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ORIGINAL ARTICLE

Teaching neonatal resuscitation at public hospitals in Brazilian State capitals

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Abstract

Objective: To analyze the teaching of neonatal resuscitation offered by Brazilian public hospitals to undergraduate doctors and nurses, pediatric residents and neonatal fellows.

Methods: This cross-sectional multicenter study included 36 hospitals in 20 Brazilian state capitals during June/2003. Local coordinators collected data regarding what the institutions offer to undergraduate doctors and nurses, pediatric residents and neonatal fellows in terms of neonatal resuscitation training and practical activities in neonatal delivery room care. Descriptive analysis was performed.

Results: Twenty-three of the 36 institutions had undergraduate doctors: at 13 of them students were given practical activities in the delivery room, 12 offered neonatal resuscitation training, and at two of the 13 hospitals, interns cared for neonates in the delivery room without specific training. Twenty-three of the 36 hospitals had undergraduate nurses: at eight of them students were given practical activities in the delivery room and at seven of them nursing students cared for neonates in the delivery room without specific training. Twenty-seven of the 36 institutions had pediatric residence programs: at all of them the trained residents cared for neonates in the delivery room, but this training was heterogeneous: theoretical training (2-3 hours) at four institutions and theoretical and practical training (4-64 hours) at 23. Additionally, 15 had neonatal fellowship programs: at all of these the trained fellows cared for neonates in the delivery room, but this training was heterogeneous: theoretical training (2 hours) at one hospital and theoretical and practical training (3-68 hours) at 14.

Conclusion: Formal neonatal resuscitation training is insufficient during medical and nursing graduation and heterogeneously offered to pediatric residents and neonatal fellows.

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Introduction

The number of live births in Brazil in 2001 was 3,106,525 and 61,807 of these children died before reaching one year of age.^{1,2} The number of deaths by 7 days and by 28 days of life were 31,566 and 8,639, respectively, for that year, with early and late neonatal mortality rates of 14.0 and 3.8 per 1,000 live births.^{1,2} For the entire last decade perinatal asphyxia was the primary cause of death in around 10% of neonatal deaths,³ without taking into consideration the results of asphyxia on neonatal mortality for other causes. It is estimated that the figures given here correspond to around 80% of the total number of newborn baby deaths in the country, since data on infant and neonatal mortality are underestimated due to non-reporting, particularly in the North and Mid-West regions.³

Adequate care of the newborn in the delivery room is of fundamental importance to prevent asphyxia injuries, which lead to death. One of the eight strategic interventions for reducing the mortality of children up to 5 years of age on a global level is resuscitation at birth, which has a leading role to play, with an estimated 359,000 deaths of newborn babies per year worldwide that could be prevented by the application of the correct procedures.⁴ Furthermore neonatal rapid and effective resuscitation can reduce the rate of neurological sequelae among survivors, which reduces quality of life for the child and their family, in addition to the elevated economic costs for society, including healthcare costs and the lost productivity of the affected individual.

Several different studies have shown that resuscitation training is a relatively simple and inexpensive strategy for reducing early neonatal mortality.⁴⁻⁸ The most successful of the many different methods of improving professionals' knowledge of the subject has been that proposed by the International Liaison Committee on Resuscitation.^{9,10} This educational program was designed to teach, in a sequential manner, management of newborns who require resuscitation during the critical minutes immediately after birth and its Textbook of Neonatal Resuscitation has been translated into 27 different languages.¹¹

In Brazil, the Neonatal Resuscitation Program was launched in 1994 by the Brazilian Society of Pediatrics (*Sociedade Brasileira de Pediatria*) and, by the end of 1997, practically all states already had instructors ready to multiply knowledge about neonatal care in the delivery room. Lessons focus on the initial steps of neonatal resuscitation, ventilation with mask and bag, chest compressions, tracheal intubation and the use of drugs in the delivery room. The teaching material is delivered in Portuguese and the Textbook of Neonatal Resuscitation, original editions published in 1990, 1994 and 2000, was translated into Portuguese in 1994, 1996 and 2002, respectively.¹² Today the Brazilian Society of Pediatrics has 388 instructors, all of them pediatricians, who, by the end of 2003 had delivered 1,123 theoretical-practical training courses in neonatal resuscitation to around 24,000 graduate health care professionals who work in delivery rooms around the country.¹³

In this context, the present study aims to trace the profile of neonatal resuscitation teaching in public hospitals located in Brazilian State capitals during 2003. The primary specific objectives were:

- To verify which of these maternity hospitals were teaching sites for undergraduate students of medicine and nursing, pediatric residents and residents and/or neonatal fellows.
- To analyze neonatal resuscitation training characteristics according to the different categories of students at these institutions.
- To evaluate the number of institutions at which the different types of professionals being trained take part in the care of newborns in the delivery room.

Methods

An observational, epidemiological study, with cross-sectional collection of data on neonatal resuscitation training in delivery rooms at the centers involved during the period from June/01/2003 to June/30/2003. Approval of the study was obtained from the Committee for Ethics in Research of the institution to which the principal investigators are affiliated and from the Clinical Directors of all participating institutions.

Public maternity hospitals of Brazilian State capitals were included if they had more than 5,000 live births during 2000, according to information from the Health Ministry.¹ Each of the five regions of Brazil was represented by a minimum of 1% and a maximum of 4% their live births. The research was conducted in 20 capitals and took place at 36 different institutions distributed across the five regions: North (one public hospital in Manaus and two in Belém), Northeast (one each in Teresina, Natal, Recife, Maceió, Aracajú and Salvador, two in São Luís and three in Fortaleza), Southeast (one in Vitória, two in Belo Horizonte, four in Rio de Janeiro and seven in São Paulo), South (one in Florianópolis and two each in Curitiba and Porto Alegre) and Mid-West (one each in Brasília, Campo Grande and Goiânia). Teaching hospitals were not included in São Paulo, Rio de Janeiro or Porto Alegre. One pediatrician at each maternity unit was invited to locally coordinate the study. Each of these researchers collected the following:

Characteristics of the institutions

Researchers recorded: hospital's administrative condition; the type of hospital, whether a general or strictly a maternity; the number of beds available for rooming-in, for intermediate and intensive care, as classified by Health Ministry guidelines; characteristics of newborn babies cared for at each institution from January to June 2003; the number of delivery rooms at each institution and neonatal resuscitation units, with at least the minimum material resources^{14,15} and the total number of pediatricians and nurses who participate in the care of newborns in the delivery room.

Teaching of neonatal resuscitation

Institutions were classified by whether they were training sites for undergraduates in medicine (fifth or sixth year) and nursing (third or fourth year), for residents in Pediatrics (PL1 and PL2) and for neonatal fellows.

Data was collected on whether formal training in neonatal resuscitation was offered to undergraduate medicine and nursing students and to residents and neonatal fellows, defining this as either absent, just theoretical (number of hours) or theoretical-practical (number of hours) for each institution. Also, collection of data included to what extent these institutions offer a practical setting for training students, residents and neonatal fellows in the delivery room care of the newborn infant.

Data was recorded on questionnaires that were printed by each local researcher and mailed to the lead researchers.

Next, the response to each question was codified so as to create a database that would minimize input errors. The database was created on Microsoft Access®. After data entry homogeneity had been tested, the descriptive analysis was performed using SPSS 10.0. Categorical variables were described as number and percentage of events and the numerical ones by mean and/or median and standard error or minimum and maximum values. Data was analyzed overall with no identification of individual cities and maternity hospitals.

Results

Characteristics of the maternity hospitals

With respect of the general characteristics of the maternity hospitals studied, the majority belonged to the State health system, with more than 90% of the patients covered only by state health insurance. Around half of them were general hospitals, two thirds were part of the Baby Friendly Hospital Initiative, and the majority were referral centers for high-risk pregnancies. On average, each institution had 54 beds for rooming-in, 21 for intermediate care and 12 intensive beds. The median

number of live births between January and June 2003 per institution was 365, varying from 285 to 466. The live births population at these maternity units was characterized as having 3% of very low birth weight infants and 15% of low birth weight infants. In general, pediatricians were working at an "on-call" basis in these delivery-rooms. There were, on average, four nurses on each shift involved in neonatal care at birth per institution. The specific characteristics for each region analyzed can be observed in Table 1.

Each maternity hospital has a median of four delivery rooms (variation: 2-14) and three neonatal resuscitation units (variation: 1-8). In total, the 36 institutions had 125 neonatal resuscitation units. In terms of material resources, all of these 125 units had radiant heat source, oxygen supply and equipment for airway aspiration. Regarding material for ventilation, a self-inflating bag with suitable volume was present on 123 (93%) units and face masks on 120 (96%). In terms of material for tracheal intubation, 116 (93%) had a laryngoscope and suitable tracheal tubes were available on more than 90% of the units. The main neonatal resuscitation drugs were available for immediate use on all units.

Table 1 - General characteristics of 36 institutions in each geographic region

| | N n = 3 | NE n = 11 | SE n = 14 | S n = 5 | MW n = 3 | Total n = 36 |
|--|--------------------------|----------------------------|----------------------------|--------------------------|---------------------------|-------------------------------|
| Federal hospital | 0 | 4 | 1 | 1 | 0 | 6 (17%) |
| State | 3 | 7 | 4 | 1 | 1 | 16 (44%) |
| City | 0 | 0 | 8 | 0 | 1 | 9 (25%) |
| Private | 0 | 0 | 1 | 3 | 1 | 5 (14%) |
| General hospital | 2 | 5 | 7 | 3 | 2 | 19 (53%) |
| Maternity only | 1 | 6 | 7 | 2 | 1 | 17 (47%) |
| Baby Friendly Hospital Initiative | 2 | 8 | 7 | 5 | 2 | 24 (67%) |
| Referral centers for high risk pregnancies | 3 | 11 | 12 | 4 | 2 | 32 (89%) |
| Beds/Institution * | | | | | | |
| Rooming-in | 48±6 | 71±8 | 48±5 | 41±11 | 47±11 | 54±4 |
| Intermediary care | 25±14 | 19±3 | 23±3 | 19±6 | 14±5 | 21±2 |
| Intensive beds | 14±4 | 13±2 | 11±1 | 16±4 | 10±6 | 12±1 |
| Live births/Institution † | | | | | | |
| < 1,000 g | 4±2 | 5±1 | 3±1 | 2±1 | 2±0 | 3±0 |
| 1,000-1,499 g | 6±3 | 8±2 | 5±2 | 4±0 | 2±1 | 6±1 |
| 1,500-2,499 g | 57±26 | 57±8 | 37±6 | 27±7 | 30±11 | 43±4 |
| Total | 434±59 | 326±33 | 351±26 | 332±123 | 365±26 | |
| Professionals/Institution * | | | | | | |
| On-call pediatricians (day shift) | 4±1 | 0±0 | 3±1 | 3±2 | 5±3 | 3±1 |
| On-call pediatricians (night shift and weekends) | 24±8 | 25±3 | 28±3 | 12±2 | 11±1 | 23±2 |
| Nurses - Day shift | 4±1 | 3±1 | 4±1 | 3±0 | 5±3 | 4±1 |
| Nurses - Night shift | 7±5 | 3±1 | 4±1 | 2±0 | 3±1 | 4±1 |

N = North; NE = Northeast; SE = Southeast; S = South; MW= Mid-West.

* mean number±standard error by institution analyzed in each region.

† mean number±standard error of live births by institution analyzed in each region (June 2003.)

Teaching of neonatal resuscitation

Twenty-three (64%) of the maternity hospitals were teaching sites for undergraduate medicine and nursing students, 75% trained first and second year pediatric residents and 42% offered training for neonatal fellows. Regarding first year pediatrics residents, the two hospitals in the North region that offered this training had a total of two places filled, the eight in the Northeast had 30 residents, the 12 in the Southeast had 121 residents, the four in the South region had 33 residents and one in the Mid-West had 11 residents, during 2003. Regarding neonatal fellows, six maternity hospitals in the Northeast, four in the Southeast, four in the South and one in the Mid-West had 11, 13, 13 and two places filled, respectively in 2003.

Around half of the 23 institutions that hosted undergraduate students offered some type of formal training in neonatal resuscitation for medical students and just one trained nursing students. All of the institutions with pediatric residencies and neonatal fellowships had a training program on the procedures required to resuscitate newborns in the delivery room (Table 2).

Four of the 12 institutions that offered neonatal resuscitation training for undergraduate medical students only offered theoretical classes, with a minimum of 1 hour and a maximum of 4 hours. At the remaining eight, training was both theoretical and practical, with a minimum of 8 and maximum of 34 hours. The only institution that offered training to nursing undergraduates was in the Northeast, with this being an 8-hour theory only course. In four maternity hospitals, pediatric residents received just 2 to 3 hours of theoretical teaching. The remaining 23 hospitals had theoretical and practical training with minimum duration of 4 hours and maximum of 68 hours. It should be pointed out that at five (22%) of the institutions that offered theoretical and practical training to their pediatrics residents, this training lasted less than 8 hours. In one maternity hospital, neonatal fellows had just 2 hours of theoretical classes on neonatal resuscitation, and the other 14 offered theoretical and practical training for a minimum of 3 hours and a maximum of 68 hours. Again, two (14%) of these last 14, the theoretical and practical training lasted less than 8 hours.

At 13 of the 23 institutions with 5th and 6th year medical students, these students took part in caring for newborns in the delivery room. Two of these 13 institutions did not offer any formal training in neonatal resuscitation to their students. Eight of the 23 institutions had their third or fourth year nursing students participating in delivery room care of the newborn, with seven of them offering no formal resuscitation training. In contrast, all 27 maternity units at which first and second year pediatric residents gained practical experience, and also the 15 at which neonatal fellows gained practical experience offered theoretical or theoretical and practical training to these physicians.

Discussion

Newborn babies with asphyxia require appropriate resuscitation in the delivery room in order to survive the neonatal period with a minimum of sequelae. Around 6 to 10% of live births need immediate respiratory care, but, once spontaneous respiration has been established, the majority of these infants survive with no need for other life support measures.¹⁶⁻¹⁸ According to the World Health Organization,⁸ education and training in resuscitation offer the possibility of immediately applying recent scientific advances to reduce neonatal morbidity and mortality.

The introduction of formal neonatal resuscitation programs appears to have had a positive impact on the most important neonatal clinical outcomes, although the majority of studies on the subject present serious methodological failings. In China, the introduction of training in resuscitation in a single hospital reduced neonatal mortality by 65%.¹⁹ In ten university hospitals in India, the introduction of the Resuscitation Program reduced early neonatal mortality from 31 to 24 per 1,000 live births and the incidence of hypoxic-ischemic encephalopathy by 70%.¹⁷ Theoretical and practical training in neonatal resuscitation also results in short term benefits for the newborn, including improvements in Apgar Scores.²⁰

It is within this context that the present study is situated, in attempting to find out how neonatal resuscitation training is given to students soon to qualify as physicians, pediatricians, neonatologists and nurses at public maternity

Table 2 - Number of Medical and Nursing schools and institutions with pediatric residences and neonatal fellowship that teach neonatal resuscitation, according to geographic region

| | N | NE | SE | S | MW | Total |
|---|-----|-----|-------|-----|-----|--------------|
| Medical students from the fifth/sixth year | 2/3 | 5/9 | 2/7 | 3/3 | 0/1 | 12/23 (52%) |
| Nursing students from the third/fourth year | 0/2 | 1/8 | 0/10 | 0/1 | 0/2 | 1/23 (4%) |
| Pediatrics R1 or R2 | 2/2 | 8/8 | 12/12 | 4/4 | 1/1 | 27/27 (100%) |
| R3 or neonatol fellows | - | 6/6 | 4/4 | 4/4 | 1/1 | 15/15 (100%) |

N = North; NE = Northeast; SE = Southeast; S = South; MW= Mid-West.

hospitals in Brazilian State capitals. However, before discussing the issue of the teaching itself, it is important to analyze whether these institutions were in a position, in terms of the physical, material and human resources needed for neonatal resuscitation, to be used for health care professionals in this training.

As can be observed in the results, the hospitals and maternity units studied were predominantly public. The fact that 70% of them were in the Baby Friendly Hospital Initiative program and 90% were referral centers for high risk pregnancies indicates that these are institutions that are concerned about the care that pregnant women and their newborn babies receive. In general the institutions in our sample did have the necessary conditions to be used for training physicians and nurses. The presence at these services of 3% of very low birth weight infants and 15% with low weights, percentages that are higher than for the general Brazilian population (1 and 8%, respectively, in 2001),¹ indicates that the need for neonatal resuscitation procedures is routine at the institutions analyzed since 90 to 100% of patients with birth weights below 1,500 g require some type of resuscitation procedure in the delivery room.²¹⁻²³ In terms of human resources, the presence of pediatricians and nurses employed to care for newborns in the delivery room indicates that the students and residents, when in these situations, can in fact learn rather than have to perform a role in care without being qualified to do so. Finally, it was observed that the basic material needed to care for neonates was available on practically all resuscitation units at all of the institutions. Therefore, the minimum conditions for undergraduate students, residents and fellows to learn in service were met at the institutions analyzed.

So, if a significant percentage of the hospitals studied constitute suitable locations for students and residents to gain experience in neonatal resuscitation, and, in the face of the availability, in general, of the physical material and human resources for teaching, the following question is raised: Are the hospitals with students and residents teaching these (future) health care professionals the practical fundamentals of neonatal resuscitation in delivery rooms? In the face of this question, it is worth pointing out that, traditionally, training in resuscitation procedures was performed by observing a specialist during the. Gradually the younger physicians would progressively take responsibility for performing the procedures on real patients. These professionals, in turn, went on to teach those younger than themselves, closing the cycle of training. The efficacy of this model depends on repeated exposure of the younger physicians to the various clinical conditions that require intervention, and also on the ability and competence of the older ones.²⁴ During recent years, the way life support measures are taught has been changing in a progressive manner, with the increase in what's called "practical" teaching, in which students practice procedures with manikins and simulate real situations, complementing traditional teaching. This strategy capacitates the students to perform resuscitation procedures in an integrated manner and a rational sequence, making them feel capable of applying

them in real life. Also it provides continuing education, updating the knowledge of professionals who already provide care to newborns in the delivery room.²²

Just 52% of the 23 maternity units who had fifth and sixth year undergraduate students offered them some sort of resuscitation training. Even without taking the type of resuscitation teaching offered, this situation is worrisome because it means that a significant percentage of physicians are graduating without the basic concepts of a procedure that is strategic to improve neonatal mortality. If these professionals start to work without doing a specialization course, their resources for resuscitating newborn babies will depend entirely on previous exposure to the situation before graduating, which, in turn, varies greatly depending upon curriculum, location of training and teaching staff capacity. Furthermore, when account is taken of the fact that it is medical students who best absorb the knowledge administered in theoretical and practical neonatal resuscitation classes,²⁵ an idea of the dimension of the lost opportunity can be appreciated. This observation is further reinforced by this study's finding that a third of those institutions that do offer training in neonatal resuscitation to their undergraduate medical students, do so in an exclusively theoretical manner. An unparalleled opportunity is being lost to spread neonatal resuscitation knowledge to all physicians in this country and so create a critical consciousness of the priority of this strategic action in the prevention of thousands of deaths of newborn babies a year in Brazil^{1,2} and of millions worldwide.^{4,8}

The picture of undergraduate nursing teaching is worse still. Only one of the 23 maternity units who said they had third and fourth year nursing students offered some sort of training in neonatal resuscitation, and that training was purely theoretical. In accordance with international programs, nurses can and should be trained for delivery-room care of the newborn, so that they can help the pediatrician or, in their absence, perform the initial procedures of neonatal resuscitation.^{26,27} In Brazil, nurses can perform the initial steps of resuscitation and ventilation with bag and mask, in addition to helping pediatricians with chest compressions, intubation and drug administration.²⁸ Training of nursing students in the basic procedures of resuscitation, as recommended by the Brazilian Society of Pediatrics,²⁸ could contribute to reduce morbidity and mortality due to perinatal asphyxia in our country.

The situation with respect of pediatric residents and neonatal fellows is more optimistic. All of the institutions that receive these physicians for training offer specific neonatal resuscitation training program for these professionals. The type of training being offered is also more in line with considerations that value practical learning, in simulations of real situations. Even so, it is observed that in 20% of the maternity hospitals, the number of hours of theoretical and practical training for qualifying pediatricians and neonatologists in neonatal resuscitation was less than the 8 hours directed by the Brazilian Society of Pediatrics.

The results obtained, therefore, indicate that there is a lack of neonatal resuscitation teaching with theoretical and practical courses for undergraduate students in Medicine and Nursing and that this training is heterogenous for Pediatric residents and Neonatal fellows.

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