0021-7557/10/86-04/295
Jornal de Pediatria

Assessment of the profile of births and deaths in a referral hospital

Maria Albertina S. Rego,[1] Elisabeth Barboza França,[2] Ana Paula Azevedo Travassos,[3] Fernando C. Barros[4]

Abstract

Objective: To compare perinatal health indicators in a referral hospital in Belo Horizonte, Brazil.

Methods: Perinatal results and indicators of single live births in Hospital das Clínicas of Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil, were compared for two periods, 1995-1998 and 2003-2006. The chi-square test and Student's *t* test were applied with 5% significance level and 95% confidence interval. Data were obtained from the Perinatal Information System (Sistema Informático Perinatal, SIP), Latin American Center for Perinatology (Centro Latinoamericano de Perinatología, CLAP), Pan American Health Organization (PAHO), Hospital das Clínicas, and from medical records.

Results: Mothers were approximately 26 years old on average. The number of prenatal appointments had an average increase of one appointment, regardless of birth weight, and there was a significant decrease in the number of caesarean deliveries in the second period. The average gestational age was 38 weeks in both periods, with a high rate of premature births (17.0 and 16.7%, respectively). The rate of newborns < 2,500 g was high in both periods (17.6 and 16.6%, respectively) with a decrease in the rate of newborns considered small for their gestational age. When congenital malformations were excluded, early neonatal mortality risk decreased from 12.4 per 1,000 live births in the first period to 8.0 per 1,000 live births in the second period, with considerable decrease for newborns with gestational age < 34 weeks.

Conclusions: Important differences were verified concerning health care assistance procedures and perinatal results, and they are compatible with the global improvement in neonatal health observed in the 2003-2006 period. However, the persistence of unfortunate neonatal incidents that can be reduced with the use of available perinatal technologies reveals the need for constant monitoring of perinatal hospital care for all groups of newborns.

J Pediatr (Rio J). 2010;86(4):295-302: Health services evaluation, information systems, neonatal mortality, infant mortality.

1. Doutora, Ciências da Saúde, Saúde da Criança e do Adolescente, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, MG, Brazil. Departamento de Pediatria, Faculdade de Medicina, UFMG, Belo Horizonte, MG, Brazil.
2. Pós-doutora, University of Queensland, Brisbane, Australia. Programa de Pós-Graduação em Ciências da Saúde, Saúde da Criança e do Adolescente, Departamento de Pediatria, Faculdade de Medicina, UFMG, Belo Horizonte, MG, Brazil. Programa de Pós-Graduação em Saúde Pública, Departamento de Medicina Preventiva e Social, Faculdade de Medicina, UFMG, Belo Horizonte, MG, Brazil.
3. Mestre, Estatística, UFMG, Belo Horizonte, MG, Brazil.
4. Pós-Doutor, Epidemiologia da Assistência Médica, Escola de Higiene e Medicina Tropical, University of London, Londres, United Kingdom. Pós-Graduação, Saúde e Comportamento, Universidade Católica de Pelotas (UCPEL), Pelotas, RS, Brazil.

This study was conducted at the Pediatrics Department of the Medical School, Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, MG, Brazil.

Financial support: Research Support Foundation of the State of Minas Gerais (Fundação de Amparo à Pesquisa do Estado de Minas Gerais - FAPEMIG), nº REF: EDT 1770/2003, and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Grant nº 403707/2004-8.

No conflicts of interest declared concerning the publication of this article.

Suggested citation: Rego MA, França EB, Travassos AP, Barros FC. Assessment of the profile of births and deaths in a referral hospital. J Pediatr (Rio J). 2010;86(4):295-302.

Manuscript submitted Nov 03 2009, accepted for publication Mar 05 2010.

doi:10.2223/JPED.2004

Introduction

The increasing share of neonatal mortality within child mortality in Brazil as of 1990's, with about 60% of child deaths being caused by perinatal events, reinforces the need to study the health profile and quality of perinatal health care provided to this population group.[1] Prevalent factors associated with death are low birth weight, immaturity, intrapartum asphyxia and neonatal infections, mainly resulting from conditions potentially controlled by means of effective prenatal, intrapartum, delivery and neonatal care.[2] Mother characteristics, such as age, education, reproductive history, health conditions before and during gestation, have cumulative effects and influence on delivery and birth conditions as well as on the adaptation of the newborn to extra-uterine life. Among proximal risk factors for neonatal mortality, gestational age has been considered a more relevant predictive factor than birth weight, taken in isolation.[3] Unfavorable socioeconomic conditions, malnutrition, hypertensive syndromes and chronic infections of the mother are important factors in searching for causes of prematurity and restricted fetal growth.[4]

Assessments of health care assistance during delivery and birth and its influence on neonatal mortality reveal that, along with the risk profile of the population, the hospital performance is an important risk factor for different mortality rates found among hospitals, in countries where most deliveries take place in health care institutions, such as Brazil.[2] Identification and care provided during high-risk pregnancies, use of corticoids for imminent premature deliveries, obstetric care during labor, pediatric assistance at birth and during neonatal period, use of surfactant therapy for hyaline membrane disease among others reduce adverse effects of low birth weight, prematurity and neonatal asphyxia.[5]

Monitoring population profile and perinatal care within a hospital or a network, based on reliable information adequately collected and stored that comprises essential indicators for basic perinatal assistance is a fundamental strategy for effective interventions aimed at potentially improved clinical procedures.[6-9] In Latin America, a public domain software for standard clinical records of perinatal information of all births, named Perinatal Information System (Sistema Informático Perinatal, SIP), was developed by the Latin American Center for Perinatology (Centro Latinoamericano de Perinatología, CLAP) and the Pan American Health Organization (PAHO) to allow the incorporation of improved strategies of individual health care to a collective surveillance of perinatal health.[10]

In Belo Horizonte, state of Minas Gerais, Brazil, from 1999 to 2001, Hospital de Clínicas (HC) of Universidade Federal de Minas Gerais (UFMG) was included in the State Program of Referral Hospitals (Programa Estadual de Referência Hospitalar) for the health care of high-risk expectant mothers,[11] with infrastructure improvements in terms of equipment and human resources for the obstetrics and neonatal service, as well as changes in the management of perinatal care services in the city.[12] Within this context, this study aimed at comparing basic indicators of perinatal care at HC/UFMG in two periods, 1995-1998 and 2003-2006, based on data collected with SIP/CLAP for all deliveries performed at the institution.

Methods

Detailing the study

It is a retrospective cohort study of single birth live newborns that were followed from birth to discharge or death. Variables were collected in perinatal clinical history available at the SIP/CLAP database.

Among maternity units included in the SIP/CLAP system in Belo Horizonte, HC/UFMG was selected due to its position as a referral hospital for fetal and perinatal medical care services in the state of Minas Gerais and its undergraduate and graduate education, research and outreach programs.

Two periods were studied: 1995-1998 and 2003-2006. They were selected because of possible changes in the population profile and services of HC/UFMG after a system for referral hospitals providing high-risk expectant mothers health care was implemented in Minas Gerais[11] and after a reorganization in the municipal system of perinatal referral hospitals took place, from 1999 to 2001.[12]

The SIP/CLAP database of HC/UFMG (HC/SIP) was based on the routine collection and record of clinical information entered by assistant doctors, obstetricians and neonatologists in the form Perinatal Clinical History (HCP/SIP). It should be filled out following a sequence of modules as the health assistance is provided to the mother and newborn, from birth to discharge. Other detailed information on SIP/CLAP, its variables, specific processes for report generation and its interpretation for decision making are available in several publications of CLAP.[10]

Selected variables

The following variables on demographics, health care, evolution of mother and newborn recorded at SIP/CLAP were considered: age of mother, education of mother, number of prenatal appointments, pregnancy termination, gestational age, birth weight, birth rate/gestational age ratio, maternal diseases (hypertension, hemorrhage, infections, diabetes and heart disease), neonatal diseases (congenital malformations, hyaline membrane disease, infection, hyperbilirubinemia and other respiratory distress syndromes), 1-minute and 5-minute Apgar scores, days of hospitalization (based on birth and discharge/death dates) and newborn nutrition at discharge (breastfeeding, formula, breastfeeding and formula).

Deaths were classified according to the newborn's age: first day, less than 7 days (early neonatal) and death in hospital (before the first discharge, independent of the newborn's age). All newborns were followed for record of potential death at SIP/CLAP. Newborns assisted in HC/UFMG are discharged to go home, not being referred to other hospitals, unless they would undergo a heart surgery, thus returning for recovery in the hospital.

Due to the large number of values ignored for the number of years at school variable, "education" variable was made up of three original variables: literacy (yes or no), level of education according to the formal education system (none, primary, secondary, higher) and the number of years in the highest level achieved. "Hypertension" was considered when there was positive record of at least one of three original variables: previous hypertension, preeclampsia or eclampsia during current gestation. The same criterion was adopted for "infection," which was considered positive when there was a record of urinary infection or puerperal infection or other infections during the current gestation.

In order to determine the gestational age, the first criterion was gestational age as assessed by the obstetrician based on either an early ultrasonography (before the 20th week of gestation) or the date of the last menstrual period. If both were absent, gestational age was assessed by the pediatrician with the New Ballard Score.[13] Newborns were considered small for gestational age (SGA) when their birth weight was below the 10th percentile, according to the intrauterine growth curve of Kramer et al.[14] In order to exclude multiple deliveries, in case of no record of original variables, medical records were checked for twin pregnancy and birth order (11% of HCP/SIP).

Medical records were checked for discharge date in all cases of newborns that progressed to death, and in 2.6% of those cases date of death was corrected.

Data analysis and ethical aspects

Obstetric and neonatal variables of both periods were compared using chi-square test for categorical variables and Student *t* test for comparing the means, with a 5% significance level. For neonatal results, data were stratified according to gestational age. For mortality analysis, newborns with congenital malformations were not included because determinants for these cases are usually different from other deaths.[15] Estimates of relative mortality risks stratified according to gestational age were considered as an association between death and the period considered, with a 95% confidence interval. The first period was taken as the reference.

For data processing and statistical analyses, conventional outputs of SIP/CLAP and SPSS version 13.0 and Stata version 9.0 statistical packages were used. This study was approved by the Research Ethics Committee of UFMG (Document n. ETIC 313/04).

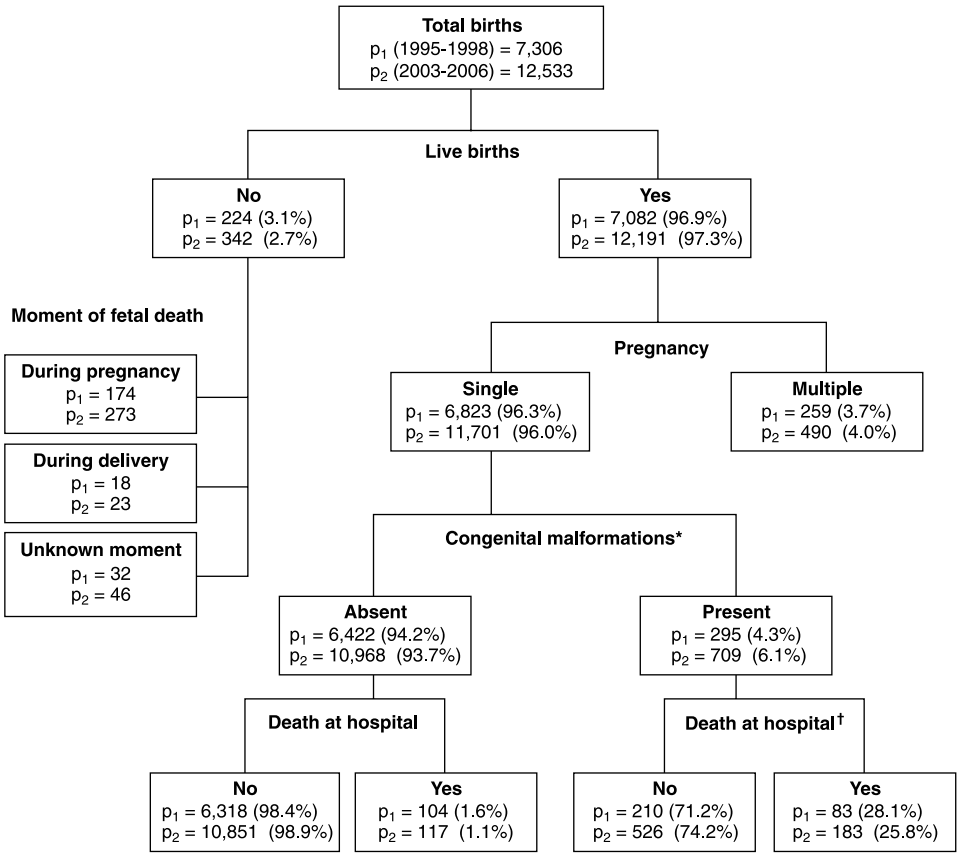
Results

Figure 1 shows the distribution of births according to the newborn status (live birth or fetal death), pregnancy type (single or multiple) and neonatal progress at hospital for singletons, with and without congenital malformations (CM) in both periods. Data analyzed: 6,823 and 11,701 singleton live births respectively corresponding to the first and second periods. Out of these, congenital malformations were identified in 4.3% of cases in the first period and 6.1% in the second period, which lead to a large number of deaths, with a mortality rate much higher (28 and 26% for the first and second periods, respectively) than that among newborns with no congenital malformations.

The distribution of newborns according to sex in both periods was similar, with 48.9 and 49.5% female newborns in each period, respectively; there was almost no lack of data.

Table 1 shows maternal, health care and neonatal characteristics selected for all live births in both periods. Mothers were approximately 26 years old on average in both periods. There was a decrease in the rate of mothers below 20 years old, but that of mothers ≥ 35 years old increased: they were 10.6% in the first period and 12.5% in the second. In terms of education, a higher number of mothers with 4 to 7 years of education was observed. However, the level of education could not be assessed for 15.5% of them in the first period and 21.1% in the second. The rate of mothers who had six or more prenatal appointments reached 73.8% in the second period, with an average increase in one appointment. There was a reduced rate of caesarean deliveries in 2003-2006, with stable rates in terms of forceps use in both periods. If only primiparous mothers are considered, the rate of caesarean deliveries decreased from 42.3% in the first period to 33.6% in the second (data not shown).

There were no relevant changes in distribution of birth weight and gestational age between the periods. The rate of low birth weight newborns (birth weight > 2,500 g) was 17.6% in the first period and 16.6% in the second. Prematurity rate (gestational age < 37 weeks) decreased from 17.0% in the first period to 16.7% in the second, but average gestational age was approximately 38 weeks for both periods. There was a reduced rate of post-term newborns (gestational age ≥ 42 weeks), decreasing from 1.5% in the first period to 0.7% in the second. Despite the rate of SGA newborns has decreased from 28.7 to 25.7% in the second period, the rate of SGA was high (57%) among newborns between 1,500 and 2,500 g (data not shown).



* For 105 (1.6%) newborns in the first period and 24 (0.2%) in the second period, there was no information.
† For 2 (0.7%) newborns in the first period there was no information.

Figure 1 - Distribution of singleton fetal deaths and live births at Hospital das Clínicas of Universidade Federal de Minas Gerais, in Belo Horizonte (state of Minas Gerais), in two periods, 1995-1998 (p1) and 2003-2006 (p2)

Neonatal results are shown according to gestational age in Table 2. The rate of neonatal diseases was high in both periods for pre-term newborns, but it was also high for full-term infants (34 to 36 weeks). A marked increase in rates of hyaline membrane disease for all pre-term infants and of infections for newborns below 32 weeks in the second period were observed.

The rate of depressed scores at birth, assessed by 1-minute and 5-minute Apgar scores < 7 was reduced in the second period for newborns with gestational age < 34 weeks. For all newborns in both periods, there was recovery of an important share in the 5-minute Apgar score (Apgar ≥ 7) in contrast to the 1-minute measure (Apgar < 7). The average number of days of hospitalization increased for newborns < 32 weeks in the second period and reduced for other groups. On the other hand, the rate of exclusive breastfeeding increased in the second period, particularly among pre-term infants.

Table 3 shows mortality rates in both periods for live births with no congenital malformations. There was a significant decrease in mortality rates of newborns with gestational age < 34 weeks for almost all periods of life assessed in 2003-2006 as compared to 1995-1998.

Discussion

Assessment of the progress of neonatal morbidity and mortality rates in a public, tertiary referral hospital with fetal and neonatal medical care services in Minas Gerais was possible due to the use of information available at SIP/CLAP/PAHO. A high low birth weight rate and prematurity in both periods identify a newborn population with unfavorable health conditions associated to the main causes for neonatal and infant morbidity and mortality.[4] On the other hand, comparison of both periods reveals important improvement in some health care indicators and results, such as increase in the average number of prenatal appointments, reduced rate of caesarean deliveries, higher rate of newborns' nutrition relying exclusively on breastfeeding, as well as lower 5-minute Apgar score rates and mortality reduction, thus indicating a general improvement in health care during prenatal, delivery and neonatal periods.

Table 1 - Some maternal, health care and singleton newborn characteristics – Hospital das Clínicas, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil, 1995-1998 and 2003-2006

Variables	1995-1998 (n = 6,823), n (%)	2003-2006 (n = 11,701), n (%)	p*
Age of mother (years)			
< 20	1,308 (19.6)	2,097 (18.2)	< 0.001
20 to 34	4,663 (69.8)	8,006 (69.3)	
≥ 35	706 (10.6)	1,443 (12.5)	
Mean ± standard deviation	25.6±6.4	25.9±6.7	< 0.050
Education (years)			
0-3	683 (11.8)	1,023 (11.1)	< 0.001
4-7	3,457 (60.0)	6,152 (66.7)	
≥ 8	1,626 (28.2)	2,052 (22.2)	
Mean ± standard deviation	5.9±3.0	5.3±2.7	< 0.001
Prenatal appointments			
0	164 (2.9)	160 (1.5)	< 0.001
1 to 5	2,393 (42.0)	2,612 (24.7)	
≥ 6	3,137 (55.1)	7,793 (73.8)	
Mean ± standard deviation	5.7±2.5	6.8±2.3	< 0.001
Maternal diseases			
Hypertensive syndromes	531 (9.7)	879 (8.0)	< 0.001
Hemorrhage	45 (0.8)	58 (0.5)	< 0.050
Infections	314 (5.7)	968 (8.8)	< 0.001
Diabetes	146 (2.7)	277 (2.5)	NS
Heart disease	122 (2.2)	103 (0.9)	< 0.001
Pregnancy termination			
Spontaneous	3,634 (53.4)	6,949 (59.4)	< 0.001
Forceps	303 (4.5)	527 (4.5)	
Caesarean	2,866 (42.1)	4,190 (35.8)	
Gestational age (weeks)			
< 32	216 (3.2)	397 (3.4)	< 0.050
32 to 33	141 (2.1)	314 (2.7)	
34 to 36	801 (11.8)	1,235 (10.6)	
≥ 37	5,647 (83.0)	9,731 (83.3)	
Mean ± standard deviation	38.1±2.6	38.0±2.6	< 0.050
Birth weight (g)			
< 1,500	244 (3.6)	365 (3.1)	NS
1,500-1,999	253 (3.7)	430 (3.7)	
2,000-2,499	705 (10.3)	1,143 (9.8)	
2,500-2,999	1,932 (28.3)	3,321 (28.4)	
≥ 3,000	3,689 (54.1)	6,442 (55.1)	
Mean ± standard deviation	2,968.0±633.9	2,982.8±617.2	NS
SGA newborn	1,955 (28.7)	3,004 (25.7)	< 0.001

NS = non-significant test (p ≥ 0,05); SGA = small for gestational age.
* p value according to chi-square test for categorical variables or Student *t* test for comparing the means between both periods.
The rate in each category is based on total valid replies, not considering missing data.
Lacking data per period (n): age of mother: 146 and 155; education: 1,057 and 2,474; prenatal appointments: 1,129 and 1,136; termination of pregnancy: 20 and 35; gestational age: 18 and 24; SGA newborn: 18 and 24; hypertensive syndromes, hemorrhage, diabetes, heart disease: 1,345 and 647; maternal infection: 1,345 and 648.

Positive neonatal results, despite the high increase in prematurity rates, were found by Barros et al. in the city of Pelotas, Brazil, in comparing two newborn population cohorts from 1982 to 1993.[16] In a study on perinatal and neonatal care in maternity units in the city of Rio de Janeiro (state of Rio de Janeiro) from 1991 to 2001, Leal et al.[17] found a population of mothers with a more unfavorable risk profile when assessed according to level of education, rate of adolescent mothers and higher number of diseases, such as hypertension and infections, in public maternity units. However, a 14.8% low birth rate and a 12.8% prematurity rate were lower than those found in the present study. An increase in prematurity and caesarean delivery rates, found in population-based studies in Brazil, even for low perinatal risk populations,[18] was not observed in the same degree in our hospital-based study.

Lower rates of neonatal depressed scores comparing 5-minute to 1-minute Apgar scores in both periods and in all birth weight groups suggest that pediatric health care demands at delivery were generally met. Obstetric interventions during prenatal period and at delivery may have also contributed to a reduced rate of < 34-week newborns with 1-minute Apgar scores < 7 in the second period, with better adaptation of these newborns during their first moments of life. Nevertheless, the rate of depressed Apgar scores in the second period remained high, even for late pre-term and full-term newborns. On the other hand, it is known that integrated health care practices, such as antenatal corticoid use and surfactant therapy during the first postnatal hours, among others, are available technologies whose clinical evidences show reduced neonatal and infant morbidity and mortality rates in cases of prematurity.[19,20]

The higher incidence of breastfeeding for all groups of premature newborns suggest positive changes in hospital procedures to favor breastfeeding, known to be one of the most important strategies in reducing infant mortality. HC became a Child Friendly Hospital in 2008.

Table 2 - Neonatal results for singletons according to gestational age – Hospital das Clínicas, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil, 1995-1998 and 2003-2006

	GA < 32		32 ≤ GA < 34		34 ≤ GA < 37		GA ≥ 37		Total	
Variables	**1995-1998 n (%)**	**2003-2006 n (%)**	**1995-1998 n (%)**	**2003-2006 n (%)**	**1995-1998 n (%)**	**2003-2006 n (%)**	**1995-1998 n (%)**	**2003-2006 n (%)**	**1995-1998 n (%)**	**2003-2006 n (%)**
Newborn diseases										
Infection	93 (48.9)	237 (62.5)*	50 (37.6)	113 (36.8)†	92 (11.8)	157 (12.8)†	127 (2.3)	283 (2.9)*	362 (5.4)	790 (6.8)*
HMD	85 (44.7)	209 (55.1)*	27 (20.3)	98 (31.9)*	27 (3.5)	78 (6.3)*	4 (0.1)	7 (0.1)†	143 (2.1)	392 (3.4)*
Congenital malformations	23 (11.5)	57 (14.4)†	18 (13.2)	44 (14.1)†	70 (8.9)	120 (9.7)†	181 (3.2)	487 (5.0)*	292 (4.4)	708 (6.1)*
Hyperbilirubinemia	82 (43.2)	225 (59.4)*	65 (48.9)	209 (68.1)*	277 (35.5)	431 (35.1)†	510 (9.2)	659 (6.8)*	934 (14.0)	1,524 (13.1)†
Other RDS	28 (14.7)	79 (20.8)†	31 (23.3)	80 (26.1)†	99 (12.7)	157 (12.8)†	100 (1.8)	189 (1.9)†	258 (3.9)	505 (4.3)†
1-minute Apgar score										
< 4	87 (43.9)	106 (27.6)*	24 (17.8)	47 (15.3)†	57 (7.3)	105 (8.6)*	193 (3.4)	443 (4.6)*	361 (5.4)	701 (6.0)*
4 to 6	28 (14.1)	84 (21.9)	20 (14.8)	46 (14.9)	51 (6.5)	114 (9.3)	226 (4.0)	686 (7.1)	325 (4.8)	930 (8.0)
≥ 7	83 (41.9)	194 (50.5)	91 (67.4)	215 (69.8)	678 (86.3)	1,004 (82.1)	5,183 (92.5)	8,552 (88.3)	6,035 (89.8)	9,965 (85.9)
5-minute Apgar score										
< 4	36 (18.2)	39 (10.2)*	7 (5.2)	18 (5.8)*	10 (1.3)	22 (1.8)†	26 (0.5)	34 (0.4)†	79 (1.2)	113 (1.0)*
4 to 6	35 (17.7)	21 (5.5)	13 (9.6)	9 (2.9)	14 (1.8)	19 (1.5)	43 (0.8)	78 (0.8)	105 (1.6)	127 (1.1)
≥ 7	127 (64.1)	324 (84.4)	115 (85.2)	284 (91.3)	762 (96.9)	1,185 (96.7)	5,536 (98.8)	9,586 (98.8)	6,540 (97.3)	11,379 (97.9)
Days of hospitalization‡	30.5±32.8	32.1±31.8†	25.2±22.5	17.5±18.0*	10.8±14.3	8.2±15.5*	3.3±5.6	3.2±6.2†	5.5±11.5	5.1±11.5*
Nutrition at discharge										
Breastfeeding	37 (35.6)	139 (57.4)*	50 (46.3)	181 (72.7)*	555 (77.7)	858 (86.9)*	5,017 (94.5)	7,398 (93.7)*	5,659 (90.7)	8,576 (91.5)*
Breastfeeding and formula	44 (42.3)	74 (30.6)	44 (40.7)	53 (21.3)	123 (17.2)	80 (8.1)	228 (4.3)	259 (3.3)	439 (7.0)	466 (5.0)
Formula	23 (22.1)	29 (12.0)	14 (13.0)	15 (6.0)	36 (5.0)	49 (5.0)	66 (1.2)	236 (3.0)	139 (2.2)	329 (3.5)

GA = gestational age; HMD = hyaline membrane disease; RDS = respiratory distress syndromes.
* Significant test ($p < 0.05$).
† Non-significant test ($p \geq 0.05$).
‡ Results in mean ± standard deviation.
The rate in each category is based on total valid replies, not considering missing data.
p value according to chi-square test for categorical variables or Student *t* test for comparing the means between both periods for each gestational age category.
Out of total deaths, 11% in the first period and 10% in the second occurred after the first 27 days of life.
Missing data per period and variable (total): gestational age: 18 (0.26%) and 24 (0.21%); 1-minute Apgar score: 84 (1.2%) and 81 (0.7%); 5-minute Apgar score: 81 (1.2%) and 58 (0.5%); newborn infection: 130 (1.9%) and 50 (0.4%); HMD, Hyperbilirubinemia, RDS: 131 (1.9%) and 50 (0.4%); congenital malformations: 104 (1.5%) and 23 (0.2%); days of hospitalization: 30 (0.4%) and 3 (0.03%); nutrition: 381 (5.6%) and 2,007 (17.2%).

Table 3 - Comparison of mortality risks according to gestational age for live births with no congenital malformations – Hospital das Clínicas, Universidade Federal de Minas Gerais, Belo Horizonte (state of Minas Gerais), 1995-1998 and 2003-2006

Gestational age	Total births		Death on 1st day*			Early neonatal death*			Death in hospital		
	1995-1998	2003-2006	1995-1998 n (rate†)	2003-2006 n (rate†)	RR (95%CI)	1995-1998 n (rate†)	2003-2006 n (rate†)	RR (95%CI)	1995-1998 n (rate†)	2003-2006 n (rate†)	RR (95%CI)
< 32	192	340	32 (167.5)	34 (100.0)	0.60 (0.38-0.93)‡	57 (298.4)	59 (173.5)	0.58 (0.42-0.80)‡	76 (395.8)	78 (229.4)	0.58 (0.45-0.75)‡
32-33	123	270	1 (8.1)	3 (11.1)	1.37 (0.14-12.9)	7 (56.9)	4 (14.8)	0.26 (0.08-0.80)‡	9 (73.2)	5 (18.5)	0.25 (0.09-0.68)‡
34-36	730	1,115	1 (1.4)	5 (4.5)	3.27 (0.43-24.76)	5 (6.8)	10 (9.0)	1.31 (0.45-3.80)	8 (11.0)	12 (10.8)	0.98 (0.40-2.39)
≥ 37	5,464	9,244	9 (1.6)	9 (1.0)	0.59 (0.24-1.47)	12 (2.2)	15 (1.6)	0.74 (0.35-1.57)	13 (2.4)	22 (2.4)	1.00 (0.50-1.98)
Total	6,509	10,969	43 (6.6)	51 (4.6)	0.70 (0.47-1.05)	81 (12.4)	88 (8.0)	0.64 (0.48-0.87)‡	106 (16.3)	117 (10.7)	0.65 (0.51-0.85)‡

95%CI = 95% confidence interval; RR = relative risk.
* Newborn with gestational age < 32 weeks was not included in the first period due to lack of information on death date.
† Mortality rate per 1,000 live births.
‡ p < 0.05 value.
Four newborns whose information on first discharge was missing (one with gestational age of < 32; one with gestational age between 34 and 36 and two with gestational age ≥ 37 weeks) and 38 newborns whose information on gestational age was missing (n = 15 in the first period and n = 23 in the second) were not included.
The 1995-1998 period was established as reference for RR (95%CI).

The high prevalence of maternal diseases may reflect a low quality prenatal care, even considering the specificities of the population served by the institution. A high prevalence of diseases among premature newborns was also observed, with high rates among late pre-term newborns, a population with increased perinatal risk if compared to full-term newborns.[15,21] Hyaline membrane disease had an important increase in the second period, possibly due to changes in diagnostic procedures, better use of perinatal technologies, such as surfactant therapy during the first hours of life, better qualified neonatal and obstetric assistance at delivery and higher survival rates for these infants. High rates were also observed in other Brazilian centers, as reported in a recent study of the Brazilian Network on Neonatal Research.[19]

The high rates of newborns with congenital malformations, increased in the second period, are higher than those reported in other studies,[22] possibly due to the fact that HC/UFMG is a referral hospital for congenital malformations, joining the Latin American Collaborative Study on Congenital Malformations (Estudo Colaborativo Latino-Americano de Malformações Congênitas, ECLAMC). The 6.1% congenital malformation rate found in the 2003-2006 period is relatively similar to that found in 2004 at the Women's Integrated Health Care Center of Universidade Estadual de Campinas (UNICAMP) in Campinas (state of São Paulo), Brazil.[23] The contribution of congenital malformations, which is an important cause for infant mortality in developing countries as Brazil, depends on quality and availability of medical and surgical care and the presence and effectiveness of primary preventive measures.[24]

When excluding congenital malformations, particularly for very low-birth-weight pre-term live births, the reduced general neonatal mortality rates observed in HC/UFMG, associated to relatively stable mother and newborn profiles in the second period, is a favorable result possibly related to better clinical practices. Reduced early and hospital neonatal mortality rates among < 32-week newborns, with half of the rate for the first period, reinforces the importance of improving health care for more immature newborns. Despite comprising a small group, the lower mortality rate among 32 and 33-week newborns represents an important result. However, for late pre-term infants, with 34 to 36 weeks of gestational age, mortality rate in the second period was relatively stable. This group of infants represented an important share among newborns with health problems and high hospitalization period (10 days on average) if compared to full-term newborns, thus demanding an important part of neonatal resources available. These results, which are similar to those of a cohort study on newborns in the city of Pelotas in 2004[21] and those of a study in live births in the US and Canada in the 1990's,[15] reinforce the need for monitoring this group of newborns with important neonatal disease and mortality risks.

This study was conducted based on information collected from a referral public hospital for expectant mothers and newborns under risk, and its results cannot be generalized

to the whole population. Indicators presented in this study, however, provide a time monitoring of perinatal health of newborns at HC/UFMG, with a broad assessment of gestational risk. Nevertheless, they must be complemented by indicators on the severity of neonatal disease at birth, which are of paramount importance to assess clinical risk for newborns in comparing results from different services or populations.[25]

Results presented in this and in other reports point to the need to monitor all the perinatal population in Brazil, where perinatal morbidity and mortality rates are still high, even for gestations of potentially low perinatal risk, including the most developed regions of the country.[26,27] Therefore, the importance of standardized information records of basic variables for all the newborn population during health care services, and not only for newborns < 1,500 g or with gestational age < 34 weeks, is stressed. The use of a publicly accessible, electronic data source such as SIP/CLAP represented an important advance in this study, because it offered qualified information and validated data,[28] which supported our assessment of perinatal health care provided by the institution in the two periods studied. Information was collected in the place where service was provided, and it represented a fundamental strategy for assessment of potentially better clinical practices under implementation.

Acknowledgements

The authors thank Professor Emilia Sakurai for her suggestions during the development of this study.

References

1. UNICEF - Fundo das Nações Unidas para a Infância. Situação mundial da infância 2008: sobrevivência infantil. Brasília: 2007.
2. Barros AJ, Matijasevich A, Santos IS, Albernaz EP, Victora CG. Neonatal mortality: description and effect of hospital of birth after risk adjustment. Rev Saude Publica. 2008;42:1-9.
3. McCormick MC. The contribution of low birth weight to infant mortality and childhood morbidity. N Engl J Med. 1985;312:82-90.
4. Martin RJ, Fanaroff AA, Walsh MC. Pregnancy disorders and their impact on the fetus. In:Fanaroff and Martin's Neonatal-Perinatal Medicine: diseases of the fetus and infant. 8th edition. USA: Elsevier; 2006.
5. American Academy of Pediatrics, The American College of Obstetrics and Gynecologists. Guidelines for perinatal care. 5ª ed. Washington: AAP/ACOG; 2002.
6. Barros FC, Diaz-Rossello JL. Redes multicêntricas e a qualidade da atenção neonatal. J Pediatr (Rio J). 2004;80:254-6.
7. Diaz-Rossello JL. Health services research, outcomes, and perinatal information systems. Curr Opin Pediatr. 1998;10:117-22.
8. Rodrigues RJ. Information systems: the key to evidence-based health practice. Bull World Health Organ. 2000;78:1344-51.
9. Horbar JD, Plsek PE, Schriefer JA, Leahy K. Evidence-based quality improvement in neonatal and perinatal medicine: the neonatal intensive care quality improvement collaborative experience. Pediatrics. 2006;118:S57-64.
10. Simini F, Rubino M, Lopez R, Gonzalo-Diaz A, Schwarcz R. Processamento de datos del sistema informático perinatal. Montevidéo: CLAP; 1996.
11. Brasil. Ministério da Saúde. Portaria nº 3018 de 19/06/1998. Diário Oficial da União 22 jun 1998c. Seção I, p.34.
12. Lansky S. A gestão da qualidade e da integralidade do cuidado em saúde da mulher e da criança no SUS de Belo Horizonte: a experiência da Comissão Perinatal. Divulg Saude Debate. 2006;36:10-17.
13. Ballard JL, Khoury JC, Wedig K, Wang L, Eilers-Walsman BL, Lipp R. New Ballard Score, expanded to include extremely premature infants. J Pediatr. 1991;119:417-23.
14. Kramer MS, Platt RW, Wen SW, Joseph KS, Allen A, Abrahamowicz M, et al. A new and improved population-based Canadian reference for birth weight for gestational age. Pediatrics. 2001;108:E35.
15. Kramer MS, Demissie K, Yang H, Platt RW, Sauvé R, Liston R. The contribution of mild and moderate preterm birth to infant mortality. Fetal and Infant Health Study Group of the Canadian Perinatal Surveillance System. JAMA. 2000;284:843-9.
16. Barros FC, Victora CG, Tomasi E, Horta B, Menezes AM, Cesar JA, et al. Saúde materno-infantil em Pelotas, Rio Grande do Sul, Brasil: principais conclusões da comparação dos estudos das coortes de 1982 e 1993. Cad Saude Publica. 1996;12 Supl.1:87-92.
17. Leal Mdo C, Gama SG, Campos MR, Cavalini LT, Garbayo LS, Brasil CL, et al. Fatores associados à morbi-mortalidade perinatal em uma amostra de maternidades públicas e privadas do Município do Rio de Janeiro, 1999-2001. Cad Saude Publica. 2004;20 Supl 1:S20-33.
18. Barros AJ, da Silva dos Santos I, Victora CG, Albernaz EP, Domingues MR, Timm IK, et al. Coorte de nascimentos de Pelotas 2004: metodologia e descrição. Rev Saude Publica. 2006;40:402-13.
19. Almeida MF, Guinsburg R, Martinez FE, Procianoy RS, Leone CR, Marba ST, et al. Perinatal factors associated with early deaths of preterm infants born in Brazilian Network on Neonatal Research centers. J Pediatr (Rio J). 2008;84:300-7.
20. National Institutes of Health Consensus Development Panel. Antenatal corticosteroids revisited: repeat courses - National Institutes of Health Consensus Development Conference Statement, August 17-18, 2000. Obstet Gynecol. 2001;98:144-50.
21. Santos IS, Matijasevich A, Silveira MF, Sclowitz JK, Barros AJ, Victora CG, et al. Associated factors and consequences of late preterm births: results from the 2004 Pelotas birth cohort. Paediatr Perinat Epidemiol. 2008;22:350-8.
22. Amorim MM, Vilela PC, Santos AR, Lima AL, Melo EF, Bernardes HF, et al. Impacto das malformações congênitas na mortalidade perinatal e neonatal em uma maternidade-escola do Recife. Rev Bras Saúde Matern Infant. 2006;6 Supl 1:S19-25.
23. Luquetti DV, Koifman RJ. Quality of reporting on birth defects in birth certificates: case study from a Brazilian reference hospital. Cad Saude Publica. 2009;25:1721-31.
24. Victora CG, Barros FC. Infant mortality due to perinatal causes in Brazil: trends, regional patterns and possible interventions. São Paulo Med J. 2001;119:33-42.
25. Almeida RT, Persson J. The use of and need for patient classification systems in Swedish neonatal care. Scand J Caring Sci. 1998;12:11-7.
26. Barros FC, Victora CG, Barros AJ, Santos IS, Albernaz E, Matijasevich A, et al. The challenge of reducing neonatal mortality in middle-income countries: findings from three Brazilian birth cohorts in 1982, 1993, and 2004. Lancet. 2005;365:847-54.
27. de Silva AA, Coimbra LC, da Silva RA, Alves MT, Lamy Filho F, Carvalho Lamy Z, et al. Perinatal health and mother-child health care in the municipality of São Luis, Maranhão State, Brazil. Cad Saude Publica. 2001;17:1413-23.
28. Rego MA, França EB, Afonso DC. Avaliação da qualidade da informação do Sistema de Informação Perinatal (SIP-CLAP/OPS) para monitoramento da assistência perinatal hospitalar, Belo Horizonte, 2004. Rev Bras Saúde Matern Infant. 2009;9:275-84.

Correspondence:
Maria Albertina Santiago Rego
Rua Henrique Quick, 399
CEP: 30210-010 - Belo Horizonte, MG - Brazil
Tel.: +55 (31) 3225.0790, +55 (31) 9982.0956
Fax: +55 (31) 3225.0790
E-mail: albertin@medicina.ufmg.br