

Clinical Outcomes of Critically Ill Patients in a Level II Closed Intensive Care Unit: A Retrospective Observational Study from a Provincial Hospital in Nepal

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ABSTRACT

Background and aims: Critical care services in provincial, resource-constrained contexts often lack strict performance measures, which impedes quality improvement initiatives. Existing research focuses mostly on tertiary care facilities, leaving a significant gap in understanding outcomes at the local level. The intensive care unit (ICU) at Bhadrapur Provincial Hospital, located in Nepal's eastern area bordering India, is a Level II closed unit managed by a consultant anaesthesiologist. This study evaluates the demographics, clinical characteristics, resource utilization, and important outcomes across two consecutive years.

Methods: For this retrospective observational study, data were extracted from ICU admission-discharge registers and electronic medical records. Descriptive statistics were utilized to summarize patient profiles and outcomes, with a comparative analysis conducted for the two years, April 2023 - April 2025.

Results: In a total of 528 admissions, the mean age was 50.4±19.7 years, with a male predominance of 57.2%. Medical cases dominated the admissions, and the median length of ICU stay was 3 days [IQR 1-4]; toxicological cases comprised 21.2% of the total admissions. Crude ICU mortality rate increased significantly from 17.3% in the first year to 24.8% in the succeeding year ($p = 0.042$). The unit operated at a bed occupancy rate of 82.9%.

Conclusion: The Level II provincial ICU is predominantly responsible for the management of acute medical and toxicological admissions. The average mortality rate of 20.7% is consistent with that of national tertiary centers. Strengthened referral networks, expanded life support capabilities, and standardised protocols are essential for improving outcomes.

Key words: Anesthesiologist, closed ICU, ICU physicians, low- and middle-income country (LMIC), provincial ICU.

INTRODUCTION

Intensive care units (ICU) occupy a pivotal position in modern healthcare systems, providing advanced monitoring and life-saving interventions for the critically ill.¹ In low- and middle-income countries (LMICs), the expansion and optimization of critical care services face considerable hurdles due to pervasive challenges, including limited financial resources, deficient infrastructure, and critical shortages of specialized personnel.²

Regulatory standards set forth by the Ministry of Health and Population mandate that at least 5% of all hospital beds should be designated as ICU beds, with appropriate mechanical ventilation ratios and a 1:1 nurse-to-patient ratio.² However, adherence to these standards remains a systemic challenge across most hospitals due to the aforementioned resource limitations.

International data highlights a stark disparity in outcomes depending on the country's economic status. Crude ICU mortality rates are markedly higher in resource-constrained LMIC settings (for example, 32.9% in Nigeria and 50.4% in Ethiopia) compared to high-income counterparts (for example, 9.3% in North America).³ In the context of Nepal, national data indicate that average ICU mortality rates range from 15.2% to 39.3%.⁴ This difference emphasizes that research findings observed in High-Income Countries (HICs) cannot be reliably applied to LMICs. This underscores the necessity for context-specific research to define the critically ill population and interpret performance metrics accurately.

Auditing ICU performance is recognized globally as an indispensable quality improvement mechanism. Existing literature examining critical care performance in Nepal primarily focuses on tertiary-level teaching institutions. This narrow focus leaves a critical void in understanding the operational realities, clinical profiles, and outcomes of ICUs operating in provincial hospitals, particularly those supervised by dedicated anesthesiologists. Establishing localized benchmarks is essential for guiding evidence-based policy implementation and resource allocation outside of major metropolitan centers.⁵

The ICU at Bhadrapur Provincial Hospital in Jhapa, a 200-bedded facility, presents a unique model within the provincial governmental network. It operates as a Level II closed unit under the direct supervision of consultant anesthesiologists, doctor in medicine (MD) in anesthesiology and critical care, facilitating adherence to standard protocols. Throughout the two years, the 3-bedded unit managed a varied case load comprising mostly medical and surgical emergencies, supported by a team of rotating medical officers and maintaining a nurse-to-patient ratio of 1:1 to 1:3.

The primary aim of this study was to evaluate patients admitted to a Level II closed ICU over two years by analyzing their demographic characteristics, clinical profiles, and

outcomes such as mortality, discharge rates, and length of stay. Secondary aims were to compare admission and outcome trends across consecutive years, examine determinants of duration of ICU stay, and identify gaps in care processes to inform strategies for quality improvement and optimization of ICU management protocols.

METHODS

This study was conducted as a retrospective observational study in the ICU of Bhadrapur Provincial Hospital, Jhapa, Nepal. It reviewed patient data spanning two consecutive years, from April 2023 to April 2025 (Baishakh 2080 to Chaitra 2081 B.S.). Ethical approval for the study was obtained from the Nepal Health Research Council (NHRC) Ethical Review Board, protocol registration number 263_2025.

The study population comprised all patients admitted to the ICU during the specified timeframe. Demographic information, including age, gender, and address, describes patient populations. Clinical data encompass the primary diagnosis, classified into medical and surgical categories. Management indicators included the duration of ICU admission and the necessity for intensive measures, such as mechanical ventilation and haemodialysis. Outcomes were categorised by patient disposition, including discharge to home, transfer to a ward, referral to a tertiary center, or left against medical advice (LAMA).

Data were systematically collected from the ICU admission-discharge register and electronic medical records. A standardized data extraction sheet was used to maintain consistency and reliability across entries. Data was securely kept in a password-protected computer and shared among three investigators for data safety and privacy.

Data Processing and Statistical Analysis

Admission-discharge register was the primary data source and data from April 2023 to April 2025 were aggregated, and a cross-verification of 10% entry was done by an author not involved in the first data entry. Repeated admissions were included as new entries, and incomplete data on patient outcomes were excluded from the study (Figure 1). Descriptive statistics were utilized to summarize the characteristics of the patient population and outcomes. Continuous variables, such as age and length of stay (LOS), are presented using the mean or median with standard deviation (SD) or inter quartile range (IQR) after test of normality. Categorical data, including gender, admission type, and outcomes, are presented as frequencies and corresponding percentages. Comparative analyses were performed to identify any significant changes between the two calendar years using independent t-test, Chi-square test, and Mann-Whitney U test after normality testing. A p value of less than 0.05 was considered to be statistically significant. Statistical analysis was performed using SPSS software (version 24.0).

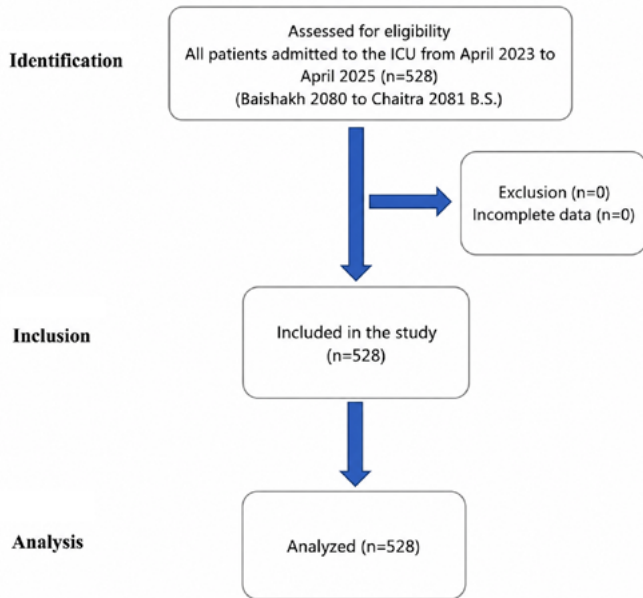


Figure 1. STROBE flow diagram.

RESULTS

The audit analyzed a total of 528 admissions across the two years, covering April 2023–April 2024 (n=283) and April 2024–April 2025 (n=245).

I. Demographics and Case Volume

The mean age of admitted patients decreased slightly from 51.9 ± 19.5 years in the first year to 48.6 ± 19.8 years in the subsequent year ($p = 0.045$). Patients were predominantly males, accounting for 56.5% of admissions in April 2023–April 2024 and increasing to 58.0% in April 2024–April 2025. The vast majority of patients were from Jhapa district (90.1% in the first year, and 91.4% in the subsequent year), highlighting the unit’s role in serving its immediate catchment area.

Table 2. Clinical conditions and outcome

Clinical Condition	Caseload [n (%)]	Transfer to Ward [n (%)]	Mortality [n (%)]	Others* [n (%)]
Sepsis & septic shock	124 (23.5)	80 (64.5)	22 (17.7)	22 (17.7)
Toxicological / self-harm	112 (21.2)	97 (86.6)	10 (8.9)	5 (4.5)
Alcohol-related liver disease	80 (15.1)	46 (57.5)	13 (16.2)	21 (26.3)
COPD exacerbation	56 (10.6)	36 (64.4)	10 (17.8)	10 (17.8)
Cerebrovascular accidents (CVA)	44 (8.3)	22 (50.0)	9 (20.4)	13 (29.6)

* Others include referral, LAMA and DOPR. LAMA: Left against medical advice. DOR: Discharged on request.

II. Admission Profile and Case Mix

The distribution of ICU admission categories, medical, surgical, neurosurgical, and obstetric, did not differ significantly between the two audit years ($p = 0.197$). The proportion of medical cases was high in both years (91.5% vs. 95.1%), while surgical cases declined from 4.6% to 0.8% ($p = 0.008$) (Table 1).

Table 1. ICU admissions by medical specialty

Medical specialty	April 2023–April 2024 (n=283)	April 2024–April 2025 (n=245)
Medical	259 (91.5%)	233 (95.1%)
Surgical	13 (4.6%)	2 (0.8%)
Neurosurgical	9 (3.2%)	10 (4.1%)
Obstetric	2 (0.7%)	0 (0.0%)

The emergency department remained the predominant source of ICU admissions, accounting for 77.9% in the first year and 75.5% in the second year. Admissions from the medical ward increased from 15.7% to 21.6%, while other wards declined from 6.7% to 2.9%. This shift in source distribution was not statistically significant ($p = 0.118$). Almost 80% of total admissions occurred outside of morning shifts (7 am–2 pm) with 44.6% of admissions during the evening shift (2–8 pm) and 35.0% during the night hours (8 pm–7 am).

III. Clinical Epidemiology and Acuity

A detailed review of primary admission diagnoses confirms that the ICU’s patient volume is driven by acute presentations across three specific critical care categories (Table 2).

Toxicological and self-harm cases: Poisoning was a persistent, high-volume emergency. Out of total admissions, 112 cases (21.2%) were attributed to poisoning across the two years. These included common exposures like organophosphate (OP) and carbamates (57.1%), zinc phosphide (6.25%), paraquat (2.7%), others (18.75%), and unknown (15.2%). While 86.6% were successfully managed and transferred out, the most severe exposures led to long stays and/or demise in 8.9%. The average LOS among survivors was 3.75 days.

Chronic non-communicable disease (NCD) exacerbations: Out of the total, 15.15% patients (n=80) presented with alcohol related liver disease, 24% of these patients presented with complications such as hepatic encephalopathy (HE), and upper gastrointestinal (UGI) bleeds. Regarding outcomes, 57.5% of these patients were transferred out to wards, 16.2% died, 17% left against the medical advice, 5% requested discharge, and 5% were referred to higher centers, mostly for variceal banding. Similarly, 56 patients (10.6%) were admitted with acute exacerbations of chronic obstructive pulmonary disease (COPD), with severe community-acquired pneumonia (CAP) being common in the elderly (mean age 69.3years), often complicated by respiratory failure and coexisting diseases. Regarding outcome, 64.3% of these patients were transferred to the ward, 17.8% died, 7.1% were referred for further management, while 9% had LAMA, and the remaining 1.2% were discharged from the ICU. Likewise, cerebrovascular accidents (CVA), both hemorrhagic (36.4%) and ischemic (63.6%), account for 55% of neurologic cases (n=80) in 2 years. The mean age of patients landing with CVA was 64.1years, of which 50% of patients were transferred to the ward after an average LOS of 3.4 days, and 20.4% died. Underlying risk factors like hypertension, dyslipidemia, and diabetes were present in 87% of these patients.

Sepsis and septic shock: A total of 124 patients (23.5%) presented with multi-organ dysfunction syndrome (MODS) secondary to sepsis, requiring one or more vasopressor

support. Of these, 64% were transferred out to the wards, while 18% died within 72 hours of admission. One third of these patients were transferred from wards after worsening of the clinical condition. Similarly, septic shock with MODS led to LAMA in 10 % patients and referred to higher centers in 8% of the cases.

IV. Resource Utilization and Length of Stay

Distribution of LOS was right-skewed in both audit years, reflecting a small number of patients with prolonged ICU admissions. Median LOS was 3.0 days (IQR 1-4). For the audited period, the bed occupancy rate (BOR) was 82.9% [calculated as (total inpatient days / (total available beds × number of days)) × 100]. Consequently, the turnover interval (TOI) [calculated as (available bed days–occupied bed days)/ number of discharges (including deaths)] was 0.71 days (approximately 17 hours).

Over the course of two years, 33 (6.25%) individuals were found to require MV, and 37 patients (7%) received haemodialysis (HD). Low use of sophisticated, resource-intensive therapies reflects capacity limitations, and this is consistent with available resources in a level II facility. Patients who needed MV and/or HD had a mortality rate of 26%, and 11.45% of them were referred to a higher center for additional care.

Comparison of outcomes between two consecutive years:

The crude ICU mortality rate, increased from 17.3% in the first year to 24.8% in the succeeding year (p = 0.042) (Table 3). The distribution of other ICU outcomes (transfer to ward, discharge, LAMA, referral, DOR) did not differ significantly between the two years (p = 0.16). The combined rate of referral, DOR, and LAMA accounted for nearly one-fifth of all admissions in both years (18.4% in the first year vs. 19.5% in the succeeding year).

Table 3. Distribution of patient outcomes by year of admission

Outcome Category	April 2023–April 2024 (n=283)	April 2024–April 2025 (n=245)	Total (n=528)	p-value [#]
Transfer to Ward	182 (64.3%)	141 (57.6%)	323 (61.2%)	0.13
Discharge	9 (3.2%)	7 (2.9%)	16 (3.0%)	0.99*
Mortality (among known outcome)	40 (17.3%)	49 (24.8%)	89 (20.7%)	0.04
LAMA	32 (11.3%)	29 (11.8%)	61 (11.6%)	0.89
Referral	17 (6.0%)	14 (5.7%)	31 (5.9%)	0.89*
DOR	3 (1.1%)	5 (2.0%)	8 (1.5%)	0.48

#Calculated using chi-square test; *calculated using Fisher's exact test; LAMA: Left Against Medical Advice, DOR: Discharge On Request

DISCUSSION

This two-year ICU audit highlights both stability and variation in patient characteristics and outcomes. The case mix predominantly consisted of medical admissions, exceeding 90% in both years, whereas neurosurgical and obstetric patients contributed negligibly. Patient demographics showed a modest but statistically significant decrease in mean age, yet paradoxically, ICU mortality increased from 17.3% to 24.8% ($p = 0.042$). This divergence indicates that younger patients admitted in the second year may have had greater illness severity or delayed presentation. The average death rate (20.7%) remained comparable to that reported by tertiary facilities in Nepal^{4,6,7} and international LMIC benchmarks (32.9% to 50.4%).^{7,8}

Auditing ICU performance is universally acknowledged as a crucial tool for ongoing quality enhancement, designed to systematically evaluate care against defined criteria, discover problems, and implement modifications for improved patient outcomes.⁶ The ICUs in LMICs have a burden of cases coupled with severe resource constraints, leading to challenges in both conducting audits and implementing resulting recommendations.^{2,9}

In this audit, the combined rate of referral, LAMA, and DOR increased from 18.4% to 19.5% between the two years. Among these, only one-third were referred to higher centers, and the remaining were forced to discontinue the care largely due to financial burden. These figures, combined with ICU mortality, indicate that the proportion of critically ill patients who do not achieve a positive outcome is substantial and rising, closely mirroring the higher crude mortality rates published for tertiary centers in Nepal and other LMICs. Comparatively, most ICUs in high-income countries report mortality rates significantly lower, a goal achievable only through addressing fundamental resource deficits.⁴

Although the overall distribution of admission categories did not differ significantly, the decline in general surgical admissions (13 to 2 cases, $p < 0.01$) suggests a change in referral or operative practices. The sharp demarcation between medical and surgical case mix indicates that the unit is functioning predominantly for medical stabilization. These findings are in contrast to reports from tertiary centers in urban areas, where the most frequent cases are either trauma or neurosurgical.^{6,10} The noticeable increase in admissions from the general medical ward (rising from 15.7% to 21.6%) in the latter year suggests increasing reliance on the ICU as a rapid step-up unit for medical ward patients experiencing deterioration. The severity of these late-transfer patients places a considerable burden on the limited capacity for advanced life support.

The shift in patient inflow between the two years reveals operational dynamics that influence patient outcomes and resource allocation. Emergency department admissions decreased marginally from 77.9% in the first year to 75.5%

in the latter year. An analysis of admission timing highlights that the majority of the ICU admissions occur outside of conventional working hours. Critically ill patients, particularly those presenting with acute, time-sensitive pathology or rapid multi-organ failure, are frequently admitted and succumb to their illness during the evening and night shifts. Cases resulting in immediate demise (LOS of 1 day) often arrived late at night. The admission of the hemodynamically unstable cases during off-hours places significant strain on the unit's limited human and infrastructural resources. While the unit maintains a nurse-to-patient ratio of 1:1–3, specialized senior physician presence is inherently less available during these periods, posing a potential barrier to immediate, resource-intensive interventions required to reverse severe, rapidly deteriorating conditions. This pattern is similar to the tertiary referral ICU, where more than two-thirds (72.3%) of total admissions occur during off-hours, with a slightly higher median APACHE II score.¹¹

Analysis of key operational metrics highlights the structural efficiency and limitations governing the ICU's function during the audited period. Based on the constrained 3-bed capacity and the 528 total admissions recorded over the two years (approximately 730 days), the unit operated with a good utilization rate. The combined mean LOS remained short at approximately 3.44 days, which is shorter than the national data from different tertiary hospitals, where LOS ranges from 3.5 to 5.9 days.^{4,6,10} The calculated operational indices demonstrate work pressure: the average BOR of 82.9% confirms sustained, near-full capacity utilization similar to a busy tertiary trauma ICU.¹⁰ Consequently, the average time a bed is vacant between patients was short at 0.71 days (approximately 17 hours). This BOR and TOI indicate that the unit was functioning at its optimum level, where any additional rise in patient volume or length of stay requires refusal of admission.

A notable aspect of our ICU's workload is the prevalence of acute poisoning and purposeful self-harm (21.2%), which significantly contributes to critical care admissions, underscoring the necessity for mental health intervention in the catchment area. The cases included highly toxic agents prevalent in agricultural settings, such as OP and carbamate compounds, alongside lethal agents like paraquat and zinc phosphide. While the unit demonstrates operational success in stabilizing many routine poisoning cases, facilitating transfer out to the general ward typically within 3–7 days, severe toxicology presentations correlate directly with poor outcomes. Cases involving paraquat poisoning, for instance, were associated with prolonged stays (up to 16 days) and subsequent demise, often requiring intensive support including mechanical ventilation. Similarly, OP poisoning requiring post-CPR management or progressing to intermediate syndrome necessitated long ICU stays (up to 24 days) and utilization of scarce ventilatory resources, frequently resulting in non-survival outcomes. This proportion of self-harm seems higher compared to data from

other centers.^{4,10} This endemic burden places continuous, high-acuity pressure on the limited resources of the Level II facility and highlights the urgent regional need for public health strategies focused on poisoning prevention.

The two-year audit establishes several critical performance baselines for provincial-level intensive care in resource-limited settings, thereby fulfilling the evidence gap. The ICU at Bhadrapur Provincial Hospital has a bed turnover rate of 88 admissions per bed per year, reflecting good operational efficiency despite limited staff, equipment, and funding. The crude ICU mortality rate of 20.7% reflects a realistic baseline for a Level II closed ICU in a provincial setting. These indicators serve as measurable quality benchmarks for future audits, capacity-building initiatives, and inter-institutional comparisons within Nepal's evolving critical care network.

This study has several limitations. As a retrospective audit, our analysis was restricted to existing medical records, which may lack specific details. Most importantly, we did not use a standard severity scoring systems. This prevents us from interpreting whether the rise in mortality in the second year was due to sicker patients, making it difficult to compare our outcomes. Furthermore, as a single-center study, our findings reflect our hospital's specific challenges and may not be generalizable to all provincial ICUs in Nepal. Finally, outcomes like LAMA or referrals are heavily influenced by financial and social factors that this study could not measure. These limitations highlight the need for future prospective audits using severity scoring to better understand and improve our care

The audit identifies key opportunities to enhance performance, particularly in light of the recent expansion to a five-bed unit, which aims to improve patient outcomes and sustain quality care. To address the observed increase in non-survival rates, the proposed strategies include routine application of severity scoring systems such as APACHE II or SOFA for risk stratification and performance monitoring. Additionally, enhancing resource capacity through full deployment of mechanical ventilation and hemodialysis, alongside specialized training for respiratory and dialysis nurses, to reduce external referrals. Finally, maintaining clinical performance requires prioritizing staff welfare, delivering structured CME focused on high-burden emergencies, and standardizing protocols to ensure consistency and equity in care delivery.

CONCLUSION

The two-year audit of the Level II closed ICU at Bhadrapur Provincial Hospital provides vital quantitative benchmarks for critical care in a resource-constrained provincial setting in Nepal. We observed a trend of increasing crude mortality in the second year. Priority actions are implementing objective severity scoring and risk adjustment, strengthening clinical support and referral networks, and conducting prospective audits.

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DISCLOSURE

Artificial intelligence tools were utilized for language refinement, grammar correction, and conciseness optimization during the revision phase of the manuscript. All authors take full responsibility for the scientific content, integrity, and final submission.

CONFLICT OF INTEREST

The authors declare no conflicts of interest related to the research, authorship, or publication of this article.

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