ORIGINAL ARTICLE

A Cross-Sectional Study on the Profile and Clinical Outcomes of Neonates Detained in a Well-Baby Nursery at Tertiary Care Setting, Multan

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ABSTRACT

Objective: To determine the clinical profile (jaundice, prematurity, low birth weight, feeding difficulties, respiratory distress) and clinical outcomes (recovery, neonatal intensive care units' referral, mortality) of neonates detained in the Well-Baby Nursery at CMH Multan.

Study Design: Cross-sectional observational study.

Place and Duration of Study: The study was conducted at the Well-Baby Nursery, Combined Military Hospital, Multan, Pakistan, from June 2025 to November 2025.

Methods: A total of 422 neonates with gestational age ≥35 weeks and birth weight ≥1.8 kg were enrolled through non-probability consecutive sampling. Data were collected using a structured proforma and hospital medical records. Information regarding maternal demographics, neonatal characteristics, mode of delivery, Apgar scores, reasons for admission, and clinical parameters at admission was recorded. Interventions such as phototherapy, supplemental feeding, and respiratory support were documented. Outcomes were categorized as discharge from Well-Baby Nursery, referral to the Neonatal Intensive Care Unit (NICU), or in-hospital mortality. All neonates were managed according to standard institutional protocols.

Results: Respiratory difficulty was the most common condition (33.6%) and was more frequent among neonates referred to NICU (44.5%) than those discharged (28.9%). Feeding difficulty (18.5%) and low birth weight (15.6%) were also significantly associated with NICU referral. Prematurity (18.2%) and neonatal jaundice (14.0%) showed no major difference between outcome groups. Overall, respiratory difficulty, feeding difficulty, and low birth weight were the strongest predictors of NICU transfer.

Conclusion: Respiratory and feeding difficulties are the leading causes of referral from the Well-Baby Nursery to the NICU. Strengthening Well-Baby Nursery infrastructure, improving staff training, and implementing standardized care protocols can promote early identification, timely intervention, and safe discharge, thereby reducing unnecessary NICU admissions and optimizing resource utilization.

Keywords: *Gestational Age, Jaundice, Low Birth Weight, Neonatal Intensive Care Units, Phototherapy.*

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Introduction

Neonates are also called newborns. It includes the first 4 weeks of the newborn's life, which is a very crucial time period because during this time, the newborn is vulnerable to an increased risk of mortality as well as morbidity.[1] There is a huge difference between the environments of intrauterine life from extra uterine. Immediately after birth, the anatomical and physiological systems, especially the cardiovascular, respiratory, and thermoregulatory mechanisms of newborns, are ready to adapt rapidly to the changes.[2] According to a record of the World Health Organization (WHO) and UNICEF, 2.3 million neonates die annually, which is almost the 47% of all deaths happening among children under the age of five years. It means 6500 neonates are dying on a daily basis.[3] Based on another study, nearly 130 million babies are born

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worldwide every year, with about 4 million dying during the neonatal period. Of these deaths, 75% occur within the first week of life, and nearly one-fourth take place before the end of the second day.[4] These mortalities are mostly related to birth asphyxia, congenital anomalies, infections, and prematurity. But all these causes with their complications are avoidable and manageable. The mortality rate varies between developing and developed countries. Developed and developing countries face challenges due to resource limitations in maternal and child health.[5] To improve the mortality rate with neonatal outcomes, work should be done on easy accessibility of resources, along with early diagnosis of diseases, treatment, and postnatal care.[3] In hospitals there are different levels of postnatal care of newborns that depends on the complexity of required interventions. Among them, the Neonatal Intensive Care Unit (NICU) is for monitoring and observation of severely ill neonates and the other one is Well Baby Nursery (WBN) that is designed to keep those newborns who only need general care with minimal supportive interventions.[6] By this approach, undue admissions and load to NICU can be reduced, resources can be utilized efficiently, and postnatal care can be optimized. After identifying hazardous factors and reviewing clinical histories and outcomes of newborns admitted to WBNs, healthcare systems can provide more resources, reduce neonatal overcrowding in NICUs, and increase the effectiveness of neonatal care. But to make and maintain the standardized protocols, it is compulsory to understand the epidemiology and etiology of admissions in WBN, which will make clinical decision-making very easy, and the survival of newborns can be increased.[7]

The developed countries are now emphasizing taking quality improvement initiatives and risk stratification models to analyze the care of neonates in both NICUs and WBNs.[8] According to a survey done in well newborn nurseries of the U.S., the most common causes of neonatal admissions are respiratory issues (especially mild to moderate respiratory difficulties such as transient tachypnea) and hyperbilirubinemia (neonatal jaundice). All these reasons if mild, can be managed easily in WBNs without NICU-level interventions. In European countries, the causes of newborns' admission to WBN are respiratory difficulty, neonatal jaundice, which sometimes needs phototherapy, and hypoglycemia with feeding difficulties.[9] After quick identification and treatment, the neonates can be discharged early by providing necessary education to parents about the care of their neonates to prevent them from further health issues. As mentioned above, developing countries are facing many challenges, including resource limitations, low literacy rates, limited availability of skilled healthcare workers, and inadequate resources to control and manage infections. All are negatively impacting on the health of newborns.[10] Due to the deficiency of well-equipped and dedicated intermediate care units, the WBNs of countries like the Subcontinent, Bangladesh, and Nigeria, etc., are playing dual functions.[11] They are used to manage healthy neonates as well as those with mild to moderate illnesses. According to a UNICEF report, India has made significant strides in reducing newborn mortality, lowering its share of global newborn deaths from nearly one-third in 1990 to less than one-fifth today. In India, approximately 3.5 million babies are born prematurely each year, and around one million newborns are discharged annually from Special Newborn Care Units (SNCUs). The rapid expansion of Special Newborn Care Units (SNCUs) throughout the country has been playing an important role in declining the neonatal mortality rates. Despite this progress, certain challenges are still there, including socio-cultural barriers, deeply rooted societal biases, and gender discrimination that are influencing easy access and utilization of newborn care services.[12] According to studies done in sub-Saharan Africa, the WBNs of those regions are well equipped with phototherapy systems, basic monitoring tools, and oxygen delivery units. All these facilities have contributed to decreasing the referrals to tertiary care hospitals and improving the neonatal survival rates.[13] In both resource-rich and resource-limited countries, the literature consistently supports the role of WBNs as a money and time-saving replacement to intensive care for neonates.

Now, coming to Pakistan, where neonatal diseases and deaths are very common. Approximately 65% of global neonatal deaths occur in only 10 countries, the majority of which are in Asia. Among them, Pakistan ranks third with an estimated 300,000

infant deaths each year. According to a report, 42 neonates die per 1000 live births, which is one of the highest in South Asia and 7% of all the neonatal deaths globally.[14] Although the health department is working very hard to improve maternal and child health, progress is very slow, especially in rural areas. Various factors contribute to it, including limited access to healthcare facilities and shortages of trained professionals.[15] Like other countries in Pakistan, the common reasons of neonatal admissions to WBNs are neonatal jaundice, feeding difficulties, respiratory distress, suspected sepsis, and low birth weight.[4] But in different hospitals the pattern of admissions are variable. Studies conducted in tertiary care hospitals of Karachi, Lahore, and Islamabad revealed that referrals to NICUs from WBNs can be reduced through the early identification of neonatal jaundice and sepsis. In addition, if a neonate is admitted with respiratory or feeding problems, not only its early identification is essential, but providing immediate basic respiratory care and breastfeeding support also plays a vital role.[16] Some other studies conducted in tertiary hospitals in Karachi have concluded that admissions to NICU can be reduced up to 20% if proper observation protocols in WBNs are followed.[17] Despite all these, numerous challenges continue to create hurdles. Out of them the most common is inadequate skilled staff including doctors, nurses and paramedics. Side by side the limited availability of equipment and the lack of adherence to established guidelines and protocols are exacerbating the situation.[18] Moreover, in Pakistan, several studies are focusing on neonatal outcomes after referral to NICU, but relatively less emphasis is on epidemiology and outcomes of WBN admissions. WBNs are used to care for healthy newborns, but in many hospitals, neonates with mild, non-life-threatening conditions are also accommodated here. Commonly, those are suffering from neonatal jaundice, prematurity, low birth weight, feeding difficulties, and mild respiratory distress. Despite their prevalence, there is very limited local data on the clinical profiles and outcomes of such neonates in Pakistan, particularly in CMH Multan. This study will provide guidance to strengthen neonatal care protocols and improve early interventions in similar healthcare settings.

Methods

This observational study was conducted at the Well-Baby Nursery (WBN) Combined Military Hospital, Multan, Pakistan, over a period of six months from June 2025 to November 2025 after taking approval from the Institutional Ethical Review Committee of the hospital vide letter no: IRB/20/2025, dated: 13th May 2025. A sample size of 422 neonates was calculated by using the WHO sample size calculator. Informed written consent was obtained from the parents or legal guardians of all eligible neonates before the research began. During the study period neonates admitted to the Well-Baby Nursery (WBN) were consecutively enrolled by using a non-probability consecutive sampling technique, by considering the inclusion criteria having both genders, neonates admitted to the WBN during the study period, gestational age ≥35 weeks and birth weight ≥1.8 kg and the exclusion criteria: any major congenital anomalies and unwilling parents/ guardians to provide consent. Data was collected by using a structured proforma developed specifically for this study. The proforma contained detailed information on maternal demographics, neonatal clinical characteristics, mode of delivery, Apgar scores, reasons for admission to the WBN, and any interventions provided, including phototherapy, supplemental feeding, and respiratory support. Clinical parameters such as temperature, respiratory rate, and heart rate at the time of admission and duration of WBN stay were also recorded. Outcomes of the study, e.g., duration of stay in the WBN (in days), recovery and discharge, and referred to the Neonatal Intensive Care Unit (NICU) were assessed. All neonates received the same standard of care according to the institutional clinical protocols. Data were obtained through real-time observation and review of hospital medical records by trained data collectors. It remained continuous until the required sample size was achieved.

The normality of continuous variables was assessed using the Shapiro–Wilk test. Continuous variables were expressed as mean ± standard deviation (SD) for normally distributed data and as median (interquartile range) for non-normally distributed data. The Independent t-test was applied to compare the means of normally distributed continuous variables between two groups. The Mann–Whitney

U test was used for comparing non-normally distributed continuous variables. The Chi-Square test was employed to assess associations between categorical variables. A *P*-value of <0.05 was considered statistically significant.

Results

During the study period in the Well-Baby Nursery (WBN) a total of 422 neonates were admitted. The demographic and clinical characteristics of these neonates were recorded and analyzed. The primary outcomes assessed included the rate of discharge and the need for referral to the Neonatal Intensive Care Unit (NICU) for further care. The results are presented in the following Tables 1, 2 and 3.

Table 1: Comparison of demographic and clinical variables between discharged neonates and those referred to the Neonatal Intensive Care Unit (NICU)

Variable		Total (N=422)	Discharged (N=294)	Shifted to NICU (N=128)	*Test* value	*P*-value
Gender	Male	220	154	66	χ^2 = 0.01	0.91
	Female	202	140	62		
Gestational Age (weeks)		37.8 ± 1.2	37.9 ± 1.1	36.8 ± 1.4	t = 2.32	0.02
Birth Weight (kg)		2.78 ± 0.45	2.81 ± 0.41	2.49 ± 0.50	U = 10240	0.001
Apgar Score at 1 min		7.5 ± 0.8	7.6 ± 0.7	6.9 ± 0.9	t = 2.56	0.01
Apgar Score at 5 min		8.9 ± 0.5	9.0 ± 0.4	8.3 ± 0.6	t = 2.14	0.03
Mode of Delivery	CS	380		116	χ^2 = 10.45	0.001
	Vaginal delivery	42	30	12		
Maternal Age (years)		28.4 ± 4.6	28.5 ± 4.4	27.6 ± 4.9	t = 0.86	0.39
*WBN Stay Duration (days)		2.8 ± 1.6	2.0 ± 1.1	4.2 ± 1.3	U = 7345	0.001

*χ^2=Chi-square test, t=Independent t-test, U=Mann-Whitney U test, *WBN=Well-Baby Nursery*

Table 2: Comparison of clinical characteristics between discharged neonates and those referred to the Neonatal Intensive Care Unit (NICU)

Variable	Total (N=422)	Discharged (N=294)	Shifted to NICU (N=128)	χ^2	*P*-value
Respiratory difficulty	142 (33.6%)	85 (28.9%)	57 (44.5%)	9.42	<0.001
Feeding difficulty	78 (18.5%)	48 (16.3%)	30 (23.4%)	3.91	0.048
Prematurity	77 (18.2%)	68 (23.1%)	9 (7.0%)	0.99	0.318
Low birth weight	66 (15.6%)	52 (17.7%)	14 (10.9%)	11.28	<0.001
Neonatal jaundice	59 (14.0%)	41 (13.9%)	18 (14.1%)	10.52	<0.001

Table 3: Outcomes of Neonates in Well-Baby Nursery (WBN)

Outcome	Frequency
Discharged	294
Shifted to NICU	128

Discussion

According to the sample size of our study 422 neonates were admitted to the Well-Baby Nursery (WBN). Out of them, newborns with respiratory difficulty (from mild to intense) was the commonest reason for admission (142/422) to WBN, 85 were

discharged and 57 were shifted to NICU (*P*-value < 0.001). This aligns with similar findings in the study of Parkash A et al. at National Institute of Child Health, Karachi, where according to the author commonest reason for admission of newborns to Nursery were respiratory issues including birth asphyxia, respiratory distress syndrome and transient tachypnea and these all are associated to newborns mortality superimposed by low birth weight and prematurity. But for better outcomes, the early diagnosis and management are compulsory. These data underscore the importance of early respiratory assessment and basic respiratory support in WBNs to reduce the progression of diseases.[17] Another study was done by Anita Lamichhane et al. The study emphasizes that respiratory distress is a significant reason for NICU admissions. To decrease the neonatal morbidity and mortality, the abrupt neonatal resuscitation is very important with early recognition of risk factors (such as birth asphyxia) and strategies to prevent perinatal hypoxia. All cases with minimal issues can be managed in nurseries instead of admitting them to the NICU.[18]

In our study 78/422 neonates with feeding difficulties were admitted to WBN. Out of which 48/294 were discharged, and 30/128 were referred to NICU (*P*-value = 0.048). 77/422 were admitted with prematurity, 68/294 were discharged, and 9/128 were referred to NICU (*P*-value = 0.318). The total number of neonates with low birth weight (LBW) admitted to WBN was 66/422, 52/294 were discharged, and 14/128 were referred to NICU (*P*-value < 0.001). Feeding difficulties are commonly seen in neonates admitted to Well-Baby Nurseries and NICUs. This is aligned with global findings that feeding difficulty is strongly associated with prematurity and low birth weight (LBW), or it is better to say that all of them influence each other due to immaturity of physiological and neurological systems. A study by Mayerl CJ et al. highlighted that preterm neonates take more time to develop full oral feeding as compared to full term. Preterm (<37 weeks) often have immature suck, swallow, breathe coordination, so oral feeding is always challenging. Alongside, delayed oro-motor skills, weak sucking reflexes, and underdeveloped gastrointestinal motility further predispose them to poor feeding with increased risk of aspiration.[19] A systematic study by Kayastha P et al. emphasized that LBW neonates have increased chances of feeding intolerance and need longer hospital stays for nutritional support. Neonates with Low birth weight (LBW, ≤2500 g) and prematurity have reduced muscle tone and stamina, limiting their ability to sustain feeding. Their caloric requirements are always high, but feeding efficiency is poor; if it is not supported with supplemental feeding strategies, it can lead to growth faltering.[20] Just like the study of Rösch L et al., it was also observed that neonates with mild feeding difficulties but who were otherwise stable, were successfully managed in WBN and discharged once feeding was established, even with feeding tubes to some of them as a supplemental feeding strategy.[21] Importantly, the use of supplemental feeding plays an important role to bridge the gap until well established effective oral feeding is established. It can be provided by expressed breast or milk. Often delivered with the help of syringes or feeding tube. It is approved from literature that such approaches increase neonatal weight gain, reduce feeding intolerance and shorten hospital stay. In contrast, neonates with severe feeding issues, or those with LBW and prematurity who failed to initiate or sustain adequate oral feeds, required referral to NICU for monitoring and nutritional support. At the same time, LBW and preterm neonates with no other complications, with well-managed feeding, were discharged safely from WBN after stabilization.

Interestingly, 59/422 neonates were admitted with a complaint of neonatal jaundice requiring phototherapy. From 24-48, they received phototherapy in WBN under close monitoring. Of these, 41/294, with isolated neonatal jaundice, improved and were discharged, while 18/128 were shifted to NICU (*P*-value < 0.001). These transferred cases had unresolved jaundice and were also suffering from associated complications such as feeding difficulties, sepsis, and respiratory distress. This suggests that isolated jaundice can be effectively managed within WBN, but in case of severity, referral to NICU is compulsory. To avoid complications like kernicterus, on-time identification and treatment of pathologic jaundice is mandatory. Our observations coincide with a study done by Baker EL et al. The authors have seen a significant reduction in admissions of neonates to NICU who

were admitted with mild feeding difficulties, jaundice, or temperature instability. These infants were safely managed in the well-baby nursery until they achieved adequate feeding and weight gain.[22] Another study done by Battersby (2017) has demonstrated that most neonates with mild jaundice, feeding difficulties and hypoglycemia can be managed outside the NICU if appropriate transitional care facilities were available. Because around two-thirds of admitted term babies were otherwise healthy and may not have required full NICU admission.[23]

Conclusion

Our study highlights the high prevalence of respiratory and feeding difficulties among WBN admissions and their role in NICU referrals. Early identification, timely intervention, and readiness for phototherapy can improve neonatal outcomes and ensure safe discharge. Strengthening WBN infrastructure, staff training, and standardized care protocols can reduce unnecessary NICU transfers and decrease the load on NICUs in Pakistan and similar settings.

The study was an observational and single-center study that limits generalizability. The study didn't assess long-term developmental outcomes.

Future studies should develop standardized protocols, with a primary focus on respiratory and feeding support, including supplemental feeding strategies, for preterm and low-birth-weight neonates. To reduce unnecessary NICU admissions, evaluation of transitional care models is also recommended.

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Author Contributions

MSA: Manuscript writing for methodology design, investigation, data acquisition, curation, statistical analysis, validation of data, interpretation, write-up of results, revising, editing, supervising for intellectual content, and approval for final submission

MFS: Conception, design of the work, writing the original draft, proofreading, and approval for final submission

MSA is the nominated guarantor and takes full responsibility for the overall content and integrity of the work