123 100%	135 100%	97 100%	178 100%	155 100%	912 100%

The correlation of neonatal mortality with low birth weight in new-borns admitted at NICU, is shown for this period 2011-2017 in Fig.2.

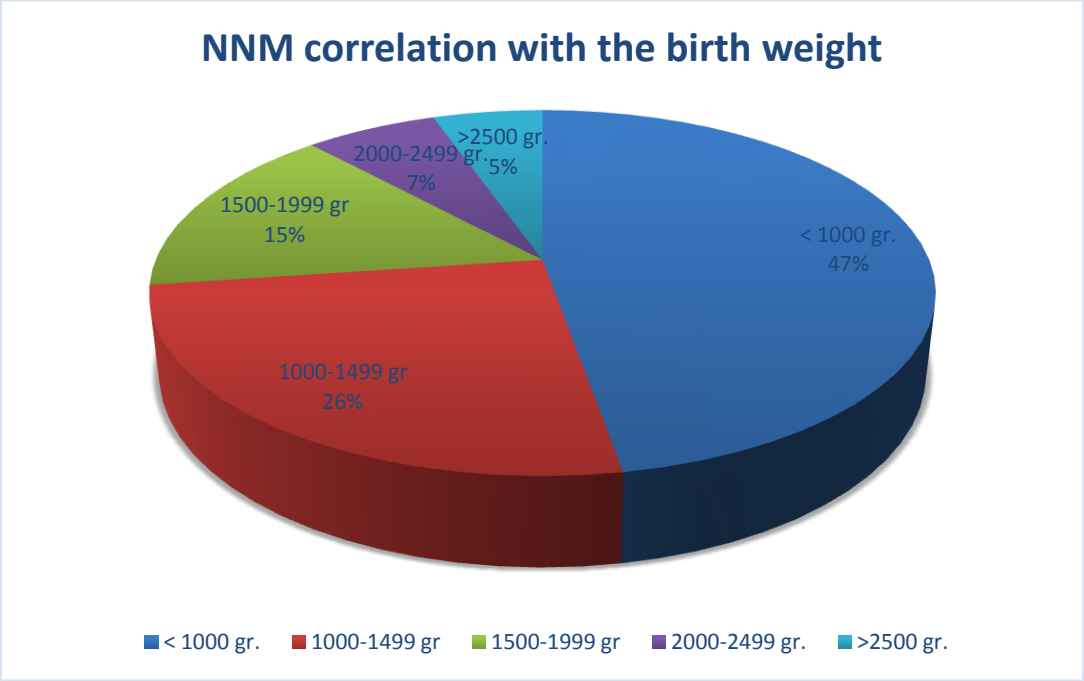

Fig. 2. Neonatal deaths- dispersion by birth weight in new-borns at NICU/ GOC-Skopje/2011-2017

Neonatal mortality rate at GOC-Skopje: Neonatal mortality rate at GOC- Skopje was 24,85 ‰, or 24,8 neonatal deaths on 1000 live- born new-borns, in the neonatal period 0-28 days after delivery, in the period from 2011-2017 years. There were 912 neonatal deaths on 36706 live- born new-borns, born at GOC- Skopje.

Discusion

Neonatal mortality at NICU at GOC-Skopje in the seven years period 2011-2017, is 19% or 912 new-borns from 4810 new-borns admitted at NICU, after delivery.

Most of neonatal deaths were related to prematurity and premature new-borns, born before 37 g.w. of pregnancy or 867 of them with 95% participation of preterm births in all neonatal deaths. Other studies from low-income countries and developing countries show the same or higher neonatal mortality in premature new-borns, admitted and treated at NICU [12,13].

In some other studies from high-developed countries neonatal mortality in premature new-borns at NICU is lower in a range from 2-4% [14,15].

Neonatal mortality at NICU at GOC- Skopje, between preterm delivered new-borns, born before 37 g.w. and born with low birth weight is high in the seven years period. Especially mortality in the group of extremely premature new-borns- born from 22-27 g.w., where mortality was 91% in the group, and new-borns with extremely low birthweight < 1000 gr. where mortality is almost 50% of all neonatal deaths. In the similar study from USA as a developed country, survival rate for new-borns born till 28 g.w. is about 60-80% and in the group of very preterm 28-32 g.w. there is more than 95% survival rate of new-borns. In the group of late preterm births, born in 33-36 g.w. there is nearly a 100% chance of survival of new-borns [16].

Preterm birth is a leading cause for neonatal mortality due to complications associated with preterm births and is a significant factor in mortality among children under 5 years.

Complications due to premature deliveries such as low birth weight, RDS, sepsis and infections in the neonatal period are the leading causes for neonatal deaths at NICU in the neonatal period from 0-28 days after delivery.

More neonatal deaths in low-income countries and developing countries are caused by complications of preterm births and infectious diseases, due to causes in developed countries where congenital malformations and prematurity are the leading causes [12-15].

Prematurity and complications due to prematurity were the biggest problem for higher neonatal mortality, in the neonatal period 0-28 days after delivery at NICU at GOC-Skopje, in the period of 2011-2017.

Highly developed countries have low neonatal mortality rates from 1- 2.5 ‰ and low hospital neonatal mortality rate [14,15].

The neonatal mortality rate at GOC- Skopje in the period of 2011-2017 was 24.85 ‰ or 24.85 neonatal deaths on 1000 live- born new-borns. Macedonia is a mid-income country, with high neonatal mortality rate, which was higher than in the Balkan and European countries in this period of seven years. Macedonia is a European country with the highest neonatal mortality rate, after Moldavia in 2017, between European countries, with neonatal mortality rate of 8.6‰ for the whole country [17].

Preterm births lead to higher neonatal morbidity and mortality, due to complications such as low birth weight, RDS, neonatal infections and sepsis in the neonatal period. Causes that lead to LBW are prematurity and foetal growth restriction. Birth weight is an indicator of greater influence on infant health and survival and infants born with a weight below the limit < 1500 gr., have a higher risk of morbidity and dying especially in the neonatal period.

Results showed that the association between mortality and birth weight is inversely proportional and the probability of death decreases as the birth weight increases. The risk of death among extremely low birth weight < 1000 gr. and very low birth weight of new-borns < 1500 gr., is especially significant. Most of the causes for neonatal mortality are preventable.

Most of the neonatal deaths at NICU are a result of preterm births and prematurity - about 95% of them, so prevention of prematurity and complications from them are the leading goal to decrease the neonatal mortality rate.

That means that the number of preterm births must be reduced in the future, with greater care for pregnant women during pregnancy, which will lead to lower neonatal mortality. That means better antenatal care and treatment of morbidities and co-morbidities in pregnant women, treatment of infections during pregnancy, more attention in multiple pregnancies, using of progesterone, cervical cerclage and all other factors which will decrease the number of premature deliveries and complications from them [18].

We need prospective studies and protocols which will follow some causes and predictors of neonatal mortality in a long period of time, which will decrease the neonatal mortality rate. Establishing modern protocols in treatment and resuscitation of preterm and all new-borns after delivery, at the Neonatal Intensive Care Units, will also increase the survival rate between new-borns.

Conclusion

Preterm births and prematurity participate with 95% in neonatal death at NICU, with the complications which they give in the neonatal period and later in life. Prevention of prematurity and complications from them are the leading goal to decrease the neonatal mortality rate and morbidity later in life.

Improving the antenatal care for pregnant women and treating pathologic conditions during pregnancy, better standard of living, efficient care during delivery and adequate care and resuscitation of new-borns after delivery at NICU will decrease the neonatal mortality rate.

Improving of prospective studies at NICU and at GOC- Skopje, as the biggest neonatal and perinatal centre in the country, which will follow in a long period of time some causes and predictors for

neonatal mortality, must be done. Such studies in our country and at GOC- Skopje have not yet been done.

Modernization of the complete healthcare system from primary to tertiary level, with efficient antenatal care for pregnant women, programmes for protection of mother and child, professional and modern technological management with hospitals and neonatal and perinatal centres will decrease the neonatal mortality rate in the future.

Abbreviations: GOC-Skopje: Gynaecology and Obstetrics Clinic-Skopje; NICU: Neonatal Intensive Care Unit; G.W.: gestational week; LBW: low birth weight; NNM: Neonatal mortality; RDS: Respiratory distress syndrome; WHO: World Health Organization

Acknowledgements: We would like to thank all participants in this study.

Authors contribution: All authors participated in the conception of this manuscript and approved its publication. Conflict of interest was not declared.

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