Utilization and Effectiveness of Free Newborn Care Service Package in Inpatient Care of Sick Newborns –A Time For its Revision to Ensure Sustainability: Evidences From a Tertiary Level Public Hospital in Nepal

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ABSTRACT

Introduction: Free Newborn Care (FNC) service has been implemented to address the financial barriers to access sick newborn care in Nepal. This study was designed to evaluate the effectiveness of FNC package in terms of its adequacy to support a facility financially and the factors to be considered for reimbursement schemes in the FNC guideline.

Methods: This is a cross sectional retrospective study where 2907 newborns who received FNC service from 2019 Mar 15 to 2021 Jan 14 over 20 months were included. Descriptive statistics using frequency and percentages were used to describe the package received. Pearson's Chi squared test was used to determine if the various factors receiving different newborn packages were statistically significant or not.

Results: Amount reimbursed by FNC package for 20 months fell short by NRs 1355541. Majority of preterm (58%), LBW (52.3%) and MAS (55.3%) received package C. Babies who received package C with single morbidity was 576 (37.3%) with two to three morbidities was 380 (48.7%) and with more than three morbidities was 301 (70.2%). Those newborns who stayed for four to seven days, majority 654 (53.4%) received package B, whereas those who stayed for eight to 14 days, 15 - 21 days and > 21 days, the majority 490 (38.4%), 66 (5.2%), 32 (2.5%) received package C respectively. There was an association between receiving package C mortality among cases ($P < 0.001$).

Conclusions: Inpatient quality newborn care can save lives of many vulnerable newborns. FNC service has provided opportune context in care of sick newborns with promising results. However, revising the reimbursing schemes by focusing on length of stay, mortality and disease severity can better strengthen sick newborn care.

Keywords: Free newborn care, length of hospital stay, SNCU/NICU, sick newborns, neonatal mortality

INTRODUCTION

Concerted efforts to set, measure and achieve goals and targets for ending preventable newborn deaths first through Millennium Development Goals (MDGs; 1990–2015) and subsequently via the Sustainable Development Goals (SDGs; 2016–2030) has resulted in reduction of global neonatal deaths from 5.0 million in 1990 to 2.4 million in 2019.[1] However, this reduction in neonatal mortality is slower as compared to the under-five mortality rates in the developing countries, where almost 99% of the overall neonatal deaths occur.[2] In Nepal, Community based –integrated management of infant and childhood illness (CB-IMNCI), Nutrition and immunization program, Safe motherhood program, are some of the critical interventions which helped achieve a reduction in neonatal mortality rate from 33 to 21 per thousand live births between 2006 to 2016.[3,4] Barriers to sick newborn care such as poverty, inequity of care etc. prompted the Ministry of Health, Nepal to prioritize implementing the free newborn care (FNC) service package to treat the sick newborns nationwide to achieve the SDG target of reducing neonatal mortality to < 12 per 1000 live births by 2030.[5,6] To ensure that every admitted newborn receive care in the Special newborn care unit / Neonatal intensive care unit (NICU / SNCU) free of cost, a FNC guideline was introduced so that the institution providing the care could be reimbursed an appropriate amount based on the provision of care as described in figure 1.[5] In Nepal, NICU / SNCU establishments have been increased in number since (2017 / 2018) by as many as 21 SNCU and 11 NICU within the public hospitals outside the capital from only two Government supported NICUs previously.[7]

Capacitating health workers in newborn care in the background of free newborn care scheme has been conducive to serve a significant number of neonatal sepsis, birth asphyxia, preterm babies with complications, neonatal jaundice, meconium aspiration syndrome etc even in the distant health facilities.[8-10] This financing scheme has strengthened the health facilities in managing sick newborns, reduction in referral of sick newborns to other facilities, mortality during transport and expenses of the family especially during travel.[10,11] Although FNC package has renewed focus on newborn care, feedbacks and stories from institutions implementing this innovative package reflect the need for its revision in reimbursement so as to meet up with the overall expenses of newborn unit.[10] Further revisions can be conducive in growing public – private partnership in newborn care.[12] The current guideline comprises of package A, B, C and O, based on the level of newborn care and the investigations done to manage the sick newborns. On the basis of this, amount is reimbursed to the particular institution.[10] Factors such as morbidity condition, severity of disease, mortality and length of stay in the hospital relate to the financial burden of the hospital or the family and may need to be included in the revised guideline.[10,13]

In the background of only scare evidences available in the context of effectiveness of FNC, this study could be imperative to shed light on financial aspects of running a SNCU / NICU. The findings and recommendations from this evaluation will contribute to future expansion of this program and policy level decisions and will also ensure factors to be revised by concerned authority to meet the unmet expenses of the health facilities for providing sustainability of service for equitable and quality care of newborns. In this study, we aimed to assess the effectiveness of FNC service in terms of newborns served, adequacy of financial support the hospital is disbursed, and the additional factors to be considered for reimbursement schemes in FNC guideline.

METHODS

The study was conducted in Paropakar Maternity and Women's Hospital which serves 22000 to 24000 deliveries per year. It provides level III care to admitted sick newborns with a team of eight pediatricians, 10 medical officers, 12 nursing staffs, six attendants and one security guard. All babies delivered in the study period who were admitted for sick newborn care and received treatment free of cost were included in this study. All the related information about the admitted newborns regarding the diagnosis, treatment provided, investigations done and outcome of the baby till discharge was recorded by the nursing staffs or medical officers in

the sick newborn registers. After the completion of treatment, the babies were assigned to have received either package A, B or C following the FNC guideline. Data on newborns and package received by each newborn were collected by the doctors working in the newborn units. The forms that were completed were then assessed by the Paediatricians for completeness. The cleaned data were exported into Statistical Package for the Social Sciences (SPSS) for further data analysis. Descriptive statistics using frequency and percentages was used to describe the package received in terms of neonatal morbidity, mortality, length of hospital stay and management. Pearson's Chi squared test was used to determine the level of significance among various factors receiving different newborn package. The total costs for running SNCU/NICU was compiled by consulting various departments, looking at the records of expenditures on newborn related headings over the study period of 20 months. The purchase of drugs, ventilator circuits, oxygen delivery equipment, over the study period done for the management of 2907 babies was reviewed from records. The total amount which was provided free for lab investigations, X-ray and ultrasonogram during the study period was calculated. As the monthly ABG maintenance expense was NRs 100000, it was multiplied with 20 for 20 months, which was a total of NRs 2000000. Before the implementation of FNC program, the hospital used to charge a minimum or NRs 1000 for each day of hospital stay. The amount collected would bear the cost for ancillary services, personnel salary cost other than the government staffs. Ancillary services included expenditures in materials and supplies like laundry, cleaning etc which are a day to day necessity in newborn units. To compensate for the expenses in this heading we calculated the amount by total number of hospital days for 2907 babies with average stay of minimum five days. First, the total number of babies served as either package A, B or C was estimated and the amount reimbursed to the hospital amounted to NRs 1000, 3000 and 8000 for package A, B and C newborns. The amount was summed up and the difference was compared with the total expenses.

Sick babies were classified as having any of the following morbidity:[14]

Complications of prematurity: Conditions like respiratory distress syndrome, necrotizing entero-colitis, apnea of prematurity, hypoglycemia and hypothermia.

Perinatal asphyxia: Apgar score < 3 at 1 min or < 7 at 5 minutes of birth, with clinical evidences or abnormal ABG **(**Arterial blood gas analysis).

Neonatal sepsis: Clinical signs of severe bacterial infection, with a blood culture positive for a pathogenic organism.

Neonatal jaundice: Babies with total Serum Bilirubin (TSB) increasing by > 5 mg / dl / day or 0.5 mg / dl / h, TSB > 15 mg / dl, conjugated serum bilirubin > 2 mg/dl.

Congenital malformation: A major physical defect seen in baby at birth which involves different parts of body.

Meconium aspiration syndrome (MAS): Breathing problems that a newborn baby may have when there are no other causes, and the baby has passed meconium (stool) into the amniotic fluid during labor.

Low birth weight: Birth weight of the baby less than 2500 grams

Preterm: Babies born before 37 weeks of gestation.

RESULTS

During the study period of 20 months, 2907 babies received free newborn care service. Among them, 356 (12.2%), 1236 (42.5%), 1315 (45.2%) received Package A, B and C respectively. The total amount reimbursed to the hospital was NRs.1,45,84,000. The total expenses borne by the hospital to provide laboratory services, medicines and logistics, radio-diagnostics, bed charges etc was NRs. 2,81,39,414. The extra amount that the hospital had to bear to continue free treatment to newborns was NRs. 1,35,55,414. (Fig 2 & 3)

Among the babies with sepsis 65 (5.3%), 600 (48.8%), and 563 (45.9%) received package A, B

Table 1. Free Newborn Care Service Program

Package	Services	Level of newborn care	Reimbursement NRs/ United States Dollar per sick newborn admitted
"A"	• Medicines- Antibiotics, dextrose, IV Cannula, etc. • Laboratory services including blood testing • Oxygen Supply by hood box /nasal prong • X-ray / USG	Basic Sick Newborn Care	1000/9.6
"B"	• Photo therapy • Laboratory Services- Blood culture, RFT (Sodium, potassium, urea creatinine), serum calcium • Lumbar puncture and CSF analysis • Medicine- Dopamine, dobutamine, phenobarbitone, phenytoin, midazolam, calcium gluconate, aminophylline • Bubble CPAP (Continuous Positive Airway Pressure)	Specialized Sick Newborn Care	3000 / 19.2
"C"	• NICU Admission (Must) • NICU bedside ultrasonography (USG) • NICU bedside portable X-ray •Lab: ABG, magnesium, chloride, serum osmolarity, urine specific gravity, urine electrolyte •Double volume exchange transfusion, blood transfusion • Medicine: Caffeine • Mechanical ventilation	Neonatal Intensive Care Service	8000 / 48.0

and C respectively. The distribution of package A, B and C among babies with perinatal asphyxia was 4.1%, 31.2% and 64.6% respectively. In babies diagnosed as jaundice 21.9% received package A, 52.2% received package B, and 25.9% received package C. Majority of the preterm (58%), LBW (52.3%) and MAS (55.3%) received package C. Among the babies with congenital anomalies 28.6%, 38.1% and 33.33% received Package A, B and C respectively. (Table 1).

The number of babies who received package C with single morbidity was 576 (37.3%), with two to three morbidities was 380 (48.7%) and with more than three morbidities was 301 (70.2%) (Table 2).

Similarly, majority of babies 175 (556.8%) who stayed in the hospital for 0 - 3 days received package A. In the 4 to 7 days hospital stay group majority 654 (53.4%) received package B, whereas in the groups- 8-14 days, 15-21 days and > 21 days,

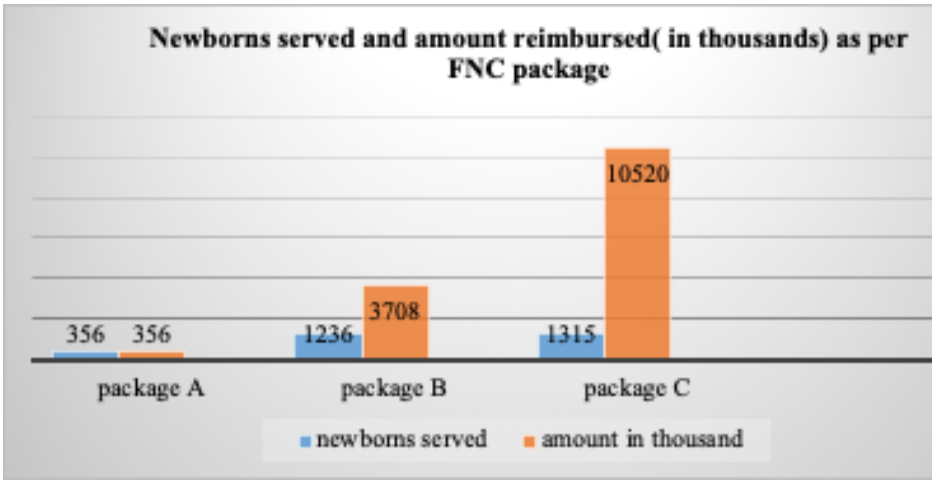

Figure 2. Prevalence of vitamin D deficiency in relation to age

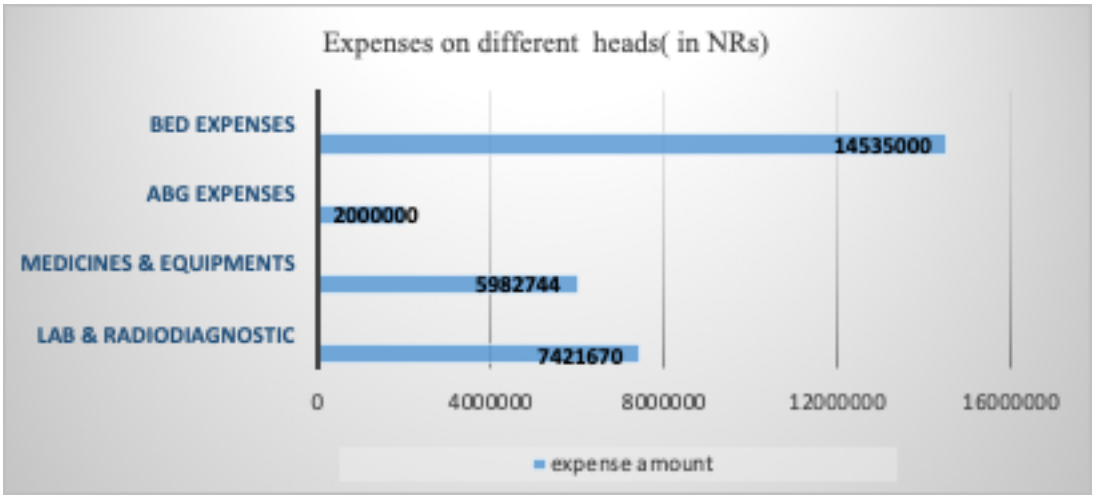

Figure 3. Prevalence of vitamin D deficiency according to gender

the majority 490 (38.4%), 66 (5.2%), 32 (2.5%) received package C respectively. (Table 3).

Comparison of the package against discharge outcome showed that, those babies who improved 1147(51.4%) received package B, while those who expired 393(88.1%) received package C. There was a significant association between newborns receiving package C and those having mortality ($p < 0.001$). (Table 4, 5)

Table 2. Package received in terms of morbidity

Morbidities	Package A (N = 324)	Package B (N = 1672)	Package C (N = 2229)
Sepsis (N = 1228)	65 (5.3%)	600 (48.8%)	563 (45.9%)
Perinatal Asphyxia (N = 919)	38 (4.1%)	288 (31.2%)	593 (64.6%)
Jaundice (N = 228)	51 (21.9%)	119 (52.2%)	58 (25.9%)
Preterm (N = 997)	86 (8.6%)	333 (33.4%)	578 (58.0%)
MAS (N = 85)	5 (5.9%)	33 (38.8%)	47 (55.3%)
LBW (N = 705)	61 (8.7%)	275 (39.0%)	369 (52.3%)
Congenital Anomaly (N = 63)	18 (28.6%)	24 (38.1%)	21 (33.3%)

DISCUSSION

In this study, effectiveness of FNC service package was evaluated in terms of management of various categories of admitted sick newborns. Further, the total sum of money disbursed based on the newborns treated as per FNC guideline was compared with the total sum of expenditures required to manage these sick newborns. Factors affecting the expenses of running a newborn unit was explored. This is probably the first study to evaluate the efforts and experiences of a hospital in the management of sick newborns free of cost under the FNC scheme in Nepal.

In our study, we found that majority of the admitted newborns treated received package C, followed by package B and package A. In the study conducted by Shrestha G. et al, majority of the babies received

Figure 3. Prevalence of vitamin D deficiency according to gender

Morbidity (N = 2752)	Package A (N = 296)	Package B (N = 1199)	Package C (N = 1257)	P-Value
Single Morbidity (N=1543)	244 (15.8%)	723 (46.9%)	576 (37.3%)	< 0.0001
2 or 3 Morbidity (N = 780)	39 (5.0%)	361 (46.3%)	380 (48.7%)	
> 3 Morbidity (N = 429)	13 (3.0%)	115 (26.8%)	301 (70.2%)	

Table 3. Comparison of Type of Package with duration of hospital stay

Duration of stay (N = 2808)	Package A (N = 308)	Package B (N = 1225)	Package C (N = 1275)	P-Value < 0.0001
0 - 3 Days	175 (56.8%)	195 (15.9%)	310 (24.3%)	
4 - 7 Days	68 (22.1%)	654 (53.4%)	377 (29.6%)	
8 - 14 Days	60 (19.5%)	353 (28.8%)	490 (38.4%)	
15 - 21 Days	2 (0.6%)	20 (1.6%)	66 (5.2%)	
> 21 Days	3 (1.0%)	3 (0.2%)	32 (2.5%)	

package B.[10] This could probably be because of the difference in setting and severity of disease in the admitted newborns in the study. Our hospital serves for level III newborn care whereas most of the hospitals involved in the other study provided level I and level II newborn care.[10,15] This might be the possible reason why most of the babies received package C in our study.

Our study showed that the total cost for the hospital to run the newborn unit was NRs1,45,55,414; higher than the amount reimbursed by the FNC scheme. FNC guideline has been designed for all level of hospitals in the same manner. Owing to the higher number of human resources and severity of disease conditions treated in tertiary level hospital, the scenarios in a district level and tertiary level hospital providing the same level of care might be different. Studies have found that cost for caring newborns in neonatal intensive care units is very high[16-18] and even the care per neonate in SNCU

Table 5. Association of Package received with mortality

	No Mortality	Mortality	Total	P-Value
Package	N = 2461	N = 446	2907	< 0.0001
Package A	333 (13.50%)	23 (5.20%)	356 (12.2%)	
Package B	1206 (49.00%)	30 (6.7%)	1236 (42.5%)	
Package C	922 (37.5%)	393 (88.10%)	1315 (45.2%)	

Table 4. Comparison of Type of Package with discharge outcome

Outcome (N = 2907)	Package A (N = 356)	Package B (N = 1236)	Package C (N = 1315)	Total (N = 2907)	P-Value
Improved (N = 2231)	309 (13.8%)	1147 (51.4%)	775 (34.8%)	2231 (77.02%)	< 0.0001
Expired (N = 446)	23 (5.2%)	30 (6.7%)	393 (88.1%)	446 (15.3%)	
LAMA (N = 56)	4 (7.1%)	12 (21.4%)	40 (71.4%)	56 (1.9%)	
DOPR (N = 16)	5 (31.3%)	8 (50.0%)	3 (18.8%)	16 (0.5%)	
Referred (N = 158)	15 (9.5%)	39 (24.7%)	104 (65.8%)	158 (5.43%)	

was found to be NRs 8144.[19] It clearly indicates that for smooth delivery of sick newborn management, the cost reimbursement policy needs a revision so that the centers which have already adopted FNC service continue the care without any disruptions and burden. And, more centers are motivated to introduce FNC into their system.

We found that most of the babies admitted for preterm and LBW received package C which indicates that these babies required more cost for care. This is in line with the studies conducted in India in which more expenses were found to occur for the treatment of preterm and LBW babies.[18,19] Preterm and LBW babies suffer from multiple complications and usually require more days of hospital stay which probably increases the ancillary costs and other costs.[20]

We found that almost half of the babies were admitted for more than seven days. However, only nearly half of these babies could receive package C, based on the current FNC guideline. As length of stay is not mentioned as an indicator to assign the type of package even the babies who stayed for longer duration had to receive package A or B too. Length of stay in the hospital is associated with excess of expenses to both the institution and family as reported by various studies.[13,20,21]

We also found that mortality was positively associated with receiving of package C. This means that babies who die during the course of treatment should be assigned a package that would reimburse a greater sum so that the unmet expenses of the hospitals could be compensated. This is consistent with a study where hospital cost was found to be more among the non-survivors.[22]

We found that having more than one morbidity would relate to package C. However, if we look at the current FNC guideline, a baby with sepsis, who develops jaundice and shock and receives dopamine and phototherapy will still receive package B. In fact, babies with multiple problems require more vigorous management and this definitely increases the cost. As the FNC Guideline is based on the investigations only, revision of the guideline in terms of clinical severity of admitted newborns could be helpful to the hospital in terms of financial support. Either an increase in the cost for each package or a separate additional package D that could be assigned in terms of length of stay, severity of disease and mortality could be helpful.

CONCLUSIONS

FNC is effective in the management sick newborns in Nepal. However, revision of the FNC guideline is necessary to strengthen the services without imposing any financial burden to run the services smoothly. Robust research at all levels of care to evaluate the impact of FNC on sick newborn care, institutional deliveries, quality care, financial sufficiency is vital to ensure its sustainability and its expansion across the country for creating a joint momentum to decrease neonatal mortality.

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