

ASSESSMENT OF RISK FACTORS INVOLVED IN PREMATURITY

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RESEARCH ARTICLE

Abstract

Prematurity has a particular impact on neonatal mortality and morbidity, but also long-term consequences on the population, which transforms premature birth from an obstetric problem into a social and health policy problem. A retrospective study was carried out on the main risk factors involved in the etiopathogenesis of premature birth, the data used being collected from the observation sheets of premature live newborns, as well as from the Hospital Manager computer program, from the period 2020-2022, cared for in the County Clinical Hospital of Emergency Oradea. Newborns with a birth weight of less than or equal to 2500 grams represent approximately 10% of all children cared for in the period 2020 - 2022. More than half of the women who gave birth to children weighing \leq 2500 grams are aged between 18 and 35 (77%), most are employed, thus having their own income (66.73%). The average gestational age in the studied group is 34.32 weeks. 58.6% newborns were born by caesarean section. The average birth weight was 1999.23 grams, with a minimum of 500 grams. 54.6% were girls and 45.4% were boys. The average length of hospitalization was 19.11 days, with a maximum of 121 days and a minimum of 2 hours. The profile of the woman who gave birth to a premature baby in the analyzed hospital, in the period 2020-2022 is: 26-35 years old, has a stable job, 33-37 weeks of gestation, gives birth by caesarean section to a female child, weighing between 2000-2500g.

Keywords: prematurity, newborn, risk factor, survivor
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INTRODUCTION

Premature birth is one of the most difficult, complex and delicate problems of modern medicine. This problem involves more and more diverse branches of medicine: from obstetrics and neonatology to immunology, genetics and fundamental research (Khandre, 2022; Ananth, 2006, Slattery, 2002). The particular impact of prematurity on neonatal mortality and morbidity, as well as the long-term consequences on the population, transform premature birth from an obstetrics problem into a social and health policy problem. Today it is accepted that the incidence of prematurity is one of the most important health indicators (Goldenberg, 2008; McCormick, 1985; Saigal, 2008).

Although we are witnessing an avalanche of new knowledge regarding the etiopathogenesis of premature birth, the complex mechanisms that make up this pathogenic chain are still incompletely elucidated. This incomplete knowledge of etiopathogenesis leads inexorably to the relative inefficiency of current therapeutic methods, but especially to the impossibility of

establishing a real prevention of premature birth. Thus, the vast majority of therapeutic measures aimed at prolonging gestation cannot be considered clearly effective, and those aimed at improving the fetal prognosis do not solve all the problems of the premature (Acharya, 2021, UNICEF, 2017; Hussein, 2020).

In the determinism of prematurity, there are numerous risk factors that act directly or indirectly and most of the time simultaneously, in association (Di Renzo, 2011; Waynforth, 2022). Only by knowing and highlighting them is it possible to assess the existence of the risk of premature birth and apply the appropriate treatment (Della Rosa, 2021).

It is estimated that around 15 million babies are born prematurely every year in the world. Nearly 1 million babies die each year from complications of premature birth. Most of the survivors experience learning disabilities, vision or hearing problems during their lifetime (Singh, 2019; Baraki, 2020, WHO, 2020).

In the conducted study, I aimed to identify some risk factors that are associated with the birth of a premature child, as well as outline a profile of the woman who gave birth prematurely. The obtained results can be useful to decision-makers in the health system, in the

implementation of concrete measures that lead to the decrease of prematurity.

MATERIAL AND METHOD

The study is retrospective, the data used were collected from the observation sheets of premature live births, as well as from the Hospital Manager computer program, from the period 2020-2022, cared for in the Neonatology section of the Oradea County Emergency Clinical Hospital.

The inclusion criteria in the study were:

- birth weight less than or equal to 2500 g,
- children discharged from 01.01.2020 until 31.12.2022.

The variables retained in the study were quantitative (mother's age, gestational age, birth weight, duration of hospitalization), nominal qualitative (sex of the newborn, mode of birth, occupation of the mother and discharge status of the newborn).

Correlations between the quantitative variables included in the study were also investigated.

The collected information was entered into an electronic database, and the rendering of the results included the statistical processing of the collected information and their graphic representation, using the SPSS Statistics program.

RESULTS AND DISCUSSIONS

Between 2020 and 2022, 10,168 newborns were cared for in the Oradea Maternity Hospital (figure 1).

Of the total newborns, 90.01% had a birth weight of over 2500 grams. The incidence of prematurity, related to birth weight, followed a downward trend during the analyzed period, from 10.97% in 2020 to 8.09% in 2022 (figure 2).

The studied batch consists of 1016 newborns, with a birth weight less than or equal to 2500 grams, which represents 9.99% of all children cared for in the period 2020-2022.

Analyzing the distribution of the batch related to the mother's age, we find that more than half of the women who gave birth to children weighing ≤ 2500 grams are between 18 and 35 years old (77%). In our group, the incidence of women over 36 years old is 12%, almost 3% higher than younger women. We identified 19 mothers aged 15, 20 cases aged 14

and 3 aged 13, the average age being 27.8 years (figure 3).

In the analyzed group, most women who gave birth to a premature child are employed, thus having their own income (66.73%). However, 33.27% are housewives, without an income (figure 4).

From the analysis of the graph showing the structure of the group according to gestational age, we notice that more than half of newborns (51.77%) were born at gestational ages between 33 and 36 weeks. In the case of 67 children, representing 6.59%, the birth occurred at a gestational age of less than 28 weeks. The average gestational age in the studied group is 34.32 weeks, with a maximum limit of 39 weeks (2 cases) and a minimum limit of 24 weeks (4 cases) (figure 5).

Regarding the mode of birth, 595 children, representing 58.6% of the batch, were born by caesarean section, and 418 (41.1%) were born spontaneously, naturally. We also identified 3 cases of children born by forceps application (figure 6).

The mean birth weight in our cohort was 1999.23 grams, with a minimum of 500 grams. From the analysis of the weight groups, we find that most children (636; 62.6%) had a birth weight between 2500 - 2000 grams, followed by those with a birth weight between 1999 - 1500 grams (202; 19, 88%). Premature babies with a birth weight of less than 1000 grams represent 6.3% of the studied group, they represent the contingent of patients whose care requires professional performance and high-level medical equipment, as well as very high hospitalization costs (figure 7).

Regarding the distribution of the batch related to the gender of the newborn, it is relatively homogeneous, 54.6% were girls and 45.4% were boys (figure 8).

The average length of hospital stay in our cohort was 19.11 days, with a maximum of 121 days and a minimum of 2 hours. Most cases (596; 58.66%) needed up to 14 days of hospitalization. 10 newborns were hospitalized for less than 24 hours, in which early death occurred, and 8 newborns needed more than 3 months of hospitalization (figure 9).

For statistical correlation analysis we performed contingency tables and correlation graphs. Data processing was carried out in SPSS Statistics and Excel 2010.

I used birth weight as an independent variable, which was divided into 4 subgroups (table 1):

G1 - from 500 g - to 999 g

G2 - from 1000 g - to 1499 g

G3 - from 1500 g - to 1999 g

G4 - from 2000 g - to 2500 g

Correlation analysis was based on the value of the coefficient of determination R^2 , which indicates the percentage of the total variation in the dependent variable that is explained by the independent variable. It takes values between 0 and 1. The closer the value of the coefficient is to 1, the stronger the dependence. The statistical correlation was performed between the numerical variables studied.

Analyzing the values of the Pearson correlation coefficient, regardless of the birth weight, the existence of an influence of the mother's age on the birth weight of the newborn was not statistically demonstrated.

In the 500-999 gram age group, more than half of the mothers were between 26-35 years old, 84.38% had a job, 65.63% had a gestational age between 24-28 weeks and 62.5% gave birth by caesarean section.

Regarding the newborn, 56.25% were female, 39.06% were hospitalized for less than 7 days, and 50% died.

Analyzing the values of the Pearson correlation coefficient in the table showing the degree of association between the variables and the statistical significance in the weight group G1 500- 999 g, we can state that:

- there is an above-average, positive, ($R^2= 0.526$), statistically significant ($p=0.00$) relationship between gestational age and birth weight.

- there is a link of medium intensity, positive ($R^2= 0.465$), statistically significant ($p=0.00$), between gestational age and the number of days of hospitalization.

In the age group 1000 - 1499 grams, 48.25% of the mothers were between 26 - 35 years old, 74.56% had a job, 59.65% had a gestational age between 29 - 32 weeks and 66.7% gave birth by caesarean section.

Regarding the newborn, 57.02% were female, 53.51% were hospitalized between 31 - 60 days, and 90.35% survived.

Analyzing the values of the Pearson correlation coefficient in the table showing the degree of association between the variables and the statistical significance in the weight group G1 1000 - 1499 g, we can state that:

- there is a link of medium intensity, positive ($R^2= 0.401$), statistically significant

- ($p=0.00$), between gestational age and birth weight.

- there is a link of medium intensity, negative ($R^2= - 0.401$), statistically significant ($p=0.00$), between gestational age and the number of days of hospitalization.

In the age group 1500 - 1999 grams, 51.98% of the mothers were between 26 - 35 years old, 67.33% had a job, 60.89% had a gestational age between 33 - 36 weeks and 64.85% gave birth by caesarean section.

Regarding the newborn, 51.49% were male, 45.54% were hospitalized for 15-30 days, and 95.54% survived.

Analyzing the values of the Pearson correlation coefficient in the table showing the degree of association between the variables and the statistical significance in the weight group G1 1500 - 1999 g, we can state that:

- there is a link of medium intensity, negative ($R^2= - 0.434$), statistically significant ($p=0.00$), between birth weight and the number of days of hospitalization.

- there is a link of medium intensity, positive ($R^2= - 0.371$), statistically significant ($p=0.00$), between gestational age and birth weight.

- there is a link of medium intensity, negative ($R^2= - 0.361$), statistically significant ($p=0.00$), between gestational age and the number of days of hospitalization.

In the age group 2000 - 2500 grams, 44.50% of the mothers were aged between 26 - 35 years. It should be noted that 12.26% were minors. 63.36% had a job, 59.75% had a gestational age between 33-36 weeks and 54.72% gave birth by caesarean section. There were also 3 cases recorded (0.47%), in which the delivery was completed by forceps application.

Regarding the newborn, 55.97% were female, 43.71% were hospitalized between 1 - 6 days, and 98.43% survived.

Analyzing the values of the Pearson correlation coefficient in the table showing the degree of association between the variables and the statistical significance in the weight group G1 2000 - 2500 g, we can state that:

- there is a link of medium intensity, negative ($R^2= - 0.360$), statistically significant ($p=0.00$), between birth weight and the number of days of hospitalization.

- there is a relationship of medium intensity, negative ($R^2= - 0.311$), statistically significant ($p=0.00$), between gestational age and the number of days of hospitalization.

- there is a link of medium intensity, positive ($R^2 = -0.330$), statistically significant ($p=0.00$), between gestational age and birth weight.

Considering the results of the statistical approach carried out, we are trying to create a profile of the woman who gave birth to a

premature child in the maternity hospital in Oradea, in the period 2020-2022: 26-35 years old, has a stable job, 33-37 weeks of gestation, gives birth by cesarean section to a female child, weighing between 2000-2500g, survivor.

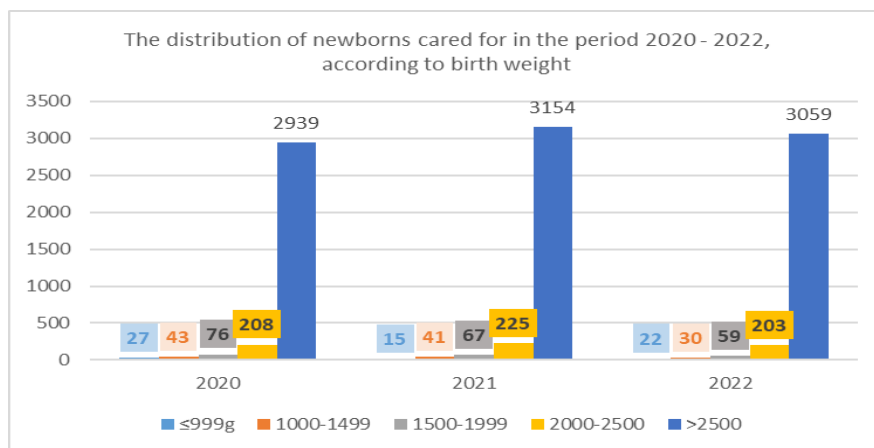


Figure 1. The distribution of newborns cared for in the period 2020 - 2022, based on birth weight)

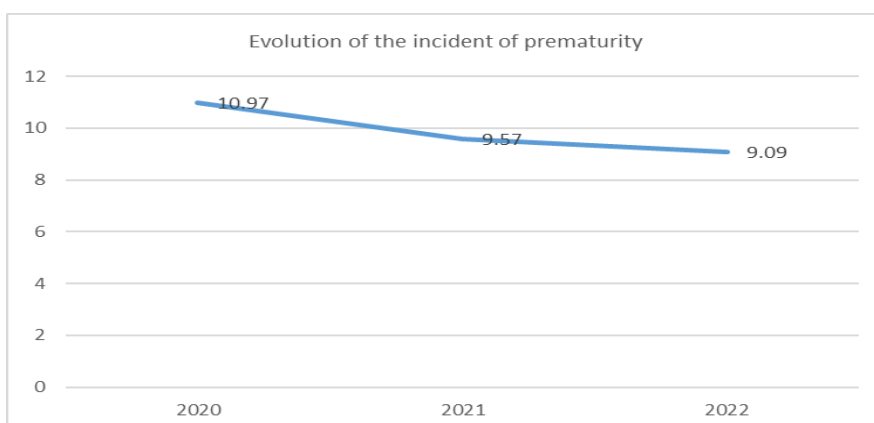


Figure 2. Evolution of the incidence of prematurity 2020 - 2022

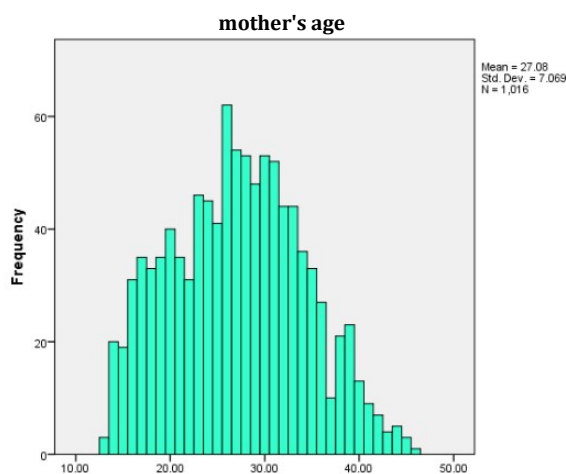


Figure 3. Batch distribution according to mother's age

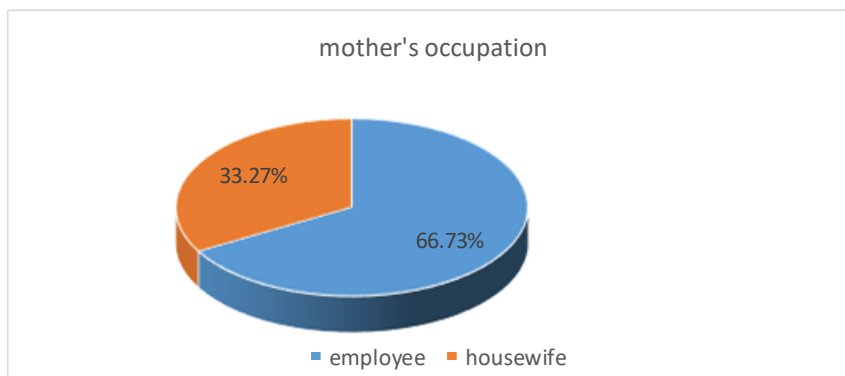


Figure 4. Batch distribution according to mother's occupation

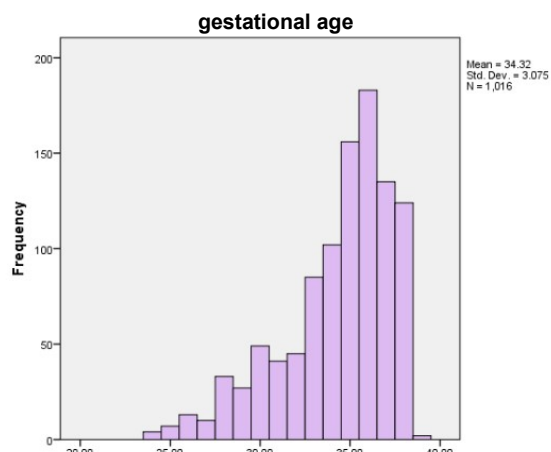


Figure 5. Batch distribution according to gestational age

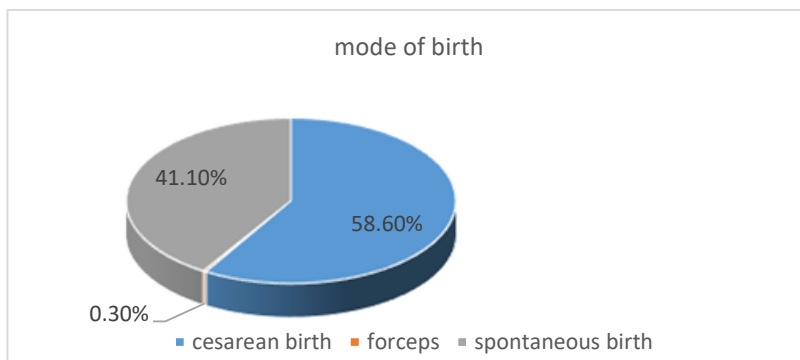


Figure 6. Distribution of the lot according to the mode of birth

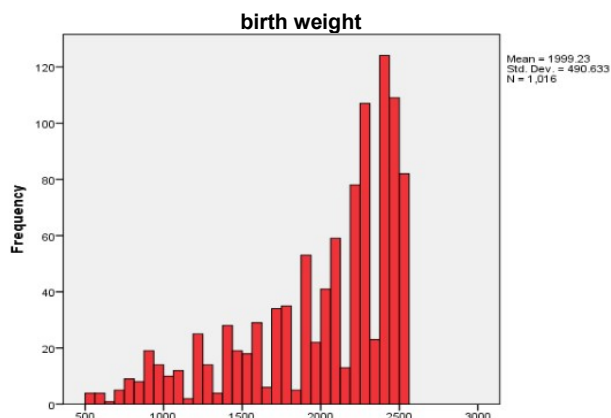


Figure 7. Batch distribution according to birth weight

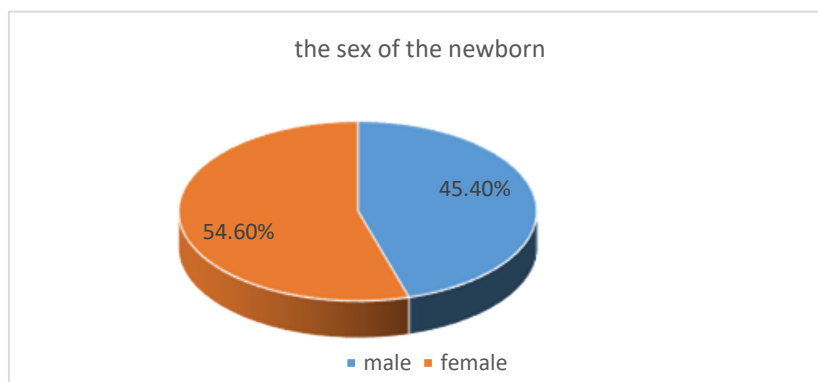


Figure 8. Batch distribution according to the gender of the newborn

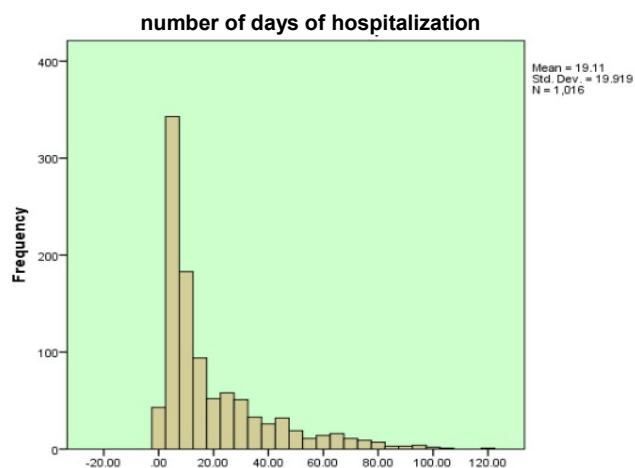


Figure 9. Distribution of the batch according to the number of days of hospitalization

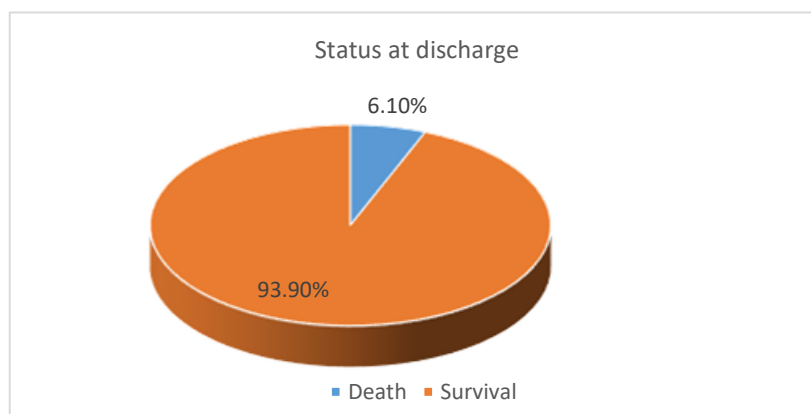


Figure 10. Batch distribution according to discharge status

Table 1

Batch distribution according to birth weight, correlated with the variables studied

		500-999 g		1000-1499 g		1500-1999 g		2000-2500 g	
500-999 g		N	%/64	N	114%	N	202%	N	636%
Gender	female	36	56.25%	65	57.02%	98	48.51%	356	55.97%
	male	28	43.75%	49	42.98%	104	51.49%	280	44.03%
Total		64	100.00%	114	100.00%	202	100.00%	636	100.00%
Gestational age	24-28	42	65.63%	23	20.18%	2	0.99%	0	0.00%
	29-32	19	29.69%	68	59.65%	63	31.19%	12	1.89%
	33-36	3	4.69%	20	17.54%	123	60.89%	380	59.75%
	37-39	0	0.00%	3	2.63%	14	6.93%	244	38.36%

Total		64	100.00%	114	100.00%	202	100.00%	636	100.00%
Mother's age	13-17	3	4.69%	10	8.77%	17	8.42%	78	12.26%
	18-25	15	23.44%	29	25.44%	58	28.71%	204	32.08%
	26-35	36	56.25%	55	48.25%	105	51.98%	283	44.50%
	36-46	10	15.63%	20	17.54%	22	10.89%	71	11.16%
Total		64	100.00%	114	100.00%	202	100.00%	636	100.00%
Hospitalization days	under 24 ore	1	1.56%	3	2.63%	3	1.49%	3	0.47%
	1.-.6	24	37.50%	2	1.75%	6	2.97%	278	43.71%
	7.-14	4	6.25%	7	6.14%	19	9.41%	256	40.25%
	15-30	3	4.69%	12	10.53%	92	45.54%	89	13.99%
	31-60	11	17.19%	61	53.51%	74	36.63%	8	1.26%
	61-90	14	21.88%	28	24.56%	8	3.96%	2	0.31%
	91-121	7	10.94%	1	0.88%	0	0.00%	0	0.00%
Total		64	100.00%	114	100.00%	202	100.00%	636	100.00%
Mother's occupation	employee	54	84.38%	85	74.56%	136	67.33%	403	63.36%
	housewife	10	15.63%	29	25.44%	66	32.67%	233	36.64%
Total		64	100.00%	114	100.00%	202	100.00%	636	100.00%
Mode of birth	spontaneous birth	24	37.50%	38	33.33%	71	35.15%	285	44.81%
	cesarean birth	40	62.50%	76	66.67%	131	64.85%	348	54.72%
	forceps	0	0.00%	0	0.00%	0	0.00%	3	0.47%
Total		64	100.00%	114	100.00%	202	100.00%	636	100.00%
Status at discharge	death	32	50%	11	9.65%	9	4.46%	10	1.57%
	survival	32	50%	103	90.35%	193	95.54%	626	98.43%
Total		64	100.00%	114	100.00%	202	100.00%	636	100.00%

CONCLUSIONS

Newborns with a birth weight less than or equal to 2500 grams, represent approximately 10% of all children cared for in the period 2020-2022.

More than half of the women who gave birth to children weighing ≤ 2500 grams are aged between 18 and 35 (77%). Most women who gave birth to a premature child are employed, thus having their own income (66.73%). However, 33.27% are housewives, without an income.

More than half of newborns (51.77%) were born at gestational ages between 33 and 36 weeks. The average gestational age in the studied group is 34.32 weeks, with a maximum limit of 39 weeks (2 cases) and a minimum limit of 24 weeks (4 cases).

595 children, representing 58.6% of the batch, were born by cesarean section, and 418 (41.1%) were born spontaneously, naturally.

We also identified 3 cases of children born by forceps application.

The mean birth weight in our cohort was 1999.23 grams, with a minimum of 500 grams. From the analysis of weight groups, we find that most children (636; 62.6%) had a birth weight between 2500 and 2000 grams.

Regarding the distribution of the batch related to the gender of the newborn, it is relatively homogeneous, 54.6% were girls and 45.4% were boys.

The average length of hospital stay in our cohort was 19.11 days, with a maximum of 121 days and a minimum of 2 hours. Most cases (596; 58.66%) needed up to 14 days of hospitalization.

The profile of the woman who gave birth to a premature child in the Maternity Hospital in Oradea, in the period 2020-2022 is: 26-35 years old, has a stable job, 33-37 weeks of gestation, gives birth by cesarean section to a female child, with weight between 2000-2500g, survivor.

REFERENCES

- Khandre V, Potdar J, Keerti A (December 27, 2022) Preterm Birth: An Overview. *Cureus* 14(12): e33006. DOI 10.7759/cureus.33006.
- Ananth CV, Vintzileos AM: Epidemiology of preterm birth and its clinical subtypes. *J Matern Fetal Neonatal Med.* 2006, 19:773-82. doi: 10.1080/14767050600965882.
- Slattery MM, Morrison JJ: Preterm delivery. *Lancet.* 2002, 360:1489-97. doi: 10.1016/S0140-6736(02)11476-0.
- Goldenberg RL, Culhane JF, Iams JD, Romero R: Epidemiology and causes of preterm birth. *Lancet.* 2008, 371:75-84. doi: 10.1016/S0140-6736(08)60074-4.
- McCormick MC: The contribution of low birth weight to infant mortality and childhood morbidity. *N Engl J Med.* 1985, 312:82-90. doi: 10.1056/NEJM198501103120204.
- Saigal S, Doyle LW: An overview of mortality and sequelae of preterm birth from infancy to adulthood. *Lancet.* 2008, 371:261-9. doi: 10.1016/S0140-6736(08)60136-1.
- Acharya R, Khanal P, Bhattarai HK, Amatya A. Risk Factors of Preterm Birth in Nepal: A Hospital-Based Matched Case-Control Study. *Front. Reprod. Health* 2021, 3:697419. doi: 10.3389/frph.2021.697419
- UNICEF. Maternal and newborn health disparities. 2017, p. 1.
- Hussein H, Shamsipour M, Yunesian M, Hasanvand MS, Fotouhi A. Association of adverse birth outcomes with exposure to fuel type use: a prospective cohort study in the northern region of Ghana. *Heliyon*, 2020, 6:e04169. doi: 10.1016/j.heliyon.2020.e04169.
- Di Renzo GC, Giardina I, Rosati A, Clerici G, Torricelli M, Petraglia F, et al. Maternal risk factors for preterm birth: a country-based population analysis. *Eur J Obstet Gynecol Reprod Biol.*, 2011, 159:342–6. doi: 10.1016/j.ejogrb.2011.09.024.
- Waynforth, D. Identifying Risk Factors for Premature Birth in the UK Millennium Cohort Using a Random Forest Decision-Tree Approach. *Reprod. Med.* 2022, 3, 320–333. <https://doi.org/10.3390/reprodmed3040025>.
- Della Rosa, P.A.; Miglioli, C.; Caglioni, M.; Tiberio, F.; Mosser, K.H.; Vignotto, E.; Canini, M.; Baldoli, C.; Falini, A.; Candiani, M.; et al. A hierarchical procedure to select intrauterine and extrauterine factors for methodological validation of preterm birth risk estimation. *BMC Pregnancy Childbirth* 2021, 21, 306.
- Singh GK, Yu SM. Infant Mortality in the United States, 1915-2017: Large Social Inequalities have Persisted for Over a Century. *Int J MCH AIDS.* 2019;8(1):19-31. doi: 10.21106/ijma.271.
- Baraki, A.G., Akalu, T.Y., Wolde, H.F. et al. Factors affecting infant mortality in the general population: evidence from the 2016 Ethiopian demographic and health survey (EDHS); a multilevel analysis. *BMC Pregnancy Childbirth* 20, 299, 2020. <https://doi.org/10.1186/s12884-020-03002-x>.
- WHO, Newborn Mortality, 2022, <https://www.who.int/news-room/factsheets/detail/levels-and-trends-in-child-mortality-report-2021>.