MED-PHOENIX: JOURNAL OF NATIONAL MEDICAL COLLEGE

ORIGINAL ARTICLE

PRESCRIPTION PATTERN IN NEONATAL INTENSIVE CARE UNIT OF TERTIARY CARE TEACHING HOSPITALS OF BIRGUNJ, NEPAL

Smita Singh[1], Dhivya Chakravathy[1], Md. Ashfaque Ansari[2], Prabin Kumar Singh[3]

[1]Department of Pharmacology, National Medical College Teaching Hospital, Birgunj, Nepal

[2]Department of Pediatrics, National Medical College Teaching Hospital, Birgunj, Nepal

[3]Department of Pediatrics, Narayani Hospital, Birgunj, Nepal

Date of Submission *: May 15, 2026*

Date of Acceptance *: May 25, 2026*

Date of Publication : August 27, 2026

Correspondence to:

Smita Singh

Department of Pharmacology

National Medical College Teaching Hospital, Birgunj, Nepal

Email: singhrajputsmita64@gmail.com

Contact No: 977-9852056346

Citation:

Singh S, Chakravathy D, Ansari MA, Singh PK. Prescription Pattern in Neonatal Intensive Care Unit of Tertiary Care Teaching Hospitals of Birgunj, Nepal. Medphoenix. 2026;11(1):46-51.

DOI:https://doi.org/10.3126/medphoenix.v11i1.94526

Conflict of interest: None, ***Funding:*** None

Publisher: *National Medical College Pvt. Ltd.*

MedPhoenix - Journal of National Medical College (JNMC); 2026,11(1), available at www.jnmc.com.np

ISSN:2631-1992 (Online); ISSN:2392-425X (Print)

ABSTRACT

Introduction: *Neonates admitted to neonatal intensive care units are subjected to wide range of medications so drug utilization studies provide a glimpse of ongoing treatment trend, identifying and avoiding side effects and promoting rationale use of medications. This study was conducted with an objective to assess the drug utilization pattern among neonates admitted at tertiary health care centres in Birgunj.*

Materials and Methods: *A cross sectional observational study was conducted at two tertiary hospitals of Birgunj for three months. Consecutive sampling method was applied and the prepared Performa contained demographic details, mode of delivery, duration of hospital stay, diagnosis, name of the drugs used, route of administration and use of generic name. Drug utilization among neonates was assessed by using World Health Organization-Anatomical Therapeutic Chemical classification (WHO-ATC) and WHO core prescribing indicators. Descriptive statistics like mean ± SD, frequency and percentage were used to evaluate the data.*

Results: *Out of 270 neonates, preterm were 113 (41.85%), male were 147 (54.44%) and 109 (40.37%) were of normal birth weight. The neonates diagnosed with neonatal sepsis were 86 (31.85%), neonatal sepsis with respiratory distress syndrome were 51 (18.89%), and neonates with Meconium aspiration syndrome were 34 (12.59%). Total number of drugs used were 1153 out of which anti-infective drugs were 667 (58.76%), nervous system 249 (21.60%), cardiovascular system 81 (7.03%), respiratory system 67 (5.81%) and alimentary system 36 (3.12%). The average number of drugs prescribed per neonate was 4.27. The percentage of prescriptions containing antibiotics was 95.19 and 85.43% of drugs were prescribed from Nepalese Essential Drug List.*

Conclusion: *Our study findings suggest a high number of drugs prescribed per neonate and extensive use of antibiotics. Policies should be implemented to prevent the overuse of drugs and reduce antibiotic resistance and financial burden. Therefore, therapeutic drug monitoring, promotion of the rational use of medications and implementation of antibiotic stewardship programs are needed.*

Keywords: *Drug Utilization, Neonates, WHO-ATC, WHO Prescribing Indicators*

INTRODUCTION

The neonatal period which comprises the first 28 days of life, is a crucial phase during which the newborn undergoes significant changes due to the transition from complete intrauterine dependency to full independence in the external environment. During this period, they experience various physiological changes and are vulnerable to a range of illness, from minor infections to severe, life-threatening conditions that can even lead to deaths.[1]

Since 2000, the global percentage of newborn fatalities has shown a declining trend and has dropped by approximately 44%. However, the World Health Organization (WHO) reported that in 2022, newborns accounted for nearly half (47%) of all under five child deaths.[2] In Nepal, the Nepal Demographic and Health Survey (2022) reported that neonatal deaths comprised nearly three-fourths of all infant deaths, with a neonatal mortality rate of 21 per 1,000 live births.[3]

The Neonatal Intensive Care Unit (NICU) is a specialized unit where critically ill newborns with various diagnoses and prognoses are admitted for close monitoring and life-saving interventions. Due to their disease conditions,

neonates are often subjected to multiple medications. Reports indicate that, on average, each neonate receives 8.6 medications per patient during hospitalization.[4]

Prescribing in neonates is a highly intricate task as it is influenced by variability in diseases, country-specific treatment protocols, formulations and dosages. The lack of evidence based pharmacodynamics and pharmacokinetic studies in neonates further complicate rational drug use. Neonates' unique physiological characteristics, such as low glomerular filtration rate, immature tubular transport, underdeveloped hepatic drug metabolizing systems and high blood brain barrier permeability, further affect absorption, distribution, metabolism and excretion making prescribing for them a complex task.[5]

The irrational use of medications has been a matter of global concern, as it leads to increased treatment costs, prolonged hospital stays, antibiotic resistance, adverse drug interactions, side effects and increased mortality and morbidity.[6]

Drug utilization studies are essential for promoting rational prescribing and ensuring evidence-based use of medications.[7] This study was conducted in the NICU of two tertiary centres in Birgunj, Nepal, with the aim of evaluating prescribing patterns among hospitalized neonates. The findings of this study may help identify prevailing prescribing trends, provide feedback to prescribers, encourage rational drug use, enhance patient safety, improve therapeutic outcomes and even support the implementation of educational programs when necessary.

MATERIALS AND METHODS

This descriptive cross sectional study was conducted at NICU of NMCTH (National Medical College and Teaching Hospital) and Narayani Hospital for three months from February 2026 to April 2026. Consecutive sampling method was applied for the sample size. All neonates' parents willing to give informed written consent were enrolled in the study whereas those with cancer, congenital anomalies requiring operative interventions, post-operated cases and neonates receiving phototherapy only for neonatal jaundice were excluded from the study. Also, neonates receiving non-medications such as only intravenous fluids, oxygen, blood products (except albumin) were also excluded.[8]

A total of 270 neonates were enrolled in the study. Ethical approval was obtained from Institutional Ethical Review Committee (F-NMC/722/082-083). Data were collected by the principal investigator from medical and prescription charts of neonates admitted to the NICU. Information on age, weight of the neonates, place and mode of delivery, diagnosis, duration of hospital stay and medication details were recorded. Combined diagnoses were recorded as documented by treating physician in medical records. Birth weight and age was classified according to WHO (World Health Organization).[9]

The prescribed medications were classified using the WHO-ATC (Anatomical Therapeutic Chemical) classification system and assessed using WHO core prescribing indicators.[8] The data were entered in SPSS version 26 and descriptive statistics like mean, standard deviation, frequency and percentage were used.

RESULTS

A total of 270 neonates were enrolled in our study with a male preponderance 147 (54.44%). Most of the neonates were term 157 (58.15%), and 109 (40.37%) had normal birth weight. Six neonates were of extremely low birth weight. The percentage of normal delivery was 61 and hospital delivery was 90. (Table 1)

Table 1: Demographic and Clinical Characteristics Details

Patients detail	Frequency (N)	Percentage (%)
Age		
Term	157	58.15
Preterm (<37 weeks)	113	41.85
Gender		
Male	147	54.44
Female	123	45.56
Birth Weight	Frequency	Percentage
Extremely low birth weight (ELBW)	6	2.22
Very low birth weight (VLBW)	37	13.70
Low birth weight (LBW)	86	31.85
Normal birth weight (NBW)	109	40.37
Large for gestational age	32	11.85
Mode of delivery		
Normal delivery	165	61.11
Caesarean delivery	105	38.89
Place of delivery		
Hospital	243	90.00
Home	27	10.00
Mean ± S.D (Duration of hospital stay in days)	8.4 ± 5.2	

Neonatal sepsis was common diagnosis accounting for 86 (31%) and it was even present in combination i.e. Neonatal sepsis with respiratory distress syndrome 51 (18.89%). The neonates with Meconium aspiration syndrome were 34 (12.59%) and Meconium aspiration syndrome with necrotizing enterocolitis were 14 (5.19%). The neonates suffering with Transient tachypnea of

newborn were 6 (2.22%). (Table 2)

Table 2: Clinical Diagnosis

Diagnosis	Frequency (N)	Percentage (%)
Neonatal sepsis	86	31.85
Neonatal sepsis + Respiratory distress syndrome	51	18.89
Respiratory distress syndrome	24	8.89
Meconium aspiration syndrome	34	12.59
Birth asphyxia with hypoxic ischemic encephalopathy	33	12.22
Birth asphyxia with meconium aspiration syndrome	22	8.15
Meconium aspiration syndrome + necrotizing entero-colitis	14	5.19
Transient tachypnea of newborn	6	2.22

In our study, anti-infective drugs use frequency was maximum, it constituted 667 (57.85%), nervous system 249 (21.60%), cardiovascular system 81 (7.03%), respiratory system 67 (5.81%), alimentary system 36 (3.12%), systemic hormonal preparations 5 (0.43%). Others include multivitamins, vitamin D drops and its use frequency was 48 (4.16%). (Table 3)

Table 3: WHO-ATC Classification of Drugs (Total 1153)

Total 1153	Anti-infective system	Alimentary system	Cardiovascular System	Nervous system	Respiratory System	Systemic hormonal Preparations
Frequency	667	36	81	249	67	5
Percentage	57.85	3.12	7.03	21.60	5.81	0.43

Cefotaxime was used among 222 (82.22%) neonates, vancomycin in 72 (26.66%) neonates, Ceftazidime in 71 (26.30%) neonates. In Alimentary system, Domperidone was used in 14 (5.19%), Ranitidine 11 (4.07%). In cardiovascular system, Dobutamine in 42 (15.56%), Adrenaline 8 (2.96%) neonates. Hydrocortisone was the only drug to be used in endocrine system. Paracetamol in 98 (36.29%) neonates, Midazolam in 52 (19.26%) neonates, Phenobarbitone in 46 (17.04%) neonates. In respiratory system, nebulisation with Adrenaline was done in 56 (20.74%) neonates. (Table 4)

Table 4: Category of Drugs with WHO-ATC Codes

Category of drug	WHO-ATC code	Name of drug	Neonates Frequency (n)	Percentage
Anti-infective	J01DD01	Cefotaxime	222	82.22
	J01GB06	Amikacin	183	67.78
	J01XA01	Vancomycin	72	26.67
	J01DD02	Ceftazidime	71	26.30
	J01DH02	Meropenem	32	11.85
	J01CR05	Piperacillin-Tazobactam	22	8.15
	J01CA01	Ampicillin	15	5.56
	J01XD01	Metronidazole	12	4.44
	J01GB03	Gentamicin	11	4.07
	J01DH51	Imipenem/Cilastatin	10	3.70
	J01XB01	Colistin	8	2.96
	J01XX08	Linezolid	6	2.22
	J05AB01	Acyclovir	3	1.11
Alimentary system	A03FA03	Domperidone	14	5.19
	A02BA02	Ranitidine	11	4.07
	A04AA01	Ondansetron	8	2.96
	A04AA02	Granisetron	3	1.11
Cardiovascular system	C01CA24	Dobutamine	42	15.56
	C01CA04	Dopamine	26	9.63
	C01CA24	Adrenaline	8	2.96
	G04BE03	Sildenafil	5	1.85
Nervous system	N02BE01	Paracetamol	98	36.29
	N05CD08	Midazolam	52	19.26
	N03AA02	Phenobarbitone	46	17.04
	N03AX14	Levetiracetam	26	9.63
	N06BC01	Caffeine	25	9.26
	N03AB02	Phenytoin	2	0.74
Respiratory system	R03CA24	Adrenaline Nebulizer	56	20.74
	R07AA02	Surfactant	11	4.07
Systemic hormonal Preparations	H02AB09	Hydrocortisone	5	1.85
Others	V06XX	Supplement	48	17.78

In this study, total number of drugs prescribed were 1153. About 95% of neonates encountered with antibiotics. None of the prescriptions contained generic name prescribing, 97% of neonates received parenteral drugs and 85% of drugs were prescribed from Nepalese Essential Drug List. (Table 5)

Table 5: WHO Core Prescribing Indicators

WHO core prescribing indicators	Value
1. Total number of drugs prescribed	1153
2. Average number of drugs prescribed per neonate	4.27
3. Percentage of encounters with antibiotics prescribed	95.19%
4. Percentage of drugs prescribed by generic name	Nil
5. Percentage of neonates receiving injection	97.04%
6. Percentage of drugs prescribed from Nepalese Essential drug list	85.43%

DISCUSSION

This study was done to find out the antibiotic prescribing trend at tertiary health care of Birgunj along with demographic profile and diagnosis which led to neonatal admission at NICU. The demographic profile showed male preponderance which was similar to study done by Neupane et al. at Nepalgunj.[9] Studies have suggested the likely reason behind this might be male having lower cell mediated and humoral immunity compared to females[10] and in our scenario the reason might also be gender preference.[11]

In our study though there was higher hospital delivery but infection remained the leading cause of hospital admission the reason behind this might be prematurity and low birth weight making neonates susceptible to infections. Neonatal sepsis was the most common cause for hospital admission. These findings are similar to study done by Bidari et al., [12] Salama et al.[13], Yadav et al.[14] The mean duration of hospital stay was 8.4±5.2 in our study which was in accordance with Kanimozhi study. The most likely reason behind this might be need of intravenous antibiotics and supportive care. However Paediatrician should be aware that longer duration can lead to hospital acquired infections and financial burden to parents so proper counselling has a vital role.[15]

In our scenario, according to WHO-ATC classification of drugs we found that anti-infective were the most commonly used and it constituted 57.85% of all our prescriptions which is concurrent to study done by Alouzi et al.[8] The higher use of anti-infective agents might be due to infectious cause and need of early management of infections to prevent further complications. Nervous system drugs were the second most commonly used drugs which is similar to study done by Jayaram et al.[16] and the drug most commonly used in our study from this class was Paracetamol which is contradictory to study by Alouzi et al. where Phenobarbital has been commonly prescribed.[8] The likely cause behind increased use of Paracetamol in our study might be to control fever caused by infection.

Antibiotics such as Cefotaxime and Amikacin were commonly used to control infections in term infants whereas higher antibiotics such as Vancomycin, Piperacillin-Tazobactam, were used in serious cases and in preterm infants which has been supported by Subash et al. study conducted in India.[17] However use of Colistin was only in serious and non-responding cases. This has been supported by various Indian studies such as Suryawanshi et al.[18], Thaker et al.[19] and also by Nepalese studies such as Neupane et al.[9] at Nepalgunj and by Singh et al. at NICU of Birgunj.[5]

The combination therapy of Cephalosporin (Cefotaxime) and Aminoglycoside (Amikacin) was seen might be due to increased resistance to penicillin group and in combination this antibiotic has synergistic action.[9] In our scenario 95% of neonates received antibiotics and this higher rate might be attributed to empirical use of broad spectrum antibiotics which is quite common in NICU where urgent treatment is required before infective agent is identified. Furthermore, unavailability of rapid diagnostic tools also leads to misuse of antibiotics which was also seen in our study. Treating paediatricians had to rely mostly on C-reactive protein and there was a substantial delay in blood culture reports. Though such practices is often necessary to prevent adverse outcome in neonates but it also highlights the importance of improved and rapid diagnostic tools and implementation of antimicrobial stewardship programs.[8,20]

The average number of drugs prescribed per prescription was 4.27 which was higher than recommended drug use per prescription by World Health Organization.[20] Different Indian studies such as by Jayaram et al.[16] showed 3.57, Muthamizh Veena R et al.[21] study showed 5.2 ± 2.1. A review study done by Asma-Al Turkait et al. reported that the range for the mean number of drugs per neonate as 11.1 to 1.7, pooled mean (S.D) 4 (2.4), some reports even showed ≥30 drugs per infant.[22] This polypharmacy often leads to adverse drug reactions, increased cost but it is often seen highlighting the importance of rational and evidence based practice.[5]

Drugs in neonates were mostly given by parenteral route (97.04%) which is similar to study done by Muthamizh Veena R et al. where percentage of intravenous route was 89.[21] Oral route is difficult to administer in neonates so parental route is preferred as bioavailability and response predictability of intravenous route is higher than that of other routes. None of the drugs were prescribed by generic name, the preference of generic name over brand name might be prescribers doubting efficacy and safety of generic name as bioequivalence studies are not done mostly in developing countries.[23] About 85% of drugs were prescribed from essential drug list of Nepal which is a good indication.

CONCLUSION

Drug utilization study gives us idea about prevailing prescribing trend, rational use of drug and if any amendment needed it can be done timely. The use of antibiotics in our scenario has highlighted the need of implementing antibiotics stewardship program to prevent antibiotic misuse. This study has also suggested that evidence based medicine should be emphasized,

treatment should be guided by culture sensitivity test. Additionally, knowledge on local resistance pattern should be present to ensure appropriate antibiotic selection.

CONFLICT OF INTEREST: None

REFERENCES

1. Roma KM, Pyakurel M, Gupta V, Kanodia P. Clinical profile and outcome of neonates admitted to neonatal intensive care unit of NGMC. J Nepalgunj Med Coll. 2017;15:1. doi:10.3126/jngmc.v15i1.23533
2. World Health Organization. Newborn mortality [Internet]. 2024 Mar 14. Available from: https://www.who.int/news-room/fact-sheets/detail/newborn-mortality
3. Nepal Demographic and Health Survey 2022 [Internet]. Published 2023 Jun 26. Available from: https://echalliance.com/news/nepal-demographic-and-health-survey-2022-releases/
4. Al-Turkait A, Szatkowski L, Choonara I, Ojha S. Review of drug utilization studies in neonatal units: A global perspective. Int J Environ Res Public Health. 2020;17(16):5669. doi:10.3390/ijerph17165669
5. Singh S, Ahmad MP, Sinha R, Sarraf DP, Singh PK. Prescribing pattern of antibiotics in neonatal sepsis at tertiary teaching hospital of Birgunj, Nepal. Med Phoenix. 2019;4:48-52. doi:10.3126/medphoenix.v4i1.25758
6. Melku L, Wubetu M, Dessie B. Irrational drug use and its associated factors at Debre Markos Referral Hospital's outpatient pharmacy in East Gojjam, Northwest Ethiopia. SAGE Open Med. 2021;9:20503121211025146. doi:10.1177/20503121211025146
7. Rasmussen L, Wettermark B, Steinke D, Pottegård A. Core concepts in pharmacoepidemiology: Measures of drug utilization based on individual-level drug dispensing data. Pharmacoepidemiol Drug Saf. 2022;31(10):1015-26. doi:10.1002/pds.5490
8. Alouzi NA, Hashad NS, Yamane MA. Drug utilization pattern in the NICU: A WHO-ATC classification-based cross-sectional study. Mediterr J Pharm Pharm Sci. 2025;5(3):75-82. doi:10.5281/zenodo.16970145
9. World Health Organization. International Statistical Classification of Diseases and Related Health Problems (ICD-11). 11th rev. Geneva: WHO; 2022.
10. Neupane GP, Rai M, Dhami DB, Singh R. Prescribing pattern of antimicrobial agents in neonates at Nepalgunj Medical College, Kohalpur, Banke, Nepal. J Nepalgunj Med Coll. 2017;15:36-39. doi:10.3126/jngmc.v15i1.23560
11. Muenchhoff M, Goulder P. Sex differences in pediatric infectious diseases. J Infect Dis. 2014;209:120-26. doi:10.1093/infdis/jiu232
12. Bidari U, Kulkarni N, Ukkali SB, Gangawati SP, Thobbi AN. A study of neonatal morbidity and mortality patterns in very low birth weight neonates admitted in NICU at Al-Ameen Medical College and Hospital, Vijayapura. Int J Contemp Pediatr. 2024;11(9):1252-56. doi:10.18203/2349-3291.ijcp20242338
13. Salama K, Gad A, El Tatawy S. Sepsis profile and outcome of preterm neonates admitted to NICU of Cairo University Hospital. Egypt Pediatr Assoc Gaz. 2021;69(1):8. doi:10.1186/s43054-021-00055-1
14. Yadav NS, Sharma S, Chaudhary DK, Panthi P, Pokhrel P, Shrestha A, et al. Bacteriological profile of neonatal sepsis and antibiotic susceptibility pattern at Kanti Children's Hospital, Kathmandu, Nepal. BMC Res Notes. 2018;11:301. doi:10.1186/s13104-018-3394-6
15. Kanimozhi P, Kumaravel KS, Velmurugan K. Length of stay of neonates in NICU in a referral hospital in India. Int J Contemp Pediatr. 2019;6:746-49. doi:10.18203/2349-3291.ijcp20190723
16. Jayaram KB, Usha D, Bhushal P. Drug utilization pattern in NICU at tertiary care hospital in Southern Karnataka, India. Int J Contemp Pediatr. 2019;6:978-82. doi:10.18203/2349-3291.ijcp20190975
17. Subash KR, Shanmugapriyan S. Prescription of antibiotics in NICU at tertiary care center. Int J Med Res Health Sci. 2015;4(2):265-68. doi:10.5958/2319-5886.2015.00049.1
18. Suryawanshi S, Pandit V, Suryawanshi P, Panditrao A. Antibiotic prescribing pattern in NICU. J Clin Diagn Res. 2015;9(11):FC21-24. doi:10.7860/JCDR/2015/14764.6807
19. Thaker VT, Chaudhari VP. Medication use pattern for neonatal sepsis at tertiary care hospital: A prospective study. Int J Pharm Sci Res. 2025;16(12):3472-77. doi:10.13040/IJPSR.0975-8232.16(12).3472-77
20. Rallis D, Giapros V, Serbis A, Kosmeri C, Baltogianni M. Fighting antimicrobial resistance in NICUs: Rational use of antibiotics in neonatal sepsis. Antibiotics (Basel). 2023;12(3):508. doi:10.3390/antibiotics12030508
21. MuthamizhVeena R, Amudhan Arvind E, Peter R. Drug utilization pattern in a special newborn care unit at a tertiary care hospital: A prospective observational study. J Popul Ther Clin Pharmacol.

2025;32(10):1719-27. doi:10.53555/vp6j1t08

22. Al-Turkait A, Szatkowski L, Choonara I, Ojha S. Review of drug utilization studies in neonatal units: A global perspective. Int J Environ Res Public Health. 2020;17(16):5669. doi:10.3390/ijerph17165669
23. Kamejaliya DZ, Kapadia JD, Desai CK, Desai MK. Knowledge, attitude and practice of resident doctors for use of generic medicines at a tertiary care hospital. J Young Pharm. 2017;9(2):23-26.
24. World Health Organization. Using indicators to measure country pharmaceutical situations: Fact book on WHO Level I and II monitoring indicators. Geneva: WHO; 2006. Available from: https://www.rhsupplies.org/uploads/tx_rhscpublications/WHO_Indicators_for_country_pharmaceutical_situations_2006.pdf