

THE STATE OF INDIA'S NEONATAL UNITS IN THE MID-NINETIES

Meharban Singh, V.K. Paul and A.K. Deorari

From the Neonatal Division, WHO collaborating center for Training and Research in Newborn Care, Department of Pediatrics, All India Institute of Medical Sciences, New Delhi 110 029.

Reprint requests: Dr. Meharban Singh, Head, Department of Pediatrics, All India Institute of Medical Sciences, New Delhi 110 029.

Manuscript received: October 10, 1996; Initial review completed: November 11, 1996;

Revision accepted: February 4, 1997

Background: A previous study in 1987 showed that neonatal care facilities in major hospitals in the country were of a very poor standard. The present study was done to reassess their status-Design: A survey. Methods: A pretested structured questionnaire was sent to 48 centers in 1994-95. The responses were analyzed. Results: A total of 37 centers returned the questionnaire duly filled. Of them, 22 belonged to the government sector, the rest 15 to the private sector. A nursery bed: nurse ratio of less than 1.0 was reported by only 4 centers. Majority of the centers cited inadequate nursing strength and frequent transferring out of nurses as a major problem. Twenty nine (78%) centers had ventilation facilities. Most of them had 1 or 2 ventilators. Blood gas facility was available with 29 centers and parenteral nutrition was undertaken at 20 (54%) centers. Resuscitation bag(s) were available at all the centers and incubators at all except one. In quantitative terms, the following equipment was available in satisfactory numbers: resuscitation bags, resuscitation bassinet, incubators/open care systems, vital sign monitors, infusion pumps and pulse oximeters in 78.3%, 43.2%, 72.9%, 56.7%, 64.8% and 43.5% centers, respectively. Indigenous products of the following categories were reasonably well accepted: resuscitation bags, resuscitation bassinets, incubators, open care systems and dextrometers. Conclusion: The newborn care facilities, particularly the ventilation facilities, have improved in recent years. Almost 10 units were operating at or near level III standard of newborn care. Indigenous equipment of selected categories is replacing the imported equipment. However, most units continue to face problems of shortage of nursing personnel.

Keywords: *Neonatal equipment, Neonatal units, Neonatal ventilation, Newborn care facilities, Nurses*

IN India, the institutional newborn care services were started in early sixties with a couple of teaching hospitals establishing their neonatal nurseries. However, the expansion of these services was tardy until recently. A survey on neonatal care services and equipment conducted by the National Neonatology Forum (NNF) in 1987 revealed a very unsatisfactory state of affairs(1,2). The key findings of this survey were that: (i) only 3 or 4 centers had ade-

quate facilities and equipment to meet the standards of a level II neonatal unit; and (n) practically all the neonatal equipment in use was imported from abroad(1,2).

During the last few years, newborn care services have received a major fillip due to: (a) recognition of the importance and relevance of neonatology as a sub-speciality of pediatrics by the academia, (b) heightened public expectation about newborn survival, (c) market perception that newborn care is a

profitable practice, and (d) introduction of organized newborn services as a part of the CSSM (Child Survival and Safe Motherhood) programme.

This survey was designed to assess the current state of neonatal units in major hospitals in the country. The emphasis was on nursing services, ventilation facilities and equipment availability.

Methods

The survey was conducted from October 1994 to February 1995. A pretested questionnaire was sent to 48 centers. These included the units accredited by the NNF and, in addition, those which, in the considered judgment of the authors, were likely to be running services of level II although not formally accredited as yet. The list of NNF members, publication in neonatology in Indian journals and abstracts of the NNF convention during the preceding 3 years were carefully scanned for this purpose.

Results

Of the 48 centers, 37 (77%) returned the duly filled questionnaire. These centers are located in the states or Union Territories of Delhi (n=8), Rajasthan (n=4), Tamil Nadu (n=4), Maharashtra (n=4), Uttar Pradesh (n=3), Madhya Pradesh (n=3), Karnataka (n=3), Chandigarh (n=1), Pondicherry (n=1), Kerala (n=1), Bihar (n=1), Gujarat (n=1), Andhra Pradesh (n=1), West Bengal (n=1) and Punjab (n=1). Twenty two centers belonged to the government sector and the rest 15 to the private sector. Twenty four units were located in medical colleges. Eleven centers catered to inborn babies exclusively, while the rest provided service to both inborn as well as outborn babies. The number of nursery beds in various centers was as follows: <10 in 6 centers, 11-20 in 14 centers, 21-30 in 10 centers, 31-40 in 6 cen-

ters and > 40 beds in one center. The availability of nursing personnel was expressed as a ratio of number of nursery beds to the number of total sanctioned nurses to the unit. The optimum bed: nurses ratio (BNR) of < 1.0 was provided in only 4 centers. The centers with BNR of 1.0-1.9, 2.0-2.9, 3.0-3.9 and 4.0 or more were 18, 7, 4 and 3 in number, respectively. As many as 26 centers considered inadequate number of nurses or their frequent transferring out as the key constraint affecting the newborn services. An overwhelming majority (30/37) of centers reported to have at least one exclusive consultant for the unit.

Ventilation services were available in 29 (78.4%) centers. The details of ventilation services are shown in *Table I*. The use of parenteral nutrition was reported by 20

TABLE I— Ventilation Services in Newborn Units (n=29).

Description	No. of centers
Year started	
Before 1985	3
1985-89	11
1990-94	15
Number of ventilators	
One	10
Two	9
Three	6
Four	3
More than four	1
No. of babies ventilated every month	
<5	15
5-10	12
11-15	1
16-20	1
Survival	
<25 %	3
25-49 %	12
50-74 %	12
>74 %	1

(54.0%) centers. Neonatal follow up services were available in 29 (78.4%) centers.

The availability of key neonatal equipment is shown in *Table II* along with the status documented in 1987(2). In order to make a quantitative estimate of the equipment availability, the optimum number was standardized for a neonatal unit catering to 2000 deliveries per annum or to 400 nursery admissions. Availability of 50% or more of the optimum number was defined as *satisfactory* quantity of equipment for the given unit. *Table III* shows the comparison of centers with satisfactory quantity of equipment in the present survey and that of 1987. Several centers were using indigenous equipment in 1994-95. Of the centers possessing the resuscitation bags (n=37), resuscitation bassinets (n=33), incubators (n=36), open care systems (n=33) and dextrometers (n=25), a total of 46%, 45%, 42%, 64% and 100% centers, respectively, possessed indigenous equipment. The equipment which continues to be exclusively imported includes ventilators, infusion pumps, pulse oximeters, bilirubinometers and blood gas analyzers.

An exercise was done on the data to es-

timate how many centers could be classified as level III newborn care units. Since

TABLE II- *Availability of Equipment: Past and Present*

Equipment	Proportion of centers having equipments	
	1987 Survey (%) (28 centers)	Present Survey (%) (37 centers)
Resuscitation bags	94	100
Resuscitation bassinets	60	90
Incubators/ open care systems	71	100
Vital sign monitors	67	90
Ventilators	36	78
Blood gas machines	14	78
Infusion pumps	32	85
Pulse oximeters	*	78
Bilirubinometers	*	26
Dextrometers	*	67
X-ray machine (access)	*	67
Portable ultrasound	*	14

* Not surveyed

TABLE III- *Centers (%) With Satisfactory Availability of Equipment Standardized to a Unit With 2000 Deliveries per Year* or 400 Nursery Admission per Year.*

Equipment	Optimum No.	No. of centers (%) with satisfactory* availability	
		1987 survey (n=28)	Present survey (n=37)
Resuscitation bags	4	11 (37.3)	29 (78.3)
Resuscitation bassinets	2	9 (32.1)	16 (43.2)
Incubators/open care systems	4	10 (35.7)	27 (72.9)
Vital sign monitors	2	6 (21.4)	21 (56.7)
Infusion pumps	2	4 (14.3)	24 (64.8)
Pulse oximeters	2	-	16(43.5)

* Satisfactory number was defined as 50% or more of the optimum

+ Only this criteria was used in 1987(2).

no national criteria for level III neonatal unit has yet been laid down, we formulated the following arbitrary criteria for the purpose of analysis:

- (1) Accredited as level II unit by NNF (this takes care of several key requirements such as nursery beds, space, treatment facilities, infection control system, *etc.*)
- (2) Provision of ventilation facilities (with at least one ventilator for 5 beds) alongwith blood gas analysis facility.
- (3) Provision of parenteral nutrition.
- (4) Provision of adequate monitoring facilities, *i.e.*, pulse oximeters and/or vital sign monitors (2 for 5 beds).
- (5) Adequate nursing strength providing a ratio of nursery beds to number of nurses (BNR) of <1.0.

Using the above criteria, a total of 3 centers could be clearly classified as level III units, while 7 or 8 others were short of one or two criteria only. Thus almost 10 centers were providing services at or near level III standard of newborn care.

Discussion

This survey reveals a mixed picture of neonatal care services in the leading hospitals. While there is a distinct improvement in the availability of facilities and equipment, the crucial aspect of nursing continues to be unsatisfactory in all except a few units.

An obvious finding of this survey is that ventilation services have come up at several neonatal centers. In 1987, only 10 centers provided ventilation care(2), while in 1994-95, this number was 29, almost 3-fold. Concomitantly,¹ there is also a definite realization that access to blood gas analysis is critical for successful (and rational) ventilation. In 1987, 6 of the 10 centers with ventilators possessed no blood gas machine(2);

currently only 3 (8%) center lacked this facility. However, the number of ventilated babies and their outcome remained modest, in general. There is a clear need at this juncture for improving the expertise in neonatal ventilation in the country through physiology-based, skill-oriented training workshops in this area. The hallmark of rational ventilation is not just controlling respiratory failure, but also achieving this at a minimum cost to the baby in terms of complications such as infection, pulmonary air leaks, chronic lung disease, retinopathy of prematurity and growth failure.

It was interesting to note that as many as 20 centers reported to be providing at least partial parenteral nutrition. In the previous survey, no center claimed to have this modality of management(2). It was heartening to find that neonatal follow up services were available at a majority (78.4%) of centers.

This study documents a markedly better equipment availability of all categories at the centers surveyed compared to the 1987 survey(2). Not only more units had more items of equipment, but also their quantity was closer to the recommended norms. For instance, the proportion of centers with satisfactory number of resuscitation bags, vital sign monitors and warming systems (incubators/open care systems) has more than doubled since 1987 (*Table III*).

One reason for a better status of newborn units in respect of equipments is the availability of the indigenous products. Resuscitation bags, resuscitation bassinets, open care systems, incubators and dextrometers of reasonable quality are now being made in the country. These are also reasonably priced, are readily available and have found acceptance among the users. For instance, almost two thirds of the 33 centers

which are equipped with open care systems have one or more indigenously manufactured machines. The progress made by indigenous biomedical industry in this regard is commendable. The NNF has been conscientiously pursuing interaction with the indigenous industry at several levels including a national workshop(3) and special sessions at annual conventions. The indigenous industry of newborn equipment indeed came of age in recent years when it rose to the occasion to meet the tight supply schedule of equipping the district hospitals, the FRUs (First Referral Units) and PHCs (Primary Health Centers) under the CSSM programme. However, the industry does need to concentrate on further improving the quality of the equipment to meet international standards of accuracy, efficiency, reliability, safety, aesthetics and after-sales service. There is also an urgent need to locally manufacture the equipment which are still being imported.

Nursing personnel is the backbone of the neonatal units. Optimum nursing strength (BNR of less than 1.0) was reported by only 4(10.8%) units surveyed. Seventy per cent (26/37) units cited inadequate availability of nurses as the major constraint faced by them. Notably, this situation has hardly changed since 1987(1). In the last survey(1), only 3 (10.7%) units claimed nursery bed to nurses' ratio of 1.0 or less. Presently too, the proportion of centers with this ratio continues to be same (4/37, 10.8%). For intermediate level of newborn care the recommended beds to nurse ratio (BNR) in a given shift is 4:1, while that for intensive care it is 2:1 and for neonates with multi-system support (advanced intensive care), it is 1:1(4). Keeping in mind our resource constraints and the level of care most neonatal units are providing at present, a ratio of 3 beds to one nurse (3:1) may be considered acceptable as a modest recommenda-

tion. Thus, a 12 bedded nursery will require 4 nurses in each of the 3 shifts amounting to a total of 12 nurses which is equal to the number of beds (bed to nurse ratio of 1:1). Accounting for the additional provision for leave and offs, it is evident that an optimum ratio is <1.0. Only 4 centers fulfilled this requirement. The gap between what is available and what is desirable even in these major hospitals highlights perhaps the weakest ingredient of newborn care services today. This complex issue needs collective action on the part of the government as well as the professional bodies of nurses and neonatologists.

An exercise was done to see how many units could be labelled as level III neonatal intensive care units using a tentative criteria. While only 3 centers met the above criteria, 7 or 8 others were close to achieving this benchmark. Time has come for the NNF to formulate the national norms for level III newborn units and begin the process of accreditation for them.

While interpreting the findings of this study two important limitations must be borne in mind. Firstly, there may be a selection bias in this survey. It is possible that some big or small units got left out either because they were not approached by us, or they did not comply with our request to take part in the survey. Secondly, this survey does not provide any information on the quality of services actually being delivered by the participating units.

Notwithstanding the above limitations, this study does provide an overview of the current neonatal care services in major hospitals, which perhaps represents the best we have in the country. The findings do help in gaining useful insights into the progress made since 1987 in this regard. Most of these units are involved in the training and education of physicians and

nurses who, in turn, are expected to look after the small and sick neonates in the field and at the referral points. However, there are at least 150 medical colleges and it is obvious that most of them still do not have any newborn care facility of any standing. This deficiency is bound to reflect in the quality of expertise of physicians, generalists and pediatricians graduating from these colleges in their competence in providing care to the newborn infants. In view of the increasing importance of neonatal care accorded in the Reproductive and Child Health (RCH) Programme, should it not be mandatory that each medical college must have at least level II neonatal unit to ensure adequate training in newborn care for physicians of tomorrow?

Acknowledgments

The inputs for this survey were provided by the following colleagues: Dr. N.K. Anand, Dr. S.S. Bhambal, Dr. B.V. Bhat, Dr. B.D. Bhatia, Dr. S. Chandrashekhara, Dr. J.P. Dadhich, Dr. M.M.A. Faridi, Dr. S. Gopaul, Dr. B.D. Gupta, Dr. N. Gupta, Dr. S. Irani, Dr. S. Jacob, Dr. S. Jain, Dr. R. Kapoor, Dr. N. Kler, Dr. L. Krishnan, Dr. P.M.C. Nair, Dr. P.P. Maiya, Dr. P.K. Misra, Dr. U.

Modi, Dr. A. Narang, Dr. A. Pandit, Dr. P. Parekh, Dr. D.P. Patra, Dr. T.P. Raghven, Dr. P.K. Rajiv, Dr. S. Rekha, Dr. P.B. Sanghavi, Dr. S.K. Saxena, Dr. A. Sen, Dr. R. Shanmughasundaram, Dr. P. Sheth, Dr. D. Shivpuri, Dr. S. Thirupuram and Dr. M. Verma. We are grateful to them for their kind co-operation and valuable contribution.

REFERENCES

1. Singh M, Deorari AK, Paul VK. Neonatal services in leading hospitals: A depressing scenario. *Bull Natl Neonatol Forum* 1988; 3: 2.
2. Singh M, Paul VK, Deorari AK. Neonatal equipments in leading hospitals. A stark reality. *Bull Natl Neonatol Forum* 1989; 1: 10-11.
3. Singh M, Paul VK, Deorari AK. Biomedical equipments: Status and perspectives. *National Neonatology Forum*. Delhi, 1990.
4. Frigollett FD, Little GA. Personnel for perinatal services. *In: Guidelines for Perinatal Care*. AAP (American Academy of Pediatrics) and ACOG (American College of Obstetricians and Gynecologists), Illinois/Washington DC, 1988; pp 39-47.