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Post-discharge follow-up of the Newborns admitted to the Selected Neonatal Intensive Care Units in Galle, Sri Lanka: A Cohort Study

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Abstract

Background: The post-discharge period of the newborns admitted to the Neonatal Intensive Care unit (NICU) is more crucial as they remain vulnerable to serious health complications. Follow-up care is vital to prevent such morbidities and mortalities.

Objective: To assess the post- discharge follow-up care of the newborns admitted to the selected NICUs in Galle, Sri Lanka

Methods: A cohort of 128 newborns admitted to NICUs in National Hospital Galle and German Sri Lanka Friendship Hospital for Women-Galle, who were followed one week after NICU discharge. Data on feeding, developmental status, health complications, healthcare utilization, and post- discharge care were collected using a structured data collection guide through telephone interviews. Data analysed using descriptive statistics with SPSS v 25.0.

Results: The response rate was 93.8%. The mean of the maternal age was 30.91 (±5.24) years. Of them, 75%, n = 96 had completed secondary school, and 75.8% (n = 97) were unemployed. Of all the newborns, 43% (n = 55) were female, and 57% (n = 74) were male. The majority (77.5%) were admitted to NICU as direct admissions, and others were transferred from the wards, 3.1%(n=4), and other hospitals, 19.4% (n=25). Among them,53.7%(n=65) were discharged from the hospitals without any complications. One week after NICU discharge, 94.2% of the neonates were exclusively breastfed, with 89.3% (n=108) exhibiting oral sucking. Common problems reported by mothers included poor sucking (11.6%, n=14), poor attachment (5.8%, n=7), vomiting during the feed (5%, n=6), nasal blockage (5%, n=6), and infections (5%, n=6). Among the newborns, 9.1%(n=11) were on antibiotic therapy. Moreover, some noted delays in developmental status (cognitive:5%, motor 4.1%, psychosocial 4.1%, communication and language: 4.1%), and 5.8% (n=7) were readmitted.

Conclusion: The study findings demonstrated low morbidity and no mortality, but they emphasize the need for ongoing post-discharge monitoring and support for a vulnerable group of post-discharge neonates to enhance neonatal health outcomes.

Background

Newborn health during the post-discharge period is critical, particularly for newborns discharged from the Neonatal Intensive Care Units (NICUs). According to the neonatal clinical guidelines introduced by WHO, Vulnerabilities such as prematurity, low birth weight, and chronic health conditions increase the risk of complications, impacting the quality of life of those babies(1)(2). Sri Lanka has made significant progress in reducing neonatal mortality rates over the past years; recent estimates stand at around 5–6 per 1,000 live births(3).

Neonatal disorders are considered the leading cause of Disability-Adjusted Life Years in all age groups globally. Severe neonatal morbidities that may arise in an apparently healthy baby include sepsis, severe

respiratory infection/pneumonia, and seizures. Neonatal morbidities have long-term consequences, particularly in terms of early development, school performance, and subsequent hospitalization (4) (5)The severity of difficulties that might emerge during the postnatal period because of neonatal morbidity justifies more investigation into postnatal care (6).

Although early discharge is advocated to minimize the risk of iatrogenic infections, enhance family bonding and attachment, and lower hospitalization and patient expenditures, some studies have shown the potential consequences of early discharge. Those include limited in-hospital training on breastfeeding, newborn care, and women's health. However, after the discharge, it is important to monitor whether parents or caregivers follow home care for their babies or not during the discharge period. Therefore, post-discharge follow-up care, including monitoring for morbidities, mortalities, or any other concerns, is crucial for developing newborns' health. Moreover, the post-discharge period is a more crucial period for disease management. Babies can develop serious complications such as respiratory difficulties, infections, dehydration, etc., which may lead to post-discharge mortalities.Another qualitative study was conducted to get the feedback from the mothers after discharging the babies to home. There, some mothers reported that complications like poor sucking and attachment during the feeding, babies were readmitted due to jaundice, sepsis like morbidities as well(7)

After the discharge, it is important to continue proper follow-up care for babies to prevent such morbidities and mortalities. Home monitoring, adequate feeding, administering medication, and regular medical follow-ups are crucial during the post-discharge period. Addressing the caregivers' concerns, such as breastfeeding techniques, psychological status, knowledge etc. also leads to building up confidence among them when providing home care for babies with chronic conditions. On the other hand, nutritional screening to monitor growth and prevent failure to thrive (by advising families on nutritional and caloric modifications), enhancing the quality of the infant's psychosocial environment and parent-infant interaction, addressing parental difficulties such as emotional problems throughout their child's first year and the conditions that raise the chance of hospital readmission may assist to reduce parental stress and readmissions (8). Moreover, according to the previous study findings, better post-discharge care and discharge planning may reduce readmission requirements as well as morbidity and mortality (9). Assessing the follow-up care and identifying the factors that influence follow-up care in the post-discharge period are crucial for improving neonatal health care practices. According to some studies, it has been revealed that if the hospital stay is shorter, having poor maternal education, multiple children, lack of awareness about the early interventions and follow-up care, and lack of referrals from physicians were some of the factors that affected the frequent attendance for the follow-up visits(10).

In Sri Lanka, NICUs treat a large number of newborns around the country. While there are research on clinical profiles and pharmacological effects, there is limited evidence on neonatal fatalities and outcomes, especially in the post-discharge period(11)

(12).There are no published data on neonatal monitoring, follow-up, post-discharge implementations, morbidities, or mortality rates after NICU discharge. Therefore, this study evaluated the post-discharge

follow-up status of neonates admitted to selected NICUs in Galle, Sri Lanka. The findings will be useful in planning community- and hospital-based interventions. It will also facilitate strengthening existing neonatal care protocols, as well as neonatal follow-up and monitoring techniques at both the local and national levels.

Materials and methods

Aim

To assess the post- discharge follow-up care of the newborns admitted to the selected NICUs in Galle, Sri Lanka

Study design

A prospective-cohort study was conducted.

Study setting

NICUs of National Hospital Galle and German Sri Lanka Friendship Hospital for Women in Galle, Sri Lanka was the study setting.

Sample population

Study was conducted among the newborn babies admitted to the NICUs in the above hospitals. Data collected from mothers and hospital records. Direct data collection were not done using invasive procedures on the newborns.

Sample size calculation

Data collected from all the discharged babies from NICUs in selected hospitals in Galle from January 2025- April 2025. The total population (128 newborns) during the study period was selected as the sample size.. Write in past tense

Selection criteria

Discharged newborns from NICU to home, transferred to any other wards in the same hospital were included in the sample. The parents/caregivers who could read and write Sinhala/ English were selected for the study, and whose babies transferred to NICUs of other hospitals, and parents/ caregivers who could read and write only Tamil were excluded from the study.

Study instruments

Data were collected using a structured data collection guide, which includes socio-demographic data, data on feeding behaviours, developmental status, health complications, healthcare utilization, and medication administration. Under the feeding behaviour, feeding type, method, and problems during the feed were assessed. Under the developmental status, it includes questions about cognitive, motor, psychosocial, and communication and language domains. Further respiratory, gastrointestinal, metabolic, neurologic, infections, and other complications were assessed under health complications that arise after discharge from NICU. Healthcare utilization and post-discharge care (after one week of NICU discharge) were assessed by questions such as whether they are attending follow-up visits, any readmissions present, and any other private consultations done. Furthermore, medications used were documented.

Data collection procedure

Data collection was done from January 2025 to April 2025. NICUs of National Hospital-Galle and German Sri Lanka Friendship Hospital for Women were selected for the data collection. Mothers were approached in person at the wards or contacted by phone if their babies had been discharged from the hospital. If contact numbers were unavailable, parents' or caregivers' contact details were collected by communicating with the respective midwives in that MOH area, and if the mother/caregiver refused to answer, they were excluded from the study. Further, if they are treated in a ward, the relevant data from the hospital records and by personal communication, the data were collected. Data on feeding status, medical issues, pharmacological management, follow-up visits, vaccination and developmental milestones were gathered weekly following discharge using a structured guide. Developmental stages were asked according to the Child Development Record (CHDR).If some data were unable to collect from parents/caregivers (e.g., medication), they were asked to send the photos via WhatsApp to the investigators. If these options are not accessible, midwives in relevant MOH areas were informed to collect the information. Before commencing the data collection, the informed consent was taken from the legal guardian at the time of discharge from NICU.

Data analysis

The data was analyzed using IBM SPSS Statistics Version 25.0. The analysis used descriptive statistical approaches. Categorical variables were characterized using frequencies and percentage distributions to interpret how individuals were dispersed across different categories. Continuous variables were summarized using mean values to show key tendencies.

Ethical consideration

Ethical approval

was obtained from the Ethical Review Committee of the Faculty of Allied Health Sciences, University of Ruhuna, Sri Lanka (Ref No: 2024.10.476).

Permission for the study was taken from the Directors of National Hospital-Galle and German Sri Lanka Friendship Hospital for Women. Then mothers of the babies were provided with the information about the study and obtained consent for participation. After obtaining consent from the legal guardian, physically before discharging the baby from the NICU.

Mothers had the option to withdraw from the research at any time. The rights of the participants were always respected. Throughout the study, it reassured privacy and confidentiality by not including the name in the study, but for communication purposes, the questionnaire included the contact details of the mother and father of the baby. Participants were recognized using a serial number, and the collected data were kept secure under lock and key and saved beside the computer with a secret password. The investigators only had access to reach, regulate, and operate the collected data. No reimbursement or compensation was received by any research participant on behalf of participation in this study.

Results

A total of 128 participants were surveyed at the time of discharge, and among them, the response rate after one week of follow-up was 93.8%. Based on the objectives, results were interpreted, and this includes a descriptive explanation about the feeding method and type, feeding issues, weight gain, developmental behaviours, consuming medications, and medical problems within a period of one week. Among the sample, all were able to survive during the 1st week after discharge from NICU.

Socio-demographic data

The mean age of the mothers of the neonates were 0.91 (± 5.24) years. Majority of them have completed (75%, n = 96) completed secondary school, and 75.8% (n = 97) were unemployed. Of all the newborns, 43% (n = 55) were female, and 57% (n = 74) were male. Prematurer rate 67.19%(n = 86)., While 19.4% (n = 25) transferred from other hospitals and 3.1% (n = 4) were from the wards of the same hospitals. The majority (77.5%) were admitted to the NICU as direct admissions.

Feeding behaviour of newborns after discharge

The mode of feeding at discharge, as reported in Table 2, demonstrates the variety of approaches used to guarantee appropriate nutrition in neonates, particularly those with initial feeding issues. Most newborns (89.3%, n = 108) were able to suck orally by the time of discharge from NICU, showing good recovery and preparedness for home feeding. However, various feeding strategies were also used, with 55.4% being cup-fed, which is a common temporary or supporting strategy in neonatal care. Tube feeding, including gavage or nasogastric (NG) procedures, was utilized in 8.3% of instances, primarily for premature newborns or those who struggled to coordinate sucking and swallowing. Furthermore, 5.8%

of the newborns got spoons or bottle feeding, demonstrating the adaptability of feeding options to individual demands.

Table 1
Feeding type of newborn after discharge (n = 128)

Feeding type	Frequency	Percentage
Breastfeeding (only)	114	94.2%
Formula feeding (only)	3	2.5%
Mix feeding	4	3.3%

Table 2
Feeding method of newborn after discharge (n = 128)

Feeding method	Frequency	Percentage
Orally sucked	108	89.3%
Cup feeding	67	55.4%
Tube feeding (NG/Gavage)	10	8.3%
Spoon bottle feeding	7	5.8%

Out of the study participants, majority had the feeding issues like poor sucking (n = 14,11.6%), poor attachment (n = 7, 5.8%), and vomiting (n = 6, 5%) while a minority showed that their babies had issues like coughing (n = 2,1.7%), exhaustion/fatigue during the feed (n = 2,1.7%) and 1.7% (n = 2) had poor milk secretion of mother as well. Furthermore, 23.1%(n = 28) showed a significant reduction of weight than the discharged weight

Health complications after one week of NICU discharge

One week after discharge, a significant number of newborns had mild morbidities, mostly due to respiratory and other systemic issues. Respiratory problems were the most prevalent, with 5% (n = 6) of infants reporting nasal block, 4.1% (n = 5) presenting with cold and shortness of breath (SOB), and 3.3% (n = 4) developing a cough. In addition to respiratory issues, 2.5% (n = 3) of newborns had neurological disorders, and another 2.5% (n = 3) had interventions like colostomy, who requires continuous medical or surgical care. Gastrointestinal problems were uncommon, with vomiting and constipation recorded in 0.8% (n = 1) of cases. Furthermore, 0.8% (n = 1) of them needed phototherapy after discharge, probably due to unresolved or recurring neonatal jaundice.

Medication Administration

When considering the medication administration, 9.1% (n = 11) were on antibiotic therapy (especially penicillin and gentamycin), and 61.2% (n = 74) received multi-vitamins, while 29.8%(n = 36) had other drugs like Levetiracetam, Omeprazole, Domperidone, etc as well (Fig. 2.).

Discharge patterns and post-discharge healthcare utilization

Most newborns (53.7%, *n* = 65) were discharged from the hospital without complications, while the rest required inpatient treatment. However, from the hospital-discharged neonates, a significant proportion (34.7%, n = 42) did not get scheduled clinic follow-up. The readmission rate (5.8%, n = 7) was relatively low, with reasons including fever, low hemoglobin levels, failure to thrive, jaundice, vomiting, and routine care such as BCG immunization. Furthermore, 8.3% (n = 10) of the infants were referred to private consultations, primarily for respiratory issues such as the common cold, nasal obstruction, and grunting.

Developmental status

Another point of concern discovered during the one-week follow-up was the early detection of developmental abnormalities in a subset of newborns. Specifically, 5% (n = 6) of infants exhibited signs of cognitive delay, and 4.1% (n = 5) had impairments in motor, psychosocial, communication, and language domains (Fig. 3). Data regarding the developmental status were collected via maternal interviews, and for those who stayed in the wards, physical assessments were conducted by the research team, incorporating maternal verbal reports. The questions related to each developmental area were asked/ assessed according to the age appropriateness.

Discussion

This study revealed the early outcomes of the post-discharge follow-up of newborns discharged from NICUs in which addressed feeding, developmental status, and healthcare utilization during the 1st week of their NICU discharge. In the first week following discharge from the NICUs, the most significant finding was the absence of mortality during this period, which indicates a better survival rate and better post-discharge care/ follow-up. In Sri Lanka, there are some strategies to reduce the mortality rate of already recovered newborns after discharging at NICUs, such as early follow-up visits, educating on breastfeeding, signs of developmental delays, and introducing the child health developmental record (CHDR) to prevent any disease complications. However, research done all over the world has shown that the newborns' survival rate is failing. This is in stark contrast to studies from similar contexts such as Tanzania and Liberia, where newborn mortality was found to be 26.8% within seven days of discharge(13). In those situations, deaths frequently happen at home, during readmission, or on the way to a healthcare facility. Therefore, the absence of death in this study could be attributed to improved perinatal care practices, increased caregiver participation, or contextual differences in healthcare access and utilization.

Considering the feeding behavior of newborns after one week from their NICU discharge, the present study discovered that the majority were breastfed and continued to use oral sucking. A notable proportion of newborns used cup feeding. Current findings proved that formula feeding remained extremely limited among the newborn population. This could be due to Sri Lanka's strong cultural

emphasis on breastfeeding, national breastfeeding promotion initiatives, and high maternal awareness of the health benefits. Economic considerations, hygiene concerns about formula preparation, and the active role of public health midwives may all contribute to a reduction in formula feeding. Additionally, due to the increasing mother-baby bond, it may lead to deviations in formula feeding. Some studies conducted in Portugal reported that at the time of discharge, 25.2% were exclusively on breast milk, while 34.1% were on formula feeding, which showed a contrasting finding even though it was reported at discharge(14). As well as a Swedish study, which was conducted at the time of discharge and after 8 weeks of discharge has discovered that 85% and 90% were exclusively fed with breast milk, respectively, which coincides with our study findings(15). This may highlight the efficacy of current national programs and cultural practices. However, persistent efforts including awareness for parents, increasing community – hospital linkage, enhancing target support for vulnerable mothers, and proper monitoring of feeding practices after discharge, are required to maintain and strengthen these beneficial results. Globally, respiratory disorders are the most commonly occurring disorder after discharge from NICU, mainly among the premature, and in newborns who survived with ventilators in NICU(16). Likewise, the health complications, like respiratory disorders and neurological disorders, after discharge from NICU were common in the present study newborn group as well. This shows that, within the present study setting, there were some issues with follow-up care practices for newborns' health. A similar study revealed that some reactions, such as skin rash, diarrhea due to antibiotics, and respiratory failure, were reported after discharge from the NICU (17). Our findings are consistent with another previous research(18) conducted by Sarda, Schwartz, and Sorrells (2023), which discovered that caregivers frequently reported respiratory complications following neonatal intensive care unit (NICU) discharge. In that study, high rates of coughing (77.8%), breathing difficulties such as dyspnea, oxygen desaturation, and fatigue were observed. Although our cohort had a lower prevalence, the similarity in symptom profiles highlights the global concern about neonatal respiratory health after discharge. These respiratory morbidities, even if mild, may indicate underlying vulnerabilities and highlight the importance of targeted postnatal care, especially for infants recently discharged from the hospital or NICU. Some studies have reported that respiratory problems, including upper and lower respiratory problems, were reported as a common morbidity in newborns discharged from NICU, while gastrointestinal problems, vision problems, anemic conditions, failure to thrive, and skin problems were also reported among newborns in previous studies, which were notably low in our study (19). This represents that parental care after discharge was at a higher level in our local context than in other countries, and this underscores the proper follow-up care for those who are discharged from NICU as well.

A newborn's readmission following NICU discharge is a key sign of continued vulnerability and reflects the quality of transitional care as well as the complexity of their medical condition. The present study found that, one week after discharge from the NICU, the readmission rate (5.8%, n = 7) was relatively low, with reasons including fever, low hemoglobin levels, failure to thrive, jaundice, vomiting, and routine care such as BCG immunization. Although global evidence from countries like Portugal and Sweden has shown a stark contrast to the current study findings. Within the first week of discharge, some showed a prevalence of more than 50%, and the majority were due to jaundice requiring phototherapy, due to the

feeding difficulties with weight loss and dehydration, followed by hypoglycemia and hyponatremia(20). But in some settings, they have consistent findings as ours with low readmission rates(21). The readmissions will report at early discharge from NICUs due to prematurity or low birth weight in high income countries like European or American countries(22). If the newborns had a long hospital stay, they may have more complicated co-morbidities that need hospital care again, and if they had a short stay, it would cause unresolved medical cases. Further, the parental education, inadequate infrastructure or financial facilities in the healthcare setting, and inadequate home support will enhance the hospital readmission rates of the newborns.

Another point of concern discovered during the one-week follow-up was the early detection of developmental abnormalities in a subset of newborns. 5% (n = 6) of infants showed signs of cognitive delay, and 4.1% (n = 5) had impairments in motor, psychosocial, communication, and language domains. These findings are consistent with the broader literature, which emphasizes the variability in developmental outcomes after hospital discharge. Other studies, however, have yielded more positive results. For example, research has shown that some parents saw normal cognitive adaptation in their infants, such as intact memory, learning capacity, expression, and communication skills, especially when there was a strong multidisciplinary follow-up after NICU discharge. This indicates that structured monitoring and early interventions can significantly support developmental trajectories while mitigating potential risks. To promote optimal neurodevelopmental outcomes and facilitate early detection of emerging concerns, integrated post-discharge programs incorporating developmental screening and parental guidance are required(23). Moreover, there is a limited number of studies conducted to assess the developmental delays within a period of one week after discharge from NICUs.

However, in comparison with the current findings and other global studies, the Sri Lankan context has been revealed through optimized healthcare delivery and follow-up interventions for newborns discharged from NICUs, resulting in fewer mortalities and lower morbidities that can be controlled further with focused person-centered care.

Limitations

When collecting the data, had difficulties in contacting some guardians due to unavailable or unreachable contact numbers; however, an effective sample could be reached. Response bias due to online interview. Due to some communication barriers among the research team, had to exclude Tamil speakers from the study.

Conclusion and Recommendations

The study revealed a low rate of morbidity and readmissions, with the absence of mortality within the 1st week of discharge from NICUs, indicating a good sign for early neonatal care outcomes of the studied cohort of the newborns. However, the presence of feeding difficulties, respiratory symptoms, and early signs of developmental delay among a significant proportion of newborns highlights the existing gaps in

post-discharge care. Many infants do not receive scheduled clinic follow-up, which limits early detection and timely management of emerging health and developmental concerns. These findings highlight the critical importance of improving continuity of care after hospital discharge through structured follow-up programs, standardized discharge planning, and routine developmental screening. It is recommended that caregivers receive education on infant feeding, danger signs, and developmental milestones, as well as improved referral pathways and accessible community-based support services. Strengthening postnatal follow-up systems, particularly in the early neonatal period, has the potential to significantly improve infant health, nutrition, and developmental outcomes while

Abbreviations

CHDR-Child Development Record

NICU- Neonatal Intensive Care Unit

WHO- World Health organization

Declarations

Ethical approval

Ethical approval was obtained from the Ethics Review Committee of the Faculty of Allied Health Sciences, University of Ruhuna (Ref No: 2024.10.476)

Availability of data

Datasets generated during the current study are not publicly available due to confidentiality but are available from the corresponding author upon a reasonable request.

Consent for publication

All the mothers of the newborns were informed about the publication before the data collection and obtained their consent.

Competing interests

No financial or non-financial benefits have been received from anyone.

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Author contribution

TP and *ES* are involved in proposal development, concept development, data collection, and data analysis. *KW* helped in getting permission for the study. Both *BI* and *KW* contributed to finding the gap, reviewing, and concept development of the study. *TP* drafted the manuscript, and *BI* helped in reviewing the manuscript and submission of the final version.

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Figures

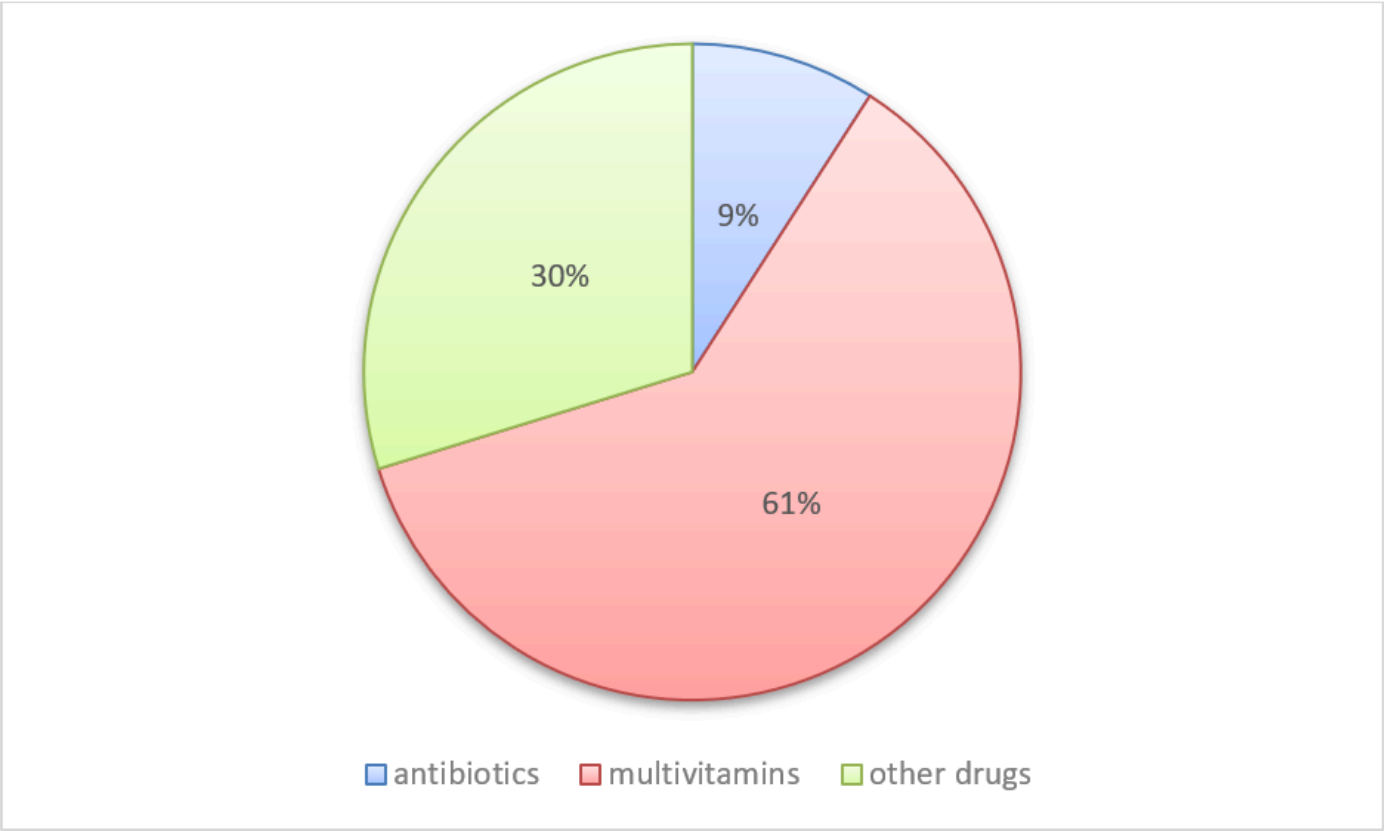


Figure 1

Types of Medication Administration

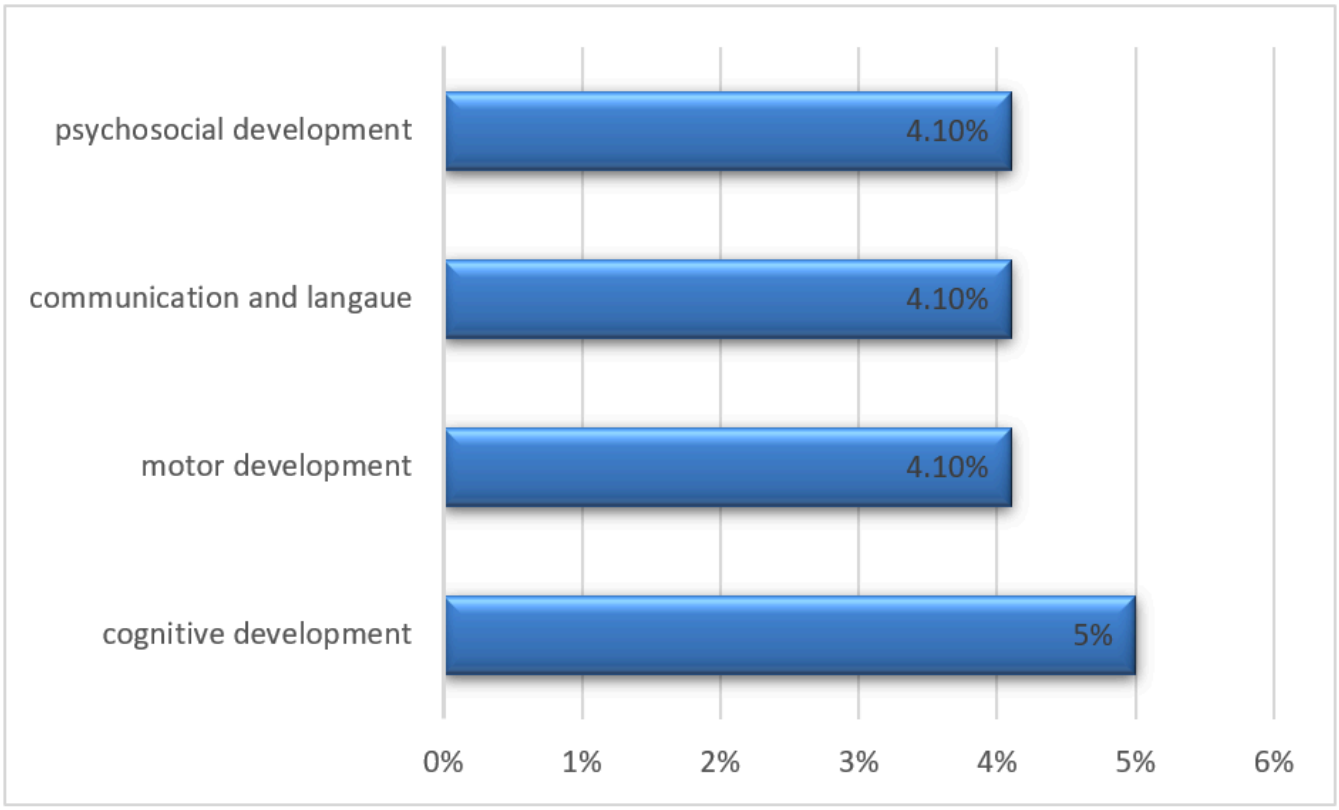


Figure 2

Developmental delay within one week after discharge from NICU