DOI: 10.14260/jemds/2015/384

ORIGINAL ARTICLE

A STUDY TO ASSESS THE ASSOCIATION OF SET-UP BEING PROVIDED AND BENEFICIARY ASSESSMENT OF SPECIAL CARE NEWBORN UNITS (SCNUS) OF INDORE AND UJJAIN DIVISIONS OF M. P. AT DIFFERENT LEVELS

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HOW TO CITE THIS ARTICLE:
Rajendra Kumar Mahore, Sanjay Dixit, S. B. Bansal, Veena Yesikar, Nirbhay Mehta. "A Study to Assess the Association of set-up being provided and Beneficiary Assessment of Special Care Newborn Units (SCNUS) of Indore and Ujjain Divisions of M. P. At Different Levels". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 16, February 23; Page: 2664-2671, DOI: 10.14260/jemds/2015/384

ABSTRACT: INTRODUCTION: The neonatal mortality rate in India is high and stagnant. Special Care Newborn Units (SCNUs) have been set up at different levels 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. **MATERIALS AND METHODS:** 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 year. A cross-sectional survey was conducted to assess the availability of infrastructure, equipment's and human resources and assessment of the beneficiaries. Descriptive statistics were used for analyzing the inputs (Resources) and outcomes (Assessment of the beneficiaries). Correlation coefficients were estimated to understand the possible association of satisfaction rate of beneficiaries with factors, such as bed: doctor ratio, bed: nurse ratio, average duration of stay, and bed occupancy rate. **RESULTS:** The major reasons for admission and the major causes of deaths were birth asphyxia, sepsis, and LBW/prematurity. Likart's Analysis is used to analyze Beneficiaries Assessment. Beneficiaries were not found at Level I NBSUs at the time of evaluation. 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). Repair and maintenance of equipment were a major concern. **CONCLUSION:** 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 infrastructure, human resources and maintenance of equipment remain.

KEYWORDS: Cross-sectional studies, Neonatal mortality, Newborn care, Performance evaluation, Beneficiaries.

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. 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. Facility-based newborn care, thus, has a significant potential for improving the survival of newborns in India.(3)

Three levels of neonatal care are envisaged. Level I care includes referral of sick newborns from Primary Health Centers (PHCs) to higher centers 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-birth weight (LBW) babies not requiring intensive care. Level II care includes functioning of Special

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Care Newborn Units (SCNUs) 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 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.[4]

According to Sample Registration System (SRS) Dec 2013 Madhya Pradesh has India's highest Infant Mortality Rate (54/1000 live births accompanied with Assam). It was demonstrated that strengthening of new born care can lead to significant reduction in mortality among admitted newborns.[5] 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]

Present study evaluated 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 SNCUs 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 SNCUs 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 three years were identified. The units functional for less than three year were excluded.

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 adopted from the National Neonatology Forum, UNICEF and Public Health Foundation of India (PHFI) norms. Information was collated from the monthly reports of the SCNUs. Where incomplete or inconsistent, the records (Admission registers and stock registers) were reviewed. The research 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: number of admissions; availability of human resources

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(doctors and nurses); adequacy and availability of essential equipment, such as radiant warmers, phototherapy units, weighing machines, oxygen concentrators, generator, and air conditioners and their functional status; availability and adequacy of beds; and morbidity profile and mortality rate among the admitted newborns. Data of the first year were taken as the baseline for every unit since data of the preceding years were not available.

For identifying the factors that potentially affect the performance, Spearman's rank correlation was used. The factors assessed were: bed: doctor ratio, bed: nurse ratio, average duration of stay, bed occupancy rate. To overcome a possible bias, the information was triangulated with the feedback obtained from the beneficiaries. At least 100 beneficiaries from each district were interviewed. Data were entered in Microsoft Excel Office 2007. The Epi Info software (version 3.5.1) was used for analysis of data. 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.

RESULTS:

BACKGROUND CHARACTERISTICS: All the SCNUs 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 two year at the time of the evaluation.

PERFORMANCE OF SCNUS: The performance was based on the analysis of inputs (In terms of infrastructure, human resources, and equipment) and output (in terms of the average duration of stay, bed occupancy rate, and Beneficiaries assessment).

INPUTS:

INFRASTRUCTURE: Each SCNU was unique in its layout and suffered from its own space constraints, making it difficult to adhere to the norms. All the SNCUs evaluated are full filling the Criteria of Infrastructure in terms of Designated area assigned for different activities like Breast feeding Room, Rooming in area, Hand washing and gowning area, Duty room for Doctors and Nurses, Clean Utility area, Soiled Utility Room, Designated area for Mixing I/v Fluids, Boiling and Autoclaving, Laundry, Stores and Side Lab. All the SNCUs are situated just adjacent to or within 50 feet of the Labour room/ Operation Theatre except for the SNCU of District Hospital Ujjain, which is situated in a separate building nearly 150-200 meter far. (At opposite side of the main road)

All the SNCUs are fully saturated in Terms of Equipments like Monitoring Equipments, Warming Equipments, Resuscitation Equipments, Oxygen Supply Facility, Investigation Equipments, General Equipments and Disposable Items enlisted in the checklist except for:

1. Separate Stethoscope for each Newborn is not available in both of the two level II and Level I units.
2. Electronic Weighing Machine is not available in Level II and I, however mechanical baby weighing scales are available there.

All the SNCU Equipment are well covered under Annual Maintenance Contract. There was no breakdown of any major SNCU equipment but the time of Repair was variable and delayed, ranges from 15 days to 2 months. All the Emergency (Life Saving) drugs Like Adrenaline, Sodium bi-

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carbonate, Nalorphine, I/V Fluids and antibiotics are available in adequate quantity at all the evaluated units. All the Disinfectants like Hypochlorite solution, Cidax, Polysan, savlon etc. Disposable equipments for patient care like needles, syringes, Chlorhexidine for hand washing, Gowns, Slippers, gloves, Hot running water and Vacuum cleaning facilities are available at all the evaluated units.

Day Light is sufficiently visible in all the SNCUs evaluated. Provision of backup Light and Electrical safety is also available in terms of Generator / Inverter and Stabilizer. However the Level I Setups are sharing the common backup sources that of Hospital. Continuous water supply is available for 24 hrs at all the SNCUs evaluate Cleaning of the SNCU is done thrice in a day (8 hourly/ during each Shift).

All the Protocols for Asepsis i.e. Hand Washing, Biochemical Waste Management, Patient Care and Case management, For Handling Equipments and the Administrative Policies for Admission, Discharge and Breast Feeding were well displayed at the designated areas at all the SNCUs evaluated. Lab facility in form of side lab is not available at any of the Level II and Level I unit evaluated. For this purpose they use the laboratory of adjoined hospital. Even in the Level III unit in Indore the facility of Microbiological investigations is not present yet.

All the Evaluated units are having Newborn Care Corner in the Labour Room/ OT with the minimum required equipments like Radiant Warmer, Oxygen Source, Self Inflating/ Resuscitation bag and Laryngoscope. Both of the Level II SNCUs evaluated were acting as a Training Centre for Health Personnel like ANMs, ASHA, Anganwadi workers. All the Level III and II units evaluated were regularly visited by the higher authorities.

All the Records were properly maintained at Level III and Level II SNCUs visited. However Level I Units were found poor in Record keeping, they said that they don't have any separate Data entry operator or Record keeper for this purpose.

BED REQUIREMENT AT DIFFERENT SNCUS: We estimated the required numbers of beds for special care based on two methods (Table 1). In the first method, the average number of live births in the district hospital (As obtained from the respective districts), the proportion of live births requiring special care (15%), and the average duration of stay (7 days) were considered. In the second method, three beds for every 1,000 annual deliveries may be dedicated to the newborn care unit. This demand is for intramural deliveries (those occurring within the district hospital). Additionally, for newborns delivered outside the hospital (extramural) and being brought to the hospital for special care, an extra allowance of 30 per cent of the estimated beds should be considered. The actual numbers of beds in the units were less than the required numbers of beds in both the instances.

HUMAN RESOURCES: Pediatricians in Level III SNCU are not recruited separately. They are the Regular Staff of MGM Medical College and M.Y Hospital Indore, taking care of SNCU on Rotation Basis along with their Post graduate students. At Level I (Sardarpur and Nagda) No Pediatrician was posted but Medical Officers who were trained in FBNC were taking care of Newborn stabilization unit.

In Ujjain Division i.e. SNCU Ujjain and NBSU Nagda, staff nurses Recruited are less as compared to the sanctioned posts (Ujjain-15 out of 22 and Nagda-2 out of 3). 7 out of 15 in Ujjain and all the 2 of Nagda were working in contractual basis. Lab Technician was not available at Level I and III SNCUs. Data Entry Operators was not available at Level I NBSUs.

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OUTPUT:

AVERAGE LENGTH OF STAY AND BED OCCUPANCY RATE: These parameters were dependent to a large extent on the admission load, numbers of beds, demand for empty beds, and profiles of babies admitted to the SCNUs. High bed occupancy resulted in sharing of beds by 2-3 babies in some instances. The bed occupancy rate also indicated the burden on the nurses since each baby requiring admission in the SCNU would need special attention. During the assessment, it ranged from 83.3% to 121% (Median 115.5%) across all the units. The average duration of stay in the surveyed units ranged from 3 days to 7.21 days (Median 5 days).

OUTCOME: BENEFICIARIES ASSESSMENT: Likart's Analysis is used to analyze Beneficiaries Assessment. Beneficiaries were not found at Level I NBSUs at the time of evaluation. Beneficiaries were not available at Level I NBSUs at the time of evaluation.

Maximum number of Beneficiaries were Satisfied by facilities provided in Indore SNCU (84) followed by Dhar (79) and Ujjain (70). Beneficiaries who were found Neutral are not considered in the satisfied group. Chi square test was applied to analyze the result. ($P = 0.048$). In Ujjain SNCU the level of satisfaction of beneficiaries is significantly lesser than Indore and Dhar SNCUs.

The Overall Satisfaction of Beneficiaries at Level II SNCUs i.e. Ujjain and Dhar SNCUs correlates with the overall mortality rates in the respective (i.e. More the Mortality in unit, lesser the Satisfaction of Beneficiaries) SNCUs.

DISCUSSION: The findings suggest that quality level Facility based Newborn Care can be provided at the district level within the public-health system.

S. Neogi et al in 2011 found that the quality level II newborn care can be provided at the district level within the public-health system.[7]

The number of beds was less than what was required across all the units (Except for the SNCU Dhar). Results of many studies were published on the provision of beds in neonatal units from developed countries.[8,9] 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.[10]

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. Experiences from many countries indicate that care gets compromised as a result of admission overload.[11]

The admission policy of a unit is also a key indicator that can influence the performance. There was an over dependence on the SCNUs in most places, and in many instances, babies were kept for mere observation due to social pressure.

The admission overload was a concern in most units. It must be considered here that the number of beds is a crucial parameter because human resources, equipment, and admission load finally depend on the number of beds. The number of beds for each SCNU needs to be revaluated. An increased admission overload also gives rise to sharing of beds often by 2-3 babies which poses a risk. This was a common observation in all the units except for SNCU Dhar. Chances of acquiring infection increases manifold with sharing of beds.

The maintenance of equipment was a major challenge in most districts. The equipment-providing companies had their offices at the state level or sometimes these were not there in every state. Service engineers preferred to plan their route map in a way that the districts falling on a particular route got covered all together, or they had a tendency to wait for the adequate number of complaints from districts on a particular route. This made economic sense to the equipment-providing company but it actually delayed in attending to complaints as by the time the turn of the particular SCNU came in the roster, it had already been quite late. This is a critical issue, and the situation would worsen in near future as the equipment would near their shelf-lives, and the frequency of breakdown would further increase.

The SCNU is largely driven by human resources. In these units, most doctors were transferred from the PHCs. This approach may help address shortages in specific circumstances but are not likely to resolve the problem in the long run. Amount of nursing care that an infant needs is somewhat unrelated to how sick that infant is.[12] The number of nursing staff is a critical parameter to ensure the quality of care. The Special Care Baby Unit, Kampala in Uganda, lacked nursing staff qualified in neonatal care.[11] In a neonatal special care unit in the USA, the infant: nurse ratio and infant census were the key determinants of nosocomial infections.[13] In a neonatal unit in Barbados, the shortage of staff had fostered deterioration in hand washing technique leading to outbreaks of nosocomial infections.[14] Maintaining an ideal bed: nurse ratio is a challenge as observed in Uganda, Greece, and Ghana.[11,15,16] The concept of Newborn Aides was developed in Purulia.[17]

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.

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. Deficiencies were found in SNCUs with respect to manpower, (their recruitment and training), maintenance of equipment and number of beds at different levels. Having an adequate number of personnel, right policies to facilitate timely repair of equipment, provision of an adequate number of beds, and imparting skills to maintain proper functioning of SNCUs are the key recommendations that will circumvent the existing challenges. In spite of Deficiencies found at different levels of SNCUs, client satisfaction rate was good with regard to the services provided. It is pertinent to learn from the experiences and outcomes of evaluated SNCUs of Indore and Ujjain Divisions of Madhya Pradesh, and 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.

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Name of Unit	Total No. of Beds	Nurse: Bed Ratio	Doctor: Bed Ratio	Reported Times (months) For Repair Of Essential Equipments (Warmer, Photo therapy Unit)	Avg. Duration (Days) Of Stay	Bed Occupancy Rate (in %)
Indore (Level 3)	30	1: 2.14	NA*	0.5	7.21	117
Dhar (Level 2)	20	1: 1	1: 6.6**	1	5.75	121
Sardarpur (Level1)	4	1: 1	1: 4	2	5	83.3

DOI: 10.14260/jemds/2015/384

Ujjain (Level 2)	24	1: 1.04	1: 12	1	4	114
Nagda (Level1)	4	1: 1	1: 4	1.5	3	Not Available

Table 1

Key Input and Output Variables to Assess the Performance of SNCU.

Facility	Indore	Dhar	Ujjain
Satisfied	84	79	70
Not Satisfied	16	21	30

Table 2

Overall Satisfaction of Beneficiaries at Indore, Dhar and Ujjain SNCUs.

Picture 1: SCNU Level II at Dhar

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FINANCIAL OR OTHER COMPETING INTERESTS: None

Date of Submission: 22/01/2015.
Date of Peer Review: 23/01/2015.
Date of Acceptance: 13/02/2015.
Date of Publishing: 20/02/2015.