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# Risk factors for mortality in Neonatal Intensive Care Unit: maternal age influence

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**ABSTRACT.** The study evaluated the influence of maternal age on the low birth weight (LBW), prematurity and deaths of newborns (NB). Was a descriptive, exploratory, retrospective and comparative study realized in Neonatal intensive care unit (NICU) of a university hospital in Brazil, with seven hundred six NB admitted in the NICU in the period of five years. The results showed high rate of childbirths of teenage mothers (27%). Among teenage mothers (193), 80% of their NB had low birth weight, and 84% were premature; and among adult mothers (513), 69% had low birth weight, and 77% were premature. During the study, 102 NB have died (mortality rate of 14.5%). The analysis of the relative risk (RR) of indicators – LBW (RR=1.75, CI95%=1.17-2.62, $p < 0.006$), prematurity (RR=1.60, CI95%=1.03-2.50, $p < 0.03$) – evidenced a higher probability of death for the NB from teenage mothers, with birth weight < 2500 grams or premature, than NB from adult mothers. In conclusion the outcome showed that the number of deaths during the neonatal period was not related to maternal age, but the prematurity and the low birth weight was.

**Keywords:** maternal age, teenage pregnancy, newborns, high risk pregnancy, low birth weight, prematurity.

## Fatores de risco para mortalidade em Unidade de Terapia Intensiva Neonatal: influência da idade materna

**RESUMO.** Este trabalho investigou a influência da idade materna sobre o baixo peso ao nascer (BPN), prematuridade e morte em recém-nascidos (RN). Foi um estudo descritivo, exploratório, retrospectivo e comparativo realizado em Unidade de Terapia Intensiva Neonatal (UTIN) de um hospital universitário no Brasil. Foram incluídos no estudo setecentos e seis RN internados na UTIN, no período de cinco anos. Os resultados mostraram elevada taxa de partos de mães adolescentes (27%). Entre as mães adolescentes (193), 80% dos RN apresentaram baixo peso ao nascer, e 84% foram prematuros. Entre as mães adultas (513), 69% dos RN foram identificados com baixo peso ao nascer, e 77% prematuros. Durante o estudo, 102 RN foram a óbito, correspondendo a 14,5% de mortalidade. A análise do risco relativo (RR) dos indicadores baixo peso ao nascer (BPN) (RR = 1,75, IC95% = 1,17-2,62, $p < 0,006$) e prematuridade (RR = 1,60, IC95% = 1,03-2,50, $p < 0,03$) demonstrou uma maior probabilidade de morte para o RN de mães adolescentes, com peso de nascimento <2500 gramas ou prematuro, quando comparado aos RN de mães adultas. O trabalho mostrou que a prematuridade e o baixo peso ao nascer foram fatores determinantes para a mortalidade de RN, e que a mesma não foi relacionada à idade materna.

**Palavras-chave:** idade materna, gravidez na adolescência, recém-nascidos, gravidez de alta de risco, baixo peso ao nascer, prematuridade.

## Introduction

Adolescence according to World Health Organization covers the life period between 10 and 19 years, and during this period, intense changes take place, mainly characterized by a rapid growth, appearance of secondary sexual characteristics, awareness of sexuality, organization of personality, environmental adaptation, and social integration (Martins, Pontes, Filho, & Ribeiro, 2014). The sexual initiation frequently happens in this period, which has been cause of concern, whether by the possibility of unwanted pregnancies, or by the spread of sexually transmitted diseases (Kirby, 2001).

In recent years the proportion of teenage pregnancy has become higher than of adult women of childbearing age. This is not exclusive of Brazil, but observed in other countries (Puhl, Pereira, Grisard, & Hallal, 2007; Paranjothy, Broughton,

Adappa, & Fone, 2009; Thaithae & Thato, 2011). Besides that, there are differences between countries and regions within the same country, determined by the developing level which is in turn results from economic conditions, culture differences, and access to health services and contraceptive methods (Costa, Santos, Nascimento Sobrinho, Moura, Souza & Assis, 2005; Costa & Heilborn, 2006).

Pregnancy in this group has worried health professionals around the world, due to its high prevalence (Phipps & Sowers, 2002; Costa et al., 2005; Costa & Heilborn, 2006; Puhl et al., 2007; World Health Organization [WHO], 2006). The teenage pregnancy may lead to complications to mother and newborn (NB). These complications are associated with the physical and psychological immaturity of the mother, lack of family support, late onset or absent prenatal care (Oliveira, Gama, & Silva, 2010). Among the main complications related to teenage mothers, stand out: anemia, preeclampsia, bleeding, infections; and among the newborns (NB), prematurity, low birth weight, low Apgar score, and respiratory diseases, which increase the perinatal mortality rate (Suebnukarn & Phupong, 2005; Dominguez-Anaya & Herazo-Beltrán, 2011). Nevertheless, the infant mortality has been the main concern of teenage pregnancy. Despite the advances in prenatal diagnoses, the prematurity and low birth weight remain as the major factors of infant morbidity and mortality (Araújo, Tanaka, Madi, & Zatti, 2005; Costa & Heilborn, 2006; Suzuki, Ceccon, Falcão, & Vaz, 2007; Oliveira et al., 2010; Dominguez-Anaya et al., 2011).

The literature indicates a greater risk for low weight and prematurity among NB from teenage mothers, suggesting the interference of maternal variables on gestational outcome (late onset of prenatal care, uncertain marital status, maternal history of teenage pregnancy, low education of the teenager, low weight, and maternal nutritional status, among others) (Aquino-Cunha, Queiroz-Andrade, Tavares-Neto, & Andrade, 2002; Fernandéz, Puig, Ferreira, & Pinero, 2004; Oliveira et al., 2010). However, few studies have performed the follow-up of the NB after admission in the Neonatal Intensive Care Unit (NICU) (Fernandéz et al., 2004).

The present study was performed in a public university hospital, where it is observed high rates (25.5%) of teenage pregnancy, owed the predominant sociodemographic characteristics of the assisted population (Silva & Pelloso, 2009), been higher than that recommended by the World Health Organization of less than 10%.

Regarding the negative complications brought about by teenage pregnancy on the health of both mother and NB, a study comparing the NB of adolescent and adult mothers, admitted in the NICU would enable to verify the difference between these groups, mainly considering the prematurity and/or low birth weight.

The goal of this research was to evaluate the influence of teenage pregnancy on the occurrence of low birth weight, prematurity and death among newborns admitted in NICU. The results of such study are important to guide health actions aiming to improve the attendance to this group of pregnant, in an attempt to reduce the prematurity, birth of underweight children and hence avoidable deaths in the NICU.

## Material and methods

This is a descriptive exploratory study, with retrospective and comparative character, developed from admissions in the NICU of a university hospital in Brazil. This hospital is a reference service for medium- and high-complexity care for 30 towns that comprise the 15$^{th}$ Health Division of the Paraná State. It is accredited to the Brazilian Unified Health System, characterized as a public institution and teaching hospital. It has 123 beds, six of which attending the NICU, and four for intermediate neonatal care (semi intensive unit).

All of the registered patients in the NICU in the period of five years were included in the present study, and the exclusion criteria were incomplete data in the records and twinning.

The variables examined were: mother age – divided into teenage mothers (10-19 years) and non-teenage or adult mothers (>20 years); gestational age (weeks) – premature (< 37 weeks) and term NB (> 37 weeks); birth weight (grams) – considering underweight the NB < 2500 g, and no-underweight the NB ≥ 2500 g; and outcome – for the occurrence or not of NB death.

Data were organized in the Microsoft Excel® Application, and the statistical analysis was run using the software *Stata* 9.0®, with the significance level set at $p < 0.05$. In order to evaluate possible associations between the different variables, it was calculated the Relative Risk: between the mother age and the birth weight, prematurity and outcome (death). The risk factor in this study is being a child from a teenage mother.

This study was approved by the Ethics Committee for Research on Human Beings of the State University of Maringá (Ref. number 758/2010).

## Results

A total of 1030 NB was registered in the NICU of the hospital of which 324 NB (32%) were excluded from the study, 304 due to the lack of data in the records, and 16 NB, by being twins. Thus, the population included in this study was 706 NB, 192 from teenage mothers (27%) and 514 from non-teenage or adult mothers (73%).

The mean age of the teenage mothers was 16.9 years, with a minimum of 12 years, and a maximum of 19 years. As for non-teenage or adult mothers, the age ranged from 20 to 43 years, with a mean of 27.4 years.

Among the admitted newborn infants, 79% were premature (558) and 72.6% had low birth weight (513). These data are listed in the Table 1.

When relating the data, an association between premature NB and teenage mothers was significantly higher ($p < 0.03$) compared with adult mothers, with percentages of 84.3% and 77%, respectively. Likewise, the low weight at birth were significantly more frequent ($p < 0.006$) for NB from teenage mothers (80.2%) than NB from adult mothers (69.8%) (Table 1).

During the admission in the NICU, 102 deaths were registered among the 706 NB, representing a mortality rate of 14.5%. Among the NB who have died, 17% were children from teenage mothers, and 13% from adult mothers. This difference was not statistically significant. However, comparing the fatal outcome (death) with the prematurity and low birth weight, regardless of the mother age, most of NB who have died was premature with low birth weight. When the prematurity was associated with the death, a percentage of 15.23% of death was observed in this group, whereas 11.49% was verified for term NB. By relating the low birth weight to the same outcome (death), a percentage of 16% was observed for this group of NB, against 9% for infants with adequate weight at birth.

**Table 1.** Variable Distribution: weight at birth, gestation age, sex, birth type and deaths of the patients, NB from teenage mothers and NB from adult mothers, admitted in the Neonatal Intensive Care Unit (NICU).

| Variable | Teenage (N= 192) | Adult (N=514) | Totals (N=706) |
|---|---|---|---|
| Birth weight (grams) | | | |
| <2500 | 154 (80.2%) | 359 (69.8%) | 513 (72.6%) |
| >2500 | 38 (19.7%) | 155 (30.1%) | 193 (27.3%) |
| Gestation age (weeks) | | | |
| PTNB (<37) | 162 (84.3%) | 396 (77.0%) | 558 (79.0%) |
| TNB (>37) | 30 (15.6%) | 118 (22.9%) | 148 (20.0%) |
| Sex | | | |
| Female | 74 (38.5%) | 241 (46.8%) | 315 (44.6%) |
| Male | 118 (61.4%) | 273 (53.1%) | 391 (55.4%) |
| Birth type | | | |
| Normal | 105 (54.6%) | 175 (34.0%) | 280 (39.6%) |
| Cesarian | 87 (45.3%) | 339 (65.9%) | 426 (60.3%) |
| Deaths | | | |
| | 33 (17.1%) | 69 (13.4%) | 102 (14.4%) |

N = number of newborns (NB); PTNB= premature NB; TNB= term NB

The results of the Relative Risk, evaluating the associations between mother age and birth weight, prematurity, and death are listed in the Tables 2 and 3.

The analysis of the relative risk of the three indicators – low birth weight, prematurity and mortality – evidenced a higher probability of death for the NB from teenage mothers admitted in the NICU, with birth weight below 2500 grams or premature, than newborn infants from adult mothers.

## Discussion

In the present study, the proportion of childbirths of teenage mothers was 27% in relation to the total. Silva & Pelloso (2009), examined the profile of pregnant women and NB in the same hospital and showed that 25.5% of the pregnant women were adolescent. This is a high index in comparison with the national average of 22% (Ministério da Saúde [MS], 2006). According to Heilborn & Cabral (2011), an increased incidence of teenage pregnancy had been observed in Brazil, unlike observed in other countries, where is observed a downward trend in this occurrence.

**Table 2.** Relative risk and distribution of weight at birth and gestational age by age group of the mother, of the patients admitted in the Neonatal Intensive Care Unit (NICU).

| Variable | Mother age (years) | | | | | | RR | CI95% | *P* |
|---|---|---|---|---|---|---|---|---|---|
| | 12-19 | | >20 | | Total | | | | |
| | N | % | N | % | N | % | | | |
| Gestational age (weeks) | | | | | | | | | |
| PTNB (<37) | 162 | 84 | 396 | 77 | 558 | 79 | 1.60 | 1.03-2.50 | 0.030 |
| TNB (>37) | 30 | 16 | 118 | 23 | 148 | 21 | | | |
| NB weight (grams) | | | | | | | | | |
| <2500 | 154 | 80 | 359 | 70 | 513 | 73 | 1.75 | 1.17-2.62 | 0.006 |
| >2500 | 38 | 20 | 155 | 30 | 193 | 27 | | | |
| Total | 192 | 100 | 514 | 100 | 706 | 100 | | | |

N = number of newborns (NB); RR = relative risk; PTNB= premature NB ; TNB= term NB; CI= confidence interval

**Table 3.** Relative risk of deaths of newborn infants admitted according to the variables: mother age, gestation age, and weight at birth of the patients admitted in the Neonatal Intensive Care Unit (NICU).

| | | Deaths (n=706) | | | |
|---|---|---|---|---|---|
| Variable | N | N | % | RR | CI95% |
| Mother age (years) | | | | | |
| Teenage (12-19) | 192 | 33 | 17 | 1.338 | 0.85-2.10 |
| Adult (>20) | 514 | 69 | 13 | | |
| Gestational age (weeks) | | | | | |
| PTNB (<37) | 558 | 85 | 15 | 1.38 | 0.79-2.41 |
| TNB (>37) | 148 | 17 | 11 | | |
| NB weight (grams) | | | | | |
| <2500 | 513 | 85 | 16.5 | 2.05 | 1.18-3.57 |
| >2500 | 193 | 17 | 8.8 | | |

N = number of newborns (NB); RR = relative risk; PTNB= premature NB; TNB= term NB; CI= confidence interval

Our data indicated that the NB from teenage mothers had unfavorable indices of weight and gestational age, when compared to adult mothers. It was observed that 80% of NB from teenage mothers presented low birth weight and 84% were premature. Although low birth weight and prematurity are frequently found in NICU, there is a distinct incidence between the groups, since among NB from adult mothers, these values corresponded to 70% and 77%, respectively.

In agreement with specific literature, these results can be due to biological factors associated with organic immaturity and nutritional dysfunction that may be related with the underweight and prematurity of NB from teenage mothers (Stevens-Simon, Beach, & Macgregor, 2002; Ministério da Saúde [MS], 2006; Paranjothy et al., 2009). Moreover, other factors can be added, such as the low socioeconomic condition of the parturients, which in some cases contributes to situations of physical abuse, use of chemicals, and lower seeking for professional care during the pregnancy (Araújo et al., 2005; Paranjothy et al., 2009). In addition, this study was performed in a NICU linked to the Brazilian Unified Health System, reference for nearby towns, accepting cases of high complexity and risk.

Indeed, a study performed in a Brazilian city (Ribeirão Preto/São Paulo State), with 7134 childbirths of teenage pregnant, pointed out a significantly higher percentage of attendance for this group in the SUS (80%), when compared to the attendance made by health plans or private system, with indices of 17.9 and 2.1%, respectively (Yazlle, 2006; Yazlle, Franco, & Michelazzo, 2009).

Nevertheless some studies highlighted controversies considering the teenage pregnancy as single risk factors for the low weight at birth (Treffers, Olukoya, Ferguson, & Liljestrand, 2001; Suzuki et al., 2007; Amorim, Lima, Lopes, Araujo, Silva, César, & Melo (2009); Yazlle et al., 2009; Oliveira et al., 2010). However, regarding the NB prematurity, data from developed and developing countries showed that teenage mothers are at the highest risk for such event, when compared to mothers above 20 years. Also, studies have indicated that the younger the mother the higher the risk of prematurity, with 19% for teenage mothers aged 15 years, and 30% for teenage mothers aged between 10 and 12 years (Treffers et al. 2001).

In the present study, the analysis on the final outcome of the NB showed that the number of deaths during the neonatal period was not related to the age of the mother. These data are similar to those of Oliveira et al., (2010), where the authors did not find any relationship between neonatal death and maternal age. But, the prematurity and the low weight at birth appear to have a direct relationship with NB death. The investigation of the birth weight evidenced the 2-fold risk of death during hospitalization in the patients with low birth weight. Oliveira et al., (2010) registered a risk of death around 8-fold higher in NB weighing lower than 2500 g. Shrimpton (2003) reported that a 100 g-increase in mean weight at birth of the underweight NB is associated with a reduction of 30 to 50% in neonatal mortality, corroborating the impact of this variable on the vulnerability of these infants. Araújo et al. (2005) verified a risk of death six times greater among NB with weight below 2500 g and/or gestational age lower than 37 weeks.

Importantly emphasizing that besides prematurity and low birth weight, several other factors, traditionally known, may determine neonatal deaths, such as severe asphyxia at birth, Apgar score between 0-3 on the first minute, twinning, high parity, low maternal education, low family income, advanced maternal age (Phipps & Sowers, 2002; Marcondes, 2005; Costa et al., 2005; Yazlle, 2006;) and early pregnancy (younger than 15 years) (Shrimpton, 2003; Behrman, Kliegman, & Jenson, 2004).

What seems evident from the results of this study is that the biological aspect of teenage motherhood has a significant influence on the prematurity and low weight at birth, but does not singly intervene on the fatal outcome, namely the death of the newborn, agreeing with Puhl et al. (2007) and Yazlle et al. (2009). This shows the importance and involvement of social and demographic factors in high rates of neonatal mortality, since the study was carried out in a public hospital (Costa et al., 2005; Puhl et al., 2007; Mukhopadhyay, Chaudhuri, & Paul, 2010; Dominguez-Anaya & Herazo-Beltrán, 2011). The

concern with pregnant teenagers has led several health services to provide a special assistance to this group during the prenatal care (Fernández et al., 2004; Costa et al., 2005; Costa & Heilborn, 2006; Mukhopadhyay et al., 2010; Dominguez-Anaya & Herazo-Beltrán, 2011; Heilborn & Cabral, 2011). The recommendation is that pregnant teenager should start early a prenatal care, which allows a more effective monitoring on the risks for hypertension or other comorbidities, and to ensure an adequate nutrition. Therefore, the implementation of projects and programs addressing this subject should be encouraged, mainly concerning the prevention of teenage pregnancy, and the planning of care for pregnant and NB in the NICU.

## Conclusion

In summary, our results validate the underweight and prematurity as the major factors of risk to appropriate development of the human being during neonatal period. Once these factors are strongly related to maternal age, we emphasized the need to consider the teenage pregnancy as an event worthy of special attention from health care policy in our country. This concern is mainly justified by the paradoxically increasing trend of these cases in the national context, when compared to the rest of the world. Thus despite the limitations of this study, and failure to draw generalizations extensive to other health care realities, it is concluded by the importance of performing researches of this nature, in order to allow the design of each specific scenario of care, providing the support for the proposition of strategies to enable its gradual transformation.

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