Original Article:
A Study to Assess the Association of Aseptic Practices Being Followed and its Effect on the Overall Outcome of Selected Special Care Newborn Units (SCNUs) of Madhya Pradesh at Different Levels.

Authors
Rajendra Kumar Mahore, Postgraduate, Department of Community Medicine,
Sanjay Dixit, Professor & Head, Department of Community Medicine,
SB Bansal, Associate Professor, Department of Community Medicine,
Veena Yesikar, Associate Professor, Department of Community Medicine,
Nirbhay Mehta, Associate Professor, Department of Pediatrics,
Sachin Parmar, Department of Community Medicine,
MGM Medical College, Indore, India.

Address for Correspondence
Dr. Rajendra Kumar Mahore,
Resident,
Department of Community Medicine,
MGM Medical College,
Indore, India.
E-mail: drrajendrakumarmahore@gmail.com

Citation

Open Access Archives
http://cogprints.org/view/subjects/OJHAS.html
http://openmedi.nic.in/view/subjects/ojhas.html

Submitted: Jan 22, 2015; Accepted: Mar 22, 2015; Published: Apr 10, 2015

Abstract: The neonatal mortality rate in India is high and stagnant. Special Care Newborn Units (SCNUs) have been set up at different levels of Health Care Delivery System to provide quality newborn-care services in several hospitals to meet this challenge. Many units are located in the districts where the burden of neonatal deaths is high, and access to special newborn care is poor. The study was conducted to assess the functioning of SCNUs in six centers of India. The evaluation was based on an analysis of secondary data from the six units that had been functioning for at least three years. A cross-sectional survey was also conducted to assess the availability of Quality care and Aseptic practices implemented at different levels of SNCUs. Descriptive statistics were used for analyzing the inputs (Quality care and aseptic practices) and outcomes (morbidity and mortality). The rate of mortality among admitted neonates was taken as the key outcome variable to assess the performance of the units. Chi-square test was used for analyzing the trend of case-fatality rate over a period of 3 years considering the first year of operationalization as the base. Correlation coefficients were estimated to understand the possible association of case-fatality rate with factors, such as bed:doctor ratio, bed:nurse ratio, average duration of stay, and bed occupancy rate, and the asepsis score was determined. The rates of admission increased from a median of 16.7 per 100 deliveries in 2012 to 19.5 per 100 deliveries in 2014. The case-fatality rate shows progressive decline in all the units in Last 3 years. Proportional mortality due to sepsis and low birthweight (LBW) declined significantly over two years (LBW <2.5 kg). The major reasons for admission and the major causes of deaths were birth asphyxia, sepsis, and LBW/prematurity. The units had a varying nurse:bed ratio (1:1-1:2.14). The bed occupancy rate ranged from 83% to 121% (median 115%), and the average duration of stay ranged from three days to 8 days (median 5 days). It is possible to set up and manage quality SCNUs and improve the survival of newborns with LBW and sepsis in developing countries, although several challenges relating to human resources, maintenance of equipment, and maintenance of asepsis remain.

Key Words: Cross-sectional studies, Neonatal mortality, Newborn care, Performance evaluation, Aseptic practices.

Introduction:
Every year, four million newborn babies die in the first month of life—99% in low and middle-income countries. (1) India carries the single largest share (around 25-30%) of neonatal deaths in the world. Neonatal deaths constitute two-thirds of infant deaths in India; 45% of the deaths occur within the first two days of life. (2) It has been estimated that about 70% of neonatal deaths could be prevented if proven interventions are implemented effectively with high coverage. (3) It was further estimated that health facility-based interventions can reduce neonatal mortality by 23-50% in different settings. (4)
newborn care, thus, has a significant potential for improving the survival of newborns in India. Three levels of neonatal care are envisaged. Newborn-care corners are established at every level to provide essential care at birth, including resuscitation. Level I care includes referral of sick newborns from Primary Health Centres (PHCs) to higher centres and care at Neonatal Stabilization Units (NSUs) in the first referral units. Care in the NSUs includes stabilization of sick newborns and care of low-birthweight (LBW) babies not requiring intensive care. Level II care includes functioning of Special Care Newborn Units (SCNU) at the district hospital level. These units are equipped to handle sick newborns other than those who need ventilatory support and surgical care. The level III units are the neonatal intensive care units.

These units are essentially equipped with radiant warmers, phototherapy units, ventilators, pulse oximeters, and intravenous infusion pumps, enough to treat and take care of babies with birth asphyxia, jaundice, sepsis, and LBW. These units cater to both inborn and outborn sick neonates. The recommended nurse:bed ratio is 1:1.2 while the doctor:bed ratio should be 1:4. It has been estimated that around 15-20% of all newborns require level II care in rural settings. (4)

According to Sample Registration System (SRS) Dec 2013 Madhya Pradesh (MP) has India’s highest Infant Mortality Rate (54/1000 live births accompanied with Assam). This creates a blot at the health scenario of MP.

To address the high rate of infant mortality in Madhya Pradesh, the state government, with budgetary and technical support from UNICEF, set-up the first Sick New-Born Care Unit (SNCU) inside the premises of the Guna district hospital on December 14, 2007. Madhya Pradesh had the country’s highest infant mortality rate of 72 per 1000 live births at that time.

It was demonstrated that strengthening of newborn care can lead to significant reduction in mortality among admitted newborns and was further estimated to lead to reduction in neonatal mortality of the entire district. (5) The neonatal mortality rate (NMR) among admitted newborns reduced by 14% in the first year and by 21% in the second year after the SCNU became functional. At the population level, this was estimated to have led to reduction in the NMR by about 10% in the district in two years.

Subsequently, the SCNUs have been scaled up in many rural districts of the country. The United Nations Children’s Fund (UNICEF) provided technical and financial support during the initial phase in establishing eight units. Within 3-4 years, more than 150 SCNUs were set up all over India. An amount of Rs 40-60 lac was spent to establish a single unit. (6) Support from the Government is a key determinant behind the successful running of these units.

We conducted an evaluation of the six units of Indore and Ujjain Divisions of M.P at different Levels to assess the feasibility and effectiveness of such an approach in improving newborn care in rural hospitals and to understand the operational bottlenecks that affect their effectiveness.

**Materials and Methods**

The evaluation was carried out in six units (One at Different Level each) across Indore and Ujjain divisions of M.P over a 12-month period. Initially it was planned to evaluate two SCNUs each for different levels in Indore and Ujjain Division (One level each in Two Different Divisions), but on proceeding further it was found that the Ujjain Division does not have any Level III SNCU (As Ujjain division has no government Medical College and Level III SCNUs are established in govt. medical colleges only). Hence the Level III SNCU to be evaluated (UNICEF funded/ Govt. funded) in this study restricted to one i.e. the one established in MGM Medical College Indore. Therefore the different Units evaluated under this study reduced from six to five, and they were as follows:

**In Indore Division**
- Level III SNCU – MGM Medical College Indore
- Level II SNCU - District Hospital Dhar
- Level I NBSU - CHC Sardarpur

**In Ujjain Division**
- Level III SNCU – N.A
- Level II SNCU - District Hospital Ujjain
- Level I NBSU - Civil Hospital Nagda

 Those units where the SCNUs were started at the Government hospitals in the last two years. The units functional for less than three year were excluded.

Based on an extensive literature review, different components of evaluation were identified. For assessment, standards laid out by the National Neonatology Forum for accreditation of these units in India and those adapted for the SCNUs were adopted. (6) A structured instrument was prepared to capture secondary data. The tool was developed from the National Neonatology Forum, UNICEF and Public Health Foundation of India (PHFI) norms. Quantitative information was gathered on the resource inputs provided and available with the unit and performance of the units in terms of the performance on neonatal mortality and morbidity indicators.

Information was collated from the monthly reports of the SCNUs. Where incomplete or inconsistent, the records (administration and stock registers) were reviewed. The team visited all the units to gather the missing information and triangulate the data with personal observations and interaction with the unit staff.

Data were collected for the 2012–October 2014 period from the five units. Information was collected on the following parameters: maintenance of asepsis, morbidity profile and mortality rate among the admitted newborns. Rates of admission were calculated taking the total number of livebirths in the hospitals as the denominator. The performance of each unit was assessed using case-fatality rate (CFR) (proportion of deaths among babies admitted to the SCNU) as the outcome variable. Data of the first year were taken as the baseline for every unit since data of the preceding years were not available. The CFR for the following years were compared with the baseline data. For identifying the factors that potentially affect the performance, Spearman’s rank correlation was used. The factors assessed were asepsis score for each unit. The asepsis score was a composite score ascertained from the following factors - giving appropriate weightage to: 24-hour running water (2), presence of an elbow-operated wash basin (1), availability of soap (1), practice of handwashing before entering the SCNU (2), practice of handwashing after touching every baby (2>), practice of wearing gowns in the SCNU (1), practice of wearing slippers in the SCNU (1), and practice of wearing mask and caps in the SCNU. (1) The parameters included in the indicators were based on the observations made by the research team at the time of visit. To overcome a possible bias, the information was triangulated with the feedback obtained from the beneficiaries. At least four beneficiaries from each district were interviewed. The mothers were encouraged to narrate the instructions given before entering the SCNU and their adherence to those instructions. Data were entered in Microsoft Excel Office 2007. The Epi Info software (version 3.5.1) and Excel were used for analysis of data.

**Ethical approval**
The proposal was reviewed by the Scientific Review Committee of the MGM Medical College Indore (M.P), and
ethical clearance was obtained. Permission was sought from the concerned authorities (Civil Surgeon of the hospitals and SCNU-in-charge of the Respective Units) to collect information, after informing them of the purpose of the study. (Ethical Approval No: 16876/SS/03/14 MGM Medical College Indore M.P, Dated 17/09/2014)

Results

Background characteristics: All the SCNUs are located in the Divisions of Indore and Ujjain in MP state. The units were established with support from the UNICEF and State governments in Term of Funding and Technical Support (For Infrastructure, Equipments, Supplies and Salaries) and were fully functional for at least three year at the time of the evaluation.

Performance of SCNUs: The performance was based on the analysis of inputs (Aseptic practices) and output in terms of the average duration of Mortality/Case Fatality Rate. The CFR was the key outcome variable that correlated with the input and output variables.

What can influence performance of SCNUs?

Aseptic practices: The aseptic practice score strongly correlated with the CFR. Nearly 50% of the variation in the CFR across the units could be explained by the aseptic practices observed by the doctors and nurses in the units. Although the number of the observed units was small, a strong correlation and plausibility of the association suggest that the aseptic practices do critically determine the outcomes of newborns in the SCNUs. The practices followed were triangulated with the practices as narrated by the beneficiaries. They appreciated the importance of following those measures meticulously.

Average duration of stay: Case fatality reduced with the increased duration of stay. Around 22% of the variation in the CFR could be explained by the average duration of stay.

Proportion of very LBW babies: The proportion of very LBW babies admitted influenced the outcome since it was strongly linked to the average duration of stay, the number of beds and nurses, and also the outcome. In the analysis, these proportions did not correlate with the CFR. This could be because only a small proportion of the admitted babies weighed less than 1,500 g (8.5%). It was also observed that the outcome of babies weighing 1,500-2,499 g improved significantly but that for the very LBW babies the results were not very encouraging. The CFR increased with the increased proportion of the outborn babies. Almost 45% of the variation in the CFR could be explained by the proportion of the outborn cases availing of SCNU services.

Discussion

The results of the assessment of the five units in Indore and Ujjain Divisions of MP suggest that quality level facility based newborn care can be provided at the district level within the public-health system.
In a similar study done by Neogi et al(7) in 2011, the results of the assessment of the eight units suggest that quality level II newborn care can be provided at the district level within the public-health system. According to the estimates in 2011 about 10-15% of all newborns have a complication requiring level II care (7). In the present study, the proportion was highly raised. While in one unit it was 23.3 % (Ujjain SNCU) it touched 36.44% in other (Dhar SNCU). It was less in unit where strict admission criteria were in place or where people preferred to visit private doctors i.e. in Ujjain there was a Private Medical College and Other well established Private Nursing Homes which serve as the alternative choices for the Neonates / beneficiaries. On the other hand, in the scenario where the surveyed unit (Dhar SNCU) was the only facility available for special care, most admissions took place in that hospital.

Figure 2: SCNU Level III at Indore
The mean proportion of babies admitted to the SCNUs compared to the number of livebirths was 24.7% (range 14-47%) in Thames in 1975.(8) Not all babies who were admitted needed intensive care. Over one-third of the workload of the typical unit was generated by infants of normal or near normal birthweight who were admitted for a short stay and received no special medical treatment. This is similar to our observations from many surveyed units that, in many instances, the babies were admitted for observation. This increased the workload and the bed occupancy rate, and the quality of care suffered. Experiences from many countries indicate that care gets compromised as a result of admission overload.(9)

The admission policy of a unit is also a key indicator that can influence the performance. Except for one unit (Purulia) where it was very stringent, in none of the units these were followed despite having the clear-cut guidelines in place. There was an overdependence on the SCNUs in most places, and in many instances, babies were kept for mere observation due to social pressure. The Purulia SCNU followed very stringent criteria to admit a neonate. If a neonate was admitted to the paediatric ward for over 48 hours, the baby was denied admission despite the availability of beds. A critical observation was that, in none of the SCNUs, except Purulia, neonates were admitted to the paediatric wards. It was, therefore, important to analyze the outcome of admission of neonates in the paediatric wards. But this, unfortunately, was beyond the scope of the study. In Vaishali, on the other hand, many newborns requiring special care ended up in a neighbourhood private hospital as it is the preferred option of the people. Similar observations were noted in Uganda where only infants having complications within 24 hours of birth were admitted to newborn units. Infants who developed complications, such as jaundice, or infection in postnatal wards, or infants discharged from hospital or readmitted to general paediatric wards were not admitted. Babies born at home but who arrived after 24 hours of age and those discharged from the neonatal unit but who later developed complications were not admitted.(9) Also, currently, the units had largely inborn admissions, thus considerably leaving a large proportion of sick newborns delivered outside the facilities. If one estimates the numbers of newborns in the district who would require level II care, the numbers of special care beds required would be much larger, indicating a huge unmet needs for special newborn care.

The CFR among the admitted neonates in our study varied from 7% to 18%. The national neonatal perinatal database of 2002-2003 shows that 11.4% of admitted neonates (extramural) expired while it was 0.9% for intramural cases. The database also indicates that the primary causes of deaths were perinatal asphyxia and extreme prematurity in both the groups. Sepsis contributed to 3 babies which poses a risk. This was a common observation in the districts of Mayurbhanj and Guna. Chances of acquiring infection increases manifold with sharing of beds.

Experiences worldwide have shown that level II units can contribute maximally towards bringing down the mortality rate among LBW babies.(8,9,11,12) With improved performance in the functioning, the NMR among infants of >1,500 g can match that of a level III unit. In our assessment, this kind of analysis was difficult because of non-availability of sufficient data. Data from Mayurbhanj indicated that the NMR among infants with birthweight of >1,500 g showed a decline while those having very LBW did not benefit much. Similar findings were discussed in India in a level II unit where weights of babies in the range of 1,500-2,499 g had the maximum decline in mortality.(11) The impact of level II units on very LBW babies yielded mixed results.(9, 12)

With the increased beds:nurse ratio, handwashing practices also get compromised to a great extent, directly influencing the quality of care. The Special Care Baby Unit, Kampala in Uganda, lacked nursing staff qualified in neonatal care. Over a period under study (1984-1989), the unit was staffed by 10-12 midwives, and only one midwife caring for 20-30 neonates was a common observation.(9) In an investigation carried out in a neonatal special care unit in the USA, the infant:nurse ratio and infant census were key determinants of nosocomial infections.(13) In a neonatal unit in Barbados, the shortage of staff had fostered deterioration in handwashing technique leading to outbreaks of nosocomial
infections.(14) Maintaining an ideal bed:nurse ratio is a challenge as observed in Uganda, Greece, and Ghana. (9,15,16) The findings of our study revealed that the CFR strongly correlated with the practices of nurses and doctors in following aseptic precautions. The environmental survey in one of the neonatal units in the UK indicated that transmission of infection was due to inadequate handwashing of nurses and mothers. (17) A problem-based and task-oriented education programme has been shown to improve hand-hygiene compliance in Hong Kong. After the intervention, overall hand-hygiene compliance increased from 40% to 53% before patient contact and from 39% to 59% after patient contact. More marked improvement was observed for high-risk procedures. The average number of patient contacts decreased from 2.8 to 18 per patient per hospital stay. The rate of healthcare-associated infection reduced from 11.3 to 6.2 per 1,000 patient-days. (18) A statewide hospital-based quality-improvement project targeting hospital staff and community physicians was effective in improving documented newborn preventive services. (19) Based on a concept described by the Vermont-Oxford Network, random safety audits were introduced in a level 3 NICU in the UK to improve infection control and routine neonatal care. At the end of six months, compliance with infection-control standards improved from a median of 70% (range 20-100%) to 95% (range 66-100%). This had been recommended strongly to improve clinical practice. (20)

The duration of stay in the intensive care units is well-dependent on birthweight. The average duration of stay in an SCNU is usually 5-7 days. (4) The average duration of stay for preterm babies or very LBW babies is usually long, and the proportion of LBW babies affects the average duration of stay. It varied between two and 15 days in our assessment. The average stay of patients varied from 26 days at 32-33 weeks to seven days at term, according to a study in New Zealand on level II and III units. (21) In California, the average hospital stay for LBW infants ranged from 6.2 days to 68.1 days whereas the average hospital stay for infants who weighed >2.500 g at birth was 2.3 days. Infants who weighed >1.249 g had progressively shorter hospital stay. (22)

Except for the Indore IMR of all the evaluated units were higher than those of Indian average. Infant Mortality Rate is inversely proportion to the literacy rate and percentage of Institution Deliveries. (Table-2)

Although there are many deficiencies and lacunae in the functioning of SNCUs, but the fact remains that they are pivotal in newborn care for the majority of Indian population in particularly, it definitely caters to the need of rural India in a very efficient manner.

Limitations

Although the study was one of the initial ones to give an evidence of feasibility of operating these Three Different level units, yet it has its own limitations. The information collected was based on secondary data routinely obtained by the respective units triangulated by personal observations. Reporting of morbidities and mortalities is a concern owing to lack of uniform case definitions used in different units. Much of the outcomes could have been related to birth weight and inborn/outborn status but this could not be analyzed because of absence of case-based data. Moreover, data were made available till September 2014. These were compared with data of previous years (Jan to Dec) which may not be very appropriate due to seasonal variations. Although we attempted to find out the possible factors that could be associated with the CFR, in this study, it was difficult to come to a meaningful conclusion due to the small sample-size. Despite these limitations, the assessment gives an insight into the potential challenges that might not have been captured during the routine monitoring.

Conclusions

The SCNUs are a critical investment to curb the neonatal mortality rate in India. Not only these are difficult to establish but it is equally important to maintain their performance. Initial results in the form of decrease in the Case Fatality Rates of various neonatal Infections have been encouraging but there are challenges that need to be looked into, before it is scaled up. Imparting skills to maintain asepsis are the key recommendations that will circumvent the existing challenges. Replicating such a technically-intensive model, which involves a great deal of coordination and support of various agencies and the acceptability of the implementing authorities and health personnel, is a difficult task. It is pertinent to learn from the experiences and outcomes of evaluated SNCUs of Indore and Ujjain Divisions of Madhya Pradesh, for us to establish the success of this establishment in diverse settings. It is hoped that lessons learnt from this assessment would assist in scaling up of such units with quality of newborn care facilities in other similar settings.

References


