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Original article

Mortality Rates and Associated Factors in a Mixed Neonatal and Pediatric Intensive Care Unit Admissions at Zawia Medical Center, Libya

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Abstract
Neonatal and pediatric intensive care patients are among the most vulnerable populations, with high mortality rates, particularly in developing countries. This study was conducted to determine mortality rates and associated factors among ICU admissions at Zawia Medical Center, Libya. A retrospective cohort study was conducted using ICU records from January to December 2024. All pediatric (29 days to 15 years) and neonatal (≤28 days) ICU admissions were included, except those with incomplete records. Data were collected, cleaned, and analyzed using descriptive and inferential statistics (Chi-square, t-tests, ORs). A total of 262 ICU admissions were analyzed (neonates: 139; pediatric: 123). Overall mortality was 13%, significantly higher among neonates (24.4%) than pediatric patients (2.9%). Leading causes of admission included respiratory distress syndrome and neonatal jaundice in neonates, and pneumonia and diabetic ketoacidosis in pediatric patients. Key mortality predictors included the need for ventilatory support (OR 280 for neonates), blood transfusions (platelets OR 12.8, FFP OR 11.9), prematurity (OR 0.42), cesarean delivery (OR 4.25), and inter-hospital referral (OR 16.3 in neonates). ICU mortality was high, particularly among neonates. Respiratory failure, sepsis, and need for transfusions were major contributors. The study highlights the need for improved referral processes, perinatal care, and the establishment of a national registry to standardize and enhance neonatal and pediatric critical care in Libya.
Keywords. NICU, Pediatric ICU, Mortality, Sepsis, Prematurity, Libya, Neonatal Mortality, Risk Factors.

Introduction

Neonatal and Pediatric ICU cases represent two of the most critically ill and vulnerable populations in the healthcare system, even when compared with other extremes of life [1]. Even for otherwise healthy children and neonates, there is an inherent biological risk for infection, injury, and other acute events that would increase their risk of requiring intensive care.

Intensive care in the pediatric and neonatal age groups represents a significant segment of the healthcare expenditure, with pre-term and low birthweight accounting for more than half of that burden [2]. However, neonatal and intensive care efforts have proven cost-effective [3]. Indeed, improving the outcomes and cost-effectiveness of neonatal and pediatric intensive care units can be achieved mainly by increasing efforts in preventing pre-term deliveries, as well as monitoring and improving intensive care quality and practices[2]. Quality improvement initiatives and practices have been shown to reduce NICU mortality rate, improve the short- and long-term outcomes, and reduce the costs associated with admission and healthcare [4].

Even with standardized and agreed-upon standards for intensive care practices, variations between mortality rates in NICUs still exist[5]. Furthermore, neonatal mortality in PICUS and NICUs is high worldwide and even higher in developing countries[6]. There is no centralized national registry for mortality rates among the critically ill neonates and pediatrics; however, such data is reported for individual tertiary centers covering wide areas of Libya [7-11]. Those publications are a valuable source of information on neonatal and pediatric mortality rates in PICUs and NICUs in the absence of a national dedicated registry.

Despite the critical need for comprehensive data, the fragmented nature of reporting presents a significant challenge to understanding the true burden of neonatal and pediatric critical illness and mortality across Libya. This lack of a unified national registry hinders effective resource allocation, policy development, and targeted interventions aimed at improving outcomes for these vulnerable populations. Without a clear national picture, identifying trends, evaluating the impact of healthcare initiatives, and benchmarking against international standards remains exceptionally difficult. Therefore, while individual center reports offer valuable insights into localized challenges and successes, their disparate nature underscores the urgent need for a more cohesive and centralized data collection system to truly address the complexities of neonatal and pediatric critical care in Libya.

Methods

This study used a retrospective cohort approach to examine the data in an intensive care unit in Zawia Medical Center in the city of Zawia, Libya. As a tertiary hospital, the ICU in the pediatric department of Zawia Medical Center admits both pediatric and neonatal admissions and also receives referrals from other obstetric, neonatal, and pediatric hospitals. The data was extracted from the archives of the ICU department of the admissions over 1 year (January-December 2024). The collected data covered the demographic

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characteristics, cause of admission, relevant clinical assessment details, interventions, and the outcome of admission, i.e., survival or mortality. The two authors collected data using a case sheet specifically designed for the aim of this study. This study comprised all the pediatric and neonatal ICU admissions during the specified study period, excluding only the cases with incomplete medical records. The files included had no missing data.

Data was uploaded to a spreadsheet through a Google Form with a private link only accessible by the two authors. The data was then stored as an Excel sheet, cleaned, and coded. Statistical analysis was performed using Jamovi for Windows (version 2.6.24). Descriptive statistics like frequencies and percentages were used for the categorical variables, while means, standard deviations, medians, and interquartile ranges were used for the continuous variables. Simple analytical methods were also used in this study, like Chi-square and t-tests. A p-value < 0.05 was considered a statistically significant result.

Results

A total of 262 pediatric and neonatal admissions were recorded in the ICU at Zawia Medical Center between January and December 2024. Neonates (≤28 days) accounted for 47% (n = 139), while pediatric patients (>28 days to 15 years) constituted 53% (n = 139). Referrals from external facilities represented 45.4% (n =119) of admissions. The more common mode of transfer for neonates was from other clinics and hospitals 77.2% (n = 95), while most pediatric patients presented from home, 82.6% (n = 114), Figure 1.

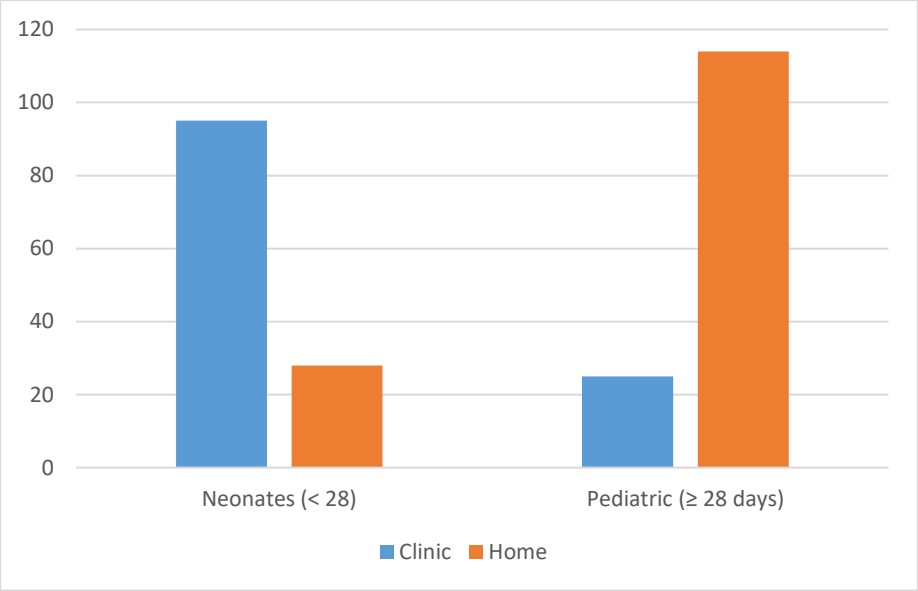

Figure 1 Modes of Transfer for the Two Age Groups

Demographic data are summarized in Table 1. The median age was 2 weeks (IQR: 1-4) for neonates and 24 months (IQR: 1-128 months) for pediatric patients. A male predominance was observed (56.9%, n = 149). Key clinical characteristics at admission included: Primary diagnoses: The most common cause of admission in the pediatric age group was pneumonia (n = 44, 31.7%), followed by (Diabetic Keto-Acidosis) DKA (n = 40, 28.8%), and the third cause was status epilepticus (n = 10, 7.2%). Other causes for admission accounted for 5 admissions or fewer and are listed in Table 1.

Table 1 Causes of Admissions among the Pediatric Cases aged 28 days or more

Cause of Admission	Frequency	Percentage
Pneumonia	44	31.65%
DKA	40	28.78%
Epilepsy	10	7.19%
Drug ingestion	6	4.32%
Bronchial asthma	5	3.60%
Meningitis	5	3.60%
Sepsis	4	2.88%
AGE	3	2.16%
Drowning	3	2.16%
UTI	3	2.16%
CHD	2	1.44%
Malaria	2	1.44%

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Encephalitis	2	1.44%
AFP	2	1.44%
ITP	1	0.72%
Scorpion Sting	1	0.72%
Emphysema	1	0.72%
Neonatal jaundice	1	0.72%
Pleural effusion	1	0.72%
Pneumothorax	1	0.72%
Tetanus neonatorum	1	0.72%

The pediatric cases had a different pattern for the cause of admission. The most common cause of admission in the neonates was RDS 81.6% (n = 62), followed by neonatal jaundice 75.3% (n = 55), Necrotizing Enterocolitis (NEC) was the third most common cause with 63% (n = 34) cases. The other causes of admission are either individually presented or in combination with other causes are shown in Table 2.

Table 2. Causes of Admission for the Neonates (n = 123)

Cause of Admission	Frequency	Percentage
RDS	62	50.4%
Neonatal Jaundice	55	44.7%
NEC	34	27.6%
Sepsis	31	25.2%
AKI	15	12.2%
MSL	6	4.9%
TTN	4	3.3%
ELBW	1	0.8%

Mechanical ventilation was needed for 17.9% neonates (n = 22) and 9.3% pediatric patients (n = 13). Continuous Positive Airway Pressure (CPAP) was used in 6.5% (n = 8) neonates and 2.2% (n = 3) pediatric patients. Both breathing support methods were used in 7.3% (n = 9) neonates and 1.4% (n = 2) pediatric patients. Platelet transfusion was done in 28.5% of the neonates (n = 35) and 5% of the pediatric patients (n = 7). Fresh Frozen Plasma (FFP) was required in 16.3% of the neonates (n = 22) and 0.7% of the pediatric cases only 1 patient. Packed RBCs were transfused to 22.8% of the neonates (n = 28), and 11.5% pediatric cases (n= 16).
ICU admission period was significantly longer for the neonates ($p < 0.01$) with a mean ICU admission period of 6 days (SD 5.4 days), while the pediatric cases had a mean hospitalization period of 4.12 days (SD 6.3 days). Figure 2.

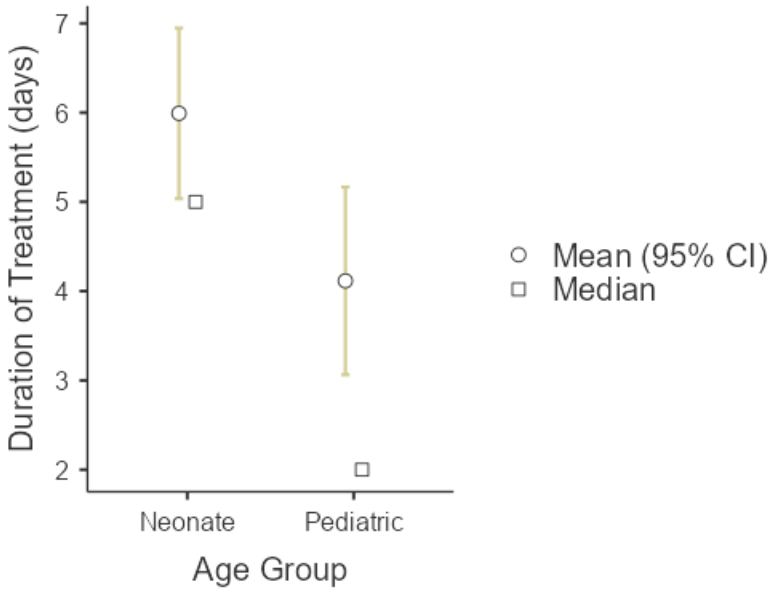

Figure 2 Mean ICU Admission Period for the Neonatal and Pediatric Cases

The Overall mortality was 13% (n = 34). Neonates had a significantly higher mortality rate 24.4% (n = 30), and 2.9% (n = 4) ($p < 0.001$). 18.3% of the patients (n = 48) were discharged against medical advice, 51.5% (n = 135) were discharged after completing the course of treatment and showing signs of recovery and

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improvement. Five patients (1.9%) were transferred to other hospitals for logistical reasons like a closer address or the need for other medical interventions, like pediatric surgeries. Sepsis was the most common cause of death in the neonates, which accounted for 71% of all neonatal mortalities (n =22). In the pediatric patients, pneumonia was the most common cause of death, which accounted for 56.3% of all pediatric mortalities (n= 9)

The most significant predictors of mortality were the need for ventilatory support (i.e., CPAP and/or MV) OR 280 [36.7 – 2144] ($p < 0.0001$) for the neonates. The risk was much lower -though statistically significant- for the pediatric age group with OR 39.3 [9-171.4] ($p < 0.0001$), followed by the need for the transfusion of any blood components (i.e., platelets, FFP, or packed RBCs), Table 3.

Table 3 Most Significant Predictors of Mortality among the study population

Blood Product Needed	Odds Ratio [Lower-Upper]	p-value
Platelets	12.8 [5.94-27.6]	< 0.001
FFP	11.9 [4.54-31.1]	< 0.001
Packed RBCs	9.9 [4.68-20.9]	< 0.001

Mode of delivery was also a significant predictor of mortality among the neonates. With cesarean section being a very significant risk factor for mortality compared with Normal Vaginal Delivery (NVD) ($p = 0.008$) OR 4.25 [1.37 – 13.2]. Prematurity was a significant predictor of mortality, OR 0.42 [0.182-0.972] ($p = 0.04$). Cases referred from another hospital had a significantly higher risk of mortality compared to those that presented from home both in the pediatric and neonatal cases OR 16.3 [4.48 – 55] ($p < 0.001$), again, the risk was much lower, but still statistically significant for the pediatric age group OR = 4.2 [1.16 – 14] ($p < 0.02$).

Discussion

This study included 262 mixed intensive care units for pediatric and neonate patients (139 neonates and 123 children). The overall mortality rate was 13%, and it was significantly higher among the neonates 25.2% compared with pediatric patients 11.5%. Pneumonia was the most common cause of pediatric admissions, while RDS was the most common cause of neonatal admissions (50% vs. 31.65% respectively). Neonates needed a significantly longer ICU stay (6 days vs. 4.12 days, $p < 0.01$). Mortality was significantly associated with the need for ventilatory support and with transfusion of any blood component. Prematurity and Cesarean section were very significant predictors of neonatal mortality.

The overall mortality rate (13%) and age-specific mortality rates (neonates: 25.2%, pediatric: 11.5%). This is much higher than reported in studies in similar settings, for example, the study by Makhlouf et al[12] reported 11.8% neonatal mortality rate. However, the pediatric mortality in this study was much lower than the reported from Tripoli Elghadban et al[11] who reported a pediatric mortality of 22.7%. Mortality rate in a dedicated PICU from Benghazi reported a mortality rate of 7.2%[13].

The study's findings are notably higher than some reported within the MENA region, as exemplified by Mosbah al.'s study, which found a lower neonatal mortality rate of 11.7%. This discrepancy could be attributed to several factors, including variations in healthcare infrastructure, access to specialized neonatal care, and differing patient demographics or severity of illness. The contrasting finding with Elghadban et al.'s study from Tripoli, which reported a higher pediatric mortality of 22.7%, highlights the heterogeneity of healthcare outcomes even within the same country. This suggests that factors such as the specific hospital's resources, quality of care, and patient referral patterns play a crucial role. The much lower mortality rate of 7.2% reported in a dedicated PICU from Benghazi further underscores this point. Dedicated, well-equipped units, even within resource-constrained settings, can achieve outcomes closer to international benchmarks, whereas the current study's higher rates may reflect the challenges faced by general or less-specialized pediatric units.

When viewed through the lens of LMICs, the study's mortality rates are more aligned with the broader challenges these countries face. The high neonatal mortality rate of 25.2% is particularly alarming and likely reflects a combination of factors common in LMICs, such as insufficient staffing, limited access to advanced respiratory support, inadequate infection control measures, and delayed presentation of critically ill neonates[14]. These rates are often driven by preventable or treatable conditions that are not managed effectively due to systemic limitations. The pediatric mortality rate, while lower than the neonatal rate, still points to significant gaps in critical care provision compared to high-income countries. These findings emphasize the urgent need for investment in critical care infrastructure, training for healthcare professionals, and the implementation of evidence-based protocols to improve patient outcomes in these settings.

Globally, these mortality rates are starkly contrasted with those in high-income countries, where advancements in critical care medicine have dramatically reduced neonatal and pediatric mortality. The PICU mortality rates reported in our study compare very closely with the data from dedicated PICUs in

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developed nations, overall mortality rates are typically in the single digits[15], with neonatal mortality rates being significantly lower than the 25.2% reported here. The study's high mortality rates serve as a powerful indicator of the global health equity gap[16]. They highlight the vulnerability of patients in settings with limited resources and underscore the need for international collaborations and support to strengthen healthcare systems in the MENA region and other LMICs[17]. Improving outcomes requires a multi-pronged approach, including knowledge transfer, technological assistance, and strategic partnerships to build sustainable critical care capacity[18].

The predominant causes of admission among pediatric patients were pneumonia. Pneumonia, the leading cause of pediatric admissions (31.65%), is a frequent reason for intensive care admission in children globally[19]. Globally, pneumonia and RDS were the most common causes for admission for the pediatric and neonatal age groups, respectively. Similar results have been published from different settings and resources[20], [21]. For example, a study for the PICU mortality rate from Yemen also found that most common cause of admission was respiratory diseases, particularly pneumonia, which was also the most common cause of death[16].

For the neonates RDS accounted for over 50% of neonatal admissions, is a recognized cause of morbidity and mortality in neonates, particularly preterm infants[22]. The high proportion of admissions due to conditions like DKA and neonatal jaundice also reflects the broad spectrum of critical illnesses managed within this mixed ICU[23]. The ICU stay for neonates (mean 6 days) compared to pediatric patients (mean 4.12 days) in this study agrees perfectly with existing literature, as neonatal critical illnesses, especially those related to prematurity or birth complications, often necessitate more prolonged and intensive care[24].

The need for ventilatory support (CPAP and/or mechanical ventilation) and mortality is a critical finding, with an exceptionally high odds ratio (OR 280 for neonates and OR 39.3 for pediatric patients) indicating that respiratory compromise requiring advanced support is a significant indicator of severe illness and poor prognosis in this population. Similarly, the requirement for any blood component transfusion (FFP, packed RBCs, or platelets) was also a highly significant predictor of mortality (all $p < 0.001$). requiring blood transfusion of any blood component, especially RBCs, was shown to be associated with higher mortality and ICU stay in multiple studies[25]. This highlights the severity of conditions leading to coagulopathy, anemia, or other hematological issues in critically ill children and neonates. Requiring blood transfusion of any blood component, especially RBCs, was shown to be associated with higher mortality and ICU stay in multiple studies [25,26]. Although transfusion of blood products is a known independent risk-factor for morbidity and mortality, the likelihood of needing transfusion of any blood product is associated with other factors, like sepsis[27], which was relatively common in this study's cohort.

Specific risk factors for neonatal mortality provide further insight. The finding that Caesarean section was a significant risk factor for neonatal mortality (OR 4.25) is noteworthy. While C-sections can be life-saving, complications associated with them or underlying conditions necessitating them might contribute to higher neonatal risk. Further investigation into the specific indications for C-section in these cases could provide more clarity. Prematurity was also identified as a significant predictor of neonatal mortality (OR 0.42, $p = 0.04$). This finding is well-established in the literature, as preterm infants have underdeveloped organs and are highly susceptible to complications[28].

Moreover, the significantly higher risk of mortality for patients referred from other hospitals, for both neonates and pediatric cases, is concerning (OR 11.86 for neonates, OR 4.2 for pediatric). Transferring critically ill patients from secondary and primary care centers to tertiary care centers have been shown that higher mortality rates were associated with transferred cases. This was linked to a delay in transfer, deterioration during transport, and the fact that only the most critically ill strata of the cases are referred to tertiary centers[29]. The literature indicates critical vulnerabilities in the transfer process, not only during patient transport, but also in the process of preparing the patient for transport [30], such factors included inadequate pre-transfer preparations, and even the lack of transfer notes, in addition to the absence of professional healthcare workers during transport[30]. Critically ill patients are vulnerable, and therefore their transfer must be done after careful planning and consideration [31,32], and following a standard sequence of steps starting with communicating with the target tertiary hospital [33]. This would minimize the morbidity and mortality associated with transfer delays and confusion that follows the arrival of an unexpected case.

Conclusion

The results of this study have several important implications for improving outcomes in the Zawia Medical Center ICU and potentially for critical care in Libya. Identifying ventilatory support and blood transfusions as major predictors of mortality highlights the need for continuous quality improvement initiatives focused on respiratory management and judicious blood product utilization. Given that sepsis was the most common cause of neonatal mortality (71%) and pneumonia for pediatric mortality (56.3%), targeted interventions for early diagnosis, aggressive management, and prevention of these infections are paramount. The increased mortality in referred cases suggests a need to assess pre-referral stabilization, transport protocols, and communication between referring facilities and Zawia Medical Center. On a broader scale, this study

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underscores the urgent need for a unified national registry for neonatal and pediatric critical illness and mortality in Libya. Such a registry would enable a clearer national picture of disease burden, facilitate trend identification, allow for evaluation of healthcare initiatives, and permit benchmarking against international standards, ultimately aiding in effective resource allocation and targeted interventions for these vulnerable populations.

Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Heneghan JA, Pollack MM. Morbidity. Pediatr Clin North Am. 2017 Oct;64(5):1147-65. doi: 10.1016/j.pcl.2017.06.011. PMID: 28941534.
2. Cheah IGS. Economic assessment of neonatal intensive care. Transl Pediatr. 2019 Jul;8(3):246-56. doi: 10.21037/tp.2019.07.03. PMID: 31516310; PMCID: PMC6716630.
3. Cutler D, Meara E. The Technology of Birth: Is it Worth it? Cambridge, MA: National Bureau of Economic Research; 1999 Oct. doi: 10.3386/w7390.
4. Ellsbury DL, Clark RH. Does quality improvement work in neonatology improve clinical outcomes? Curr Opin Pediatr. 2017 Apr;29(2):129-34. doi: 10.1097/MOP.0000000000000457. PMID: 28107219.
5. Rysavy MA, Li L, Bell EF, Das A, Hintz SR, Stoll BJ, et al. Between-Hospital Variation in Treatment and Outcomes in Extremely Preterm Infants. N Engl J Med. 2015 May 7;372(19):1801-11. doi: 10.1056/NEJMoa1410689. PMID: 25946279; PMCID: PMC4465092.
6. Chow S, Chow R, Popovic M, Lam M, Popovic M, Merrick J, et al. A Selected Review of the Mortality Rates of Neonatal Intensive Care Units. Front Public Health. 2015 Oct 27;3:225. doi: 10.3389/fpubh.2015.00225. PMID: 26579509; PMCID: PMC4623455.
7. Abushhaiwia AME, Ziyani MMN, Dekna M. Mortality in the special care baby unit of the main children's hospital in Tripoli, Libyan Arab Jamahiriya. East Mediterr Health J. 2010 Nov;16(11):1137-42. doi: 10.26719/2010.16.11.1137. PMID: 21218721.
8. Alburke S, Ashur B, Assadi M. Neonatal and Perinatal Mortality Rates in Neonatal Intensive Care Unit of Misurata Teaching Hospital - Libya/2013. J Hematol Thromboembolic Dis. 2015;3(2):194. doi: 10.4172/2329-8790.1000194.
9. Altarhouni EFA, Mohamed Z, Alhouni N. Common Causes and Risk Factors for Neonatal Death in NICU in Tobruk Medical Center between July 2018 and July 2019, Libya. Libyan Int Med Univ J. 2023 Jul;8:31-8. doi: 10.1055/s-0043-1770994.
10. Alharam Z, Elsaeti I, Alferjani M. Neonatal Mortality in the Neonatal Intensive Care Unit at Benghazi Pediatric Hospital– Libya. AL-MUKHTAR J Sci. 2020 Dec;35(4):284-93. doi: 10.54172/mjsc.v35i4.331.
11. Elghadban F, Abdulhakim S. Sepsis Epidemiology and Outcomes in Pediatric Intensive Care Unit of Alkhadra Hospital, Tripoli, Libya. AlQalam J Med Appl Sci. 2024 Dec;:1464-72. doi: 10.54361/ajmas.247477.
12. Makhlouf M, Hassan IK, Lamen H. Mortality Rate in the Neonatal Intensive Care Unit at IBN SINA Teaching Hospital Sirte-Libya. Sirte J Med Sci. 2024 Jun 30;3(1). doi: 10.37375/sjms.v3i1.2876.
13. Shaki AA, Alferjani MM, Elgazal NB, ELFeituri MA. The Mortality Rate in Paediatric ICU at Benghazi children hospital. [No citation details available].
14. Olatunji G, Ademola AD, Adebayo O, Adebiyi O, Adeniyi O, Adesina A, et al. Challenges and Strategies in Pediatric Critical Care: Insights From Low-Resource Settings. Glob Pediatr Health. 2024 Jan 10;11:2333794X241285964. doi: 10.1177/2333794X241285964. PMID: 38223771; PMCID: PMC10786495.
15. Abdelatif RG, Mohammed MM, Mahmoud RA, Bakheet MAM, Gima M, Nakagawa S. Characterization and Outcome of Two Pediatric Intensive Care Units with Different Resources. Crit Care Res Pract. 2020 Mar 16;2020:5171790. doi: 10.1155/2020/5171790. PMID: 32257444; PMCID: PMC7105433.
16. Mosbah HA, Alshalwi M, Abdalraziq WS, Alferjani MM, Almadany M. Mortality of Critical Congenital Heart Disease in the Neonatal Intensive Care Unit at Benghazi Pediatric Hospital. Sch J Appl Med Sci. 2024 Dec;12(12):1699-703. doi: 10.36347/sjams.2024.v12i12.003.
17. Diaz JV, Riviello ED, Papali A, Adhikari NKJ, Ferreira JC. Global Critical Care: Moving Forward in Resource-Limited Settings. Ann Glob Health. 2019 Jan 22;85(1):3. doi: 10.5334/aogh.2413. PMID: 30741504; PMCID: PMC7055209.
18. Naal H, El Koussa M, El Hamouch M, Hneiny L, Saleh S. A systematic review of global health capacity building initiatives in low-to middle-income countries in the Middle East and North Africa region. Global Health. 2020 Jul 6;16(1):56. doi: 10.1186/s12992-020-00585-0. PMID: 32631358; PMCID: PMC7336490.
19. Chen D, Cao L, Li W. Etiological and clinical characteristics of severe pneumonia in pediatric intensive care unit (PICU). BMC Pediatr. 2023 Jul 18;23(1):362. doi: 10.1186/s12887-023-04175-y. PMID: 37464329; PMCID: PMC10353700.
20. Summers C, Singh NR, Worpole L, Simmonds R, Breen R, Pendry K, et al. Incidence and recognition of acute respiratory distress syndrome in a UK intensive care unit. Thorax. 2016 Nov;71(11):1050-1. doi: 10.1136/thoraxjnl-2016-208402. PMID: 27540027; PMCID: PMC5108681.
21. Al-Momani MM. Admission patterns and risk factors linked with neonatal mortality: A hospital-based retrospective study. Pak J Med Sci. 2020 Aug;36(6):1177-82. doi: 10.12669/pjms.36.6.2281. PMID: 32704256; PMCID: PMC7373430.
22. Kamath BD, MacGuire ER, McClure EM, Goldenberg RL, Jobe AH. Neonatal mortality from respiratory distress syndrome: lessons for low-resource countries. Pediatrics. 2011 Jun;127(6):1139-46. doi: 10.1542/peds.2010-3212. PMID: 21624879; PMCID: PMC3387897.

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23. Khan AA, Ata F, Iqbal P, Bashir M, Kartha A. Clinical and biochemical predictors of intensive care unit admission among patients with diabetic ketoacidosis. World J Diabetes. 2023 Mar 15;14(3):271-8. doi: 10.4239/wjd.v14.i3.271. PMID: 37035224; PMCID: PMC10075207.
24. Mahdally S, Krawiec C. Neonatal Intensive Care Unit to Pediatric Intensive Care Unit Transfers: A Critical Juncture in the Trajectory of Neonatal Critical Illness. J Pediatr Clin Pract. 2025 Jul;17:200162. doi: 10.1016/j.jpedcp.2025.200162.
25. Kneyber MCJ, Hersi MI, Twisk JWR, Markhorst DG, Plötz FB. Red blood cell transfusion in critically ill children is independently associated with increased mortality. Intensive Care Med. 2007 Aug;33(8):1414-22. doi: 10.1007/s00134-007-0741-9. PMID: 17541505.
26. Rajasekaran S, Kort E, Hackbarth R, Davis AT, Sanfilippo D, Fitzgerald R, et al. Red cell transfusions as an independent risk for mortality in critically ill children. J Intensive Care. 2016 Dec 1;4:2. doi: 10.1186/s40560-015-0122-3. PMID: 26719793; PMCID: PMC4696259.
27. Tiwari SK, Rajesh J, Mathew NM, Dhochak N, Lodha R, Joshi P. Frequency and predictors of red blood cell transfusion in the pediatric intensive care unit: a prospective observational study. J Trop Pediatr. 2025 Feb 25;71(2):fmaf004. doi: 10.1093/tropej/fmaf004. PMID: 38412202.
28. Milani F, Sharami SH, Attari SM, Sorouri ZR, Farzadi S, Kazemi S. Factors Associated with Cesarean Section in Preterm Births at a Tertiary Hospital in Rasht, Iran. J Kermanshah Univ Med Sci. 2024; [cited 2025 Aug 04]; [about p.]. Available from: https://brieflands.com/articles/jkums-144362#abstract
29. Singh J, Dalal P, Gathwala G, Rohilla R. Transport characteristics and predictors of mortality among neonates referred to a tertiary care centre in North India: a prospective observational study. BMJ Open. 2021 Jul 30;11(7):e044625. doi: 10.1136/bmjopen-2020-044625. PMID: 34330855; PMCID: PMC8329189.
30. Aggarwal K, Gupta R, Sharma S, Sehgal R, Roy M. Mortality in newborns referred to tertiary hospital: An introspection. J Fam Med Prim Care. 2015 Jul-Sep;4(3):435-40. doi: 10.4103/2249-4863.161348. PMID: 26288789; PMCID: PMC4535119.
31. Kiss T, Bölke A, Spieth PM. Interhospital transfer of critically ill patients. Minerva Anestesiol. 2017 Oct;83(10):1101-8. doi: 10.23736/S0375-9393.17.11857-2. PMID: 28447833.
32. Dunn MJG, Gwinnutt CL, Gray AJ. Critical care in the emergency department: patient transfer. Emerg Med J. 2007 Jan;24(1):40-4. doi: 10.1136/emj.2006.042044. PMID: 17183044; PMCID: PMC2658151.
33. Tan T. Interhospital and intrahospital transfer of the critically ill patient. Singapore Med J. 1997; [cited 2025 Aug 04]; Available from: https://www.semanticscholar.org/paper/Interhospital-and-intrahospital-transfer-of-the-ill-Tan/3b86c4e7d231bd6993de955efd8f4de009cfe20a

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