Addis Ababa University

College of Health Sciences

Department of Emergency and Critical Care Medicine

Assessing sedation practice in critically ill patients among ICU in TASH, a Prospective observational study

Principal Investigator: Dr. Yafet Solomon

Advisor: Dr. Finot Debebe (MD, Associate Professor of Emergency and Critical Care Medicine and Adult Intensive Care Subspecialist)

A thesis submitted to Addis Ababa University, College of Health Sciences, School of medicine, Department of Emergency and Critical Care Medicine in preparation for partial fulfillment of the requirement for a Specialty certificate in Emergency and Critical Care Medicine

Dec, 2025

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Declaration

I, Yafet Solomon, declare that this thesis is my original work and has not been submitted elsewhere. I also declare that a complete list of references is provided indicating all the sources of information quoted or cited.

Signature _____ Date_____

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I would like to thank my advisor Dr. Finot Debebe and Dr. Birhanu Tesfaye for their constructive advice and committed guidance through the research proposal process. I would also like to thank the department of Emergency and Critical Care Medicine at AAU college of health Sciences for allowing me to do this research proposal I would like to thank the department of emergency medicine and critical care at Addis Ababa university for giving me this educational opportunity to conduct this study

Acronyms

APACHE II – Acute Physiology and Chronic Health Evaluation II*:*

CAM-ICU – Confusion Assessment Method for the Intensive Care Unit

CKD – Chronic Kidney Disease

COPD – Chronic Obstructive Pulmonary Disease

CRF – Case Report Form*:*

FiO_2 – Fraction of Inspired Oxygen

GCS – Glasgow Coma Scale

HTN – Hypertension

ICDSC – Intensive Care Delirium Screening Checklist

ICU – Intensive Care Unit

MAP – Mean Arterial Pressure

MPM II - Mortality Probability Model II

RASS – Richmond Agitation-Sedation Scale

RR – Respiratory Rate

SD – Standard Deviation

SOFA – Sequential Organ Failure Assessment

SPSS – Statistical Package for the Social Sciences

WBC – White Blood Cell count

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Abstract

Background: Sedation is an essential component of care for mechanically ventilated ICU patients, aimed at ensuring comfort, and safety. Evidence-based guidelines recommend light, protocolized sedation with routine use of validated assessment tools. However, adherence to these practices remains variable in low-resource settings, contributing to suboptimal outcomes.

Object: -This study evaluated sedation practices, monitoring patterns, and associated outcomes in an ICU patient.

Methods: A cross-sectional review of ICU patients receiving mechanical ventilation was conducted. Demographic characteristics, sedative agents used, sedation monitoring methods, and sedation-related outcomes were analyzed. Findings were interpreted in relation to international guidelines and recent literature on protocolized sedation strategies.

Results: The ICU cohort consisted predominantly of young to middle-aged adults (14–45 years: 61.2%) and males (63.9%). Respiratory failure, ARDS, and neurological conditions were the most common reasons for ICU admission. Ketamine was the most frequently used sedative agent (25%), followed by propofol (16.7%) and ketofol (13.9%), with doses within accepted therapeutic ranges. Continuous infusions were used in 36.1% of cases, and light sedation targets (RASS –2 to 0) were applied in 30.6% of patients. However, substantial gaps in monitoring were identified: only 40.3% had documented sedation scale assessments, and daily sedation interruption was performed in just 6.9%. Prolonged mechanical ventilation (≥3 days in 86.1%), extended ICU stays, and high 30-day mortality (55.6%) were observed. Delirium and sedation-related complications were rarely documented, likely reflecting under-assessment.

Conclusion: Sedation practices in this ICU setting are characterized by acceptable choice of sedative agents but significant deficiencies in monitoring, documentation, and protocol adherence. Limited use of sedation scales and daily interruption may contribute to prolonged ventilation and poor outcomes.

Keywords: sedation, mechanical ventilation, ICU, ketamine, RASS, protocolized sedation, resource-limited settings

1. Introduction

1.1 Background

Sedation is a cornerstone of intensive care management, particularly for patients requiring mechanical ventilation. It facilitates patient comfort, reduces anxiety, and ensures synchrony with ventilators. However, inappropriate sedation—whether excessive or insufficient—can lead to adverse outcomes such as prolonged mechanical ventilation, increased ICU length of stay, delirium, and long-term cognitive impairment [1,2].

Recent studies have emphasized the importance of protocolized sedation strategies, including algorithm-based titration and daily sedation interruption, to optimize outcomes. These approaches have been associated with reduced mortality, shorter ventilation duration, and decreased ICU stay without increasing the risk of self-extubation [1]. Moreover, sedative choice plays a critical role; agents like dexmedetomidine have shown favorable profiles in minimizing delirium and facilitating earlier extubation compared to traditional agents such as midazolam [3]. Despite these advancements, sedation practices remain variable across ICUs, and the balance between adequate sedation and minimizing harm continues to be a clinical challenge. Therefore, optimizing sedation protocols tailored to patient-specific needs is essential to improve outcomes in critically ill populations.

In Ethiopia, there is limited published data on sedation practices in ICUs, making it essential to assess current approaches and identify gaps. An observational study in Addis Ababa can provide valuable insights into local practices, inform policy development, and guide future interventions aimed at optimizing sedation management in critically ill patients.

1.2 Statement of the Problem

Sedation is a critical component of care for mechanically ventilated patients in the intensive care unit (ICU), aimed at reducing anxiety, ensuring comfort, and facilitating medical interventions. However, inappropriate sedation—whether excessive or insufficient—can lead to adverse outcomes such as prolonged mechanical ventilation, increased risk of delirium, longer ICU stays, and higher mortality rates [1,2].

Globally, evidence-based sedation protocols have been shown to improve patient outcomes by promoting optimal sedation levels and minimizing complications [3]. Yet, in many low-resource settings, including Ethiopia, the implementation of such protocols remains inconsistent due to limited training, resource constraints, and lack of standardized monitoring tools [4,5].

In Addis Ababa, there is a notable gap in published data regarding current sedation practices in ICUs. A recent study assessing physician knowledge and practice revealed moderate awareness but poor adherence to sedation and delirium management protocols [6]. Without a clear understanding of existing practices, it is difficult to identify areas for improvement or develop context-specific guidelines.

Therefore, an observational study assessing sedation practices in Addis Ababa ICUs is essential to uncover current trends, evaluate adherence to recommended protocols, and inform future interventions aimed at enhancing patient safety and care quality

1.3 Significance of the Study

Sedation in the intensive care unit is a delicate balance that directly influences clinical outcomes, including the duration of mechanical ventilation, risk of delirium, ICU length of stay, and mortality [1,2]. While evidence-based guidelines exist to optimize sedation strategies, their implementation often varies, particularly in resource-limited settings.

This study is significant for several key reasons by evaluating current sedation practices in ICUs, the findings will highlight areas for improvement in patient safety, sedation monitoring, and adherence to evidence-based protocols. Insights from the study can inform local guidelines, helping healthcare administrators and policymakers to standardize ICU sedation practices across public and private institutions. The study will serve as a resource for ICU practitioners and residents, bridging gaps in awareness and encouraging consistent use of tools like the Richmond Agitation-Sedation Scale (RASS). Given the lack of existing data in Ethiopia, the study will contribute regionally relevant evidence to the body of global sedation literature, helping to advocate for tailored interventions in low-resource settings.

In Ethiopia, many ICUs operate under constraints such as limited access to advanced monitoring equipment, variability in drug availability, inadequate staffing ratios, and absence of formalized sedation guidelines. As a result, sedation decisions often rely heavily on individual clinical judgment rather than evidence-based practice, which can lead to inconsistent dosing, prolonged ventilation times, and increased risk of complications like ICU delirium or accidental extubation [1,4,6]. It will opens avenues for longitudinal studies evaluating the impact of protocol-based sedation on patient outcomes in Ethiopian ICUs. Ultimately, this research aligns with broader goals of improving critical care delivery and ensuring that sedation—an essential yet nuanced component of ICU practice—is administered safely and effectively.

2. Literature Review

Sedation is a cornerstone of intensive care management, particularly for mechanically ventilated patients. Its primary goals include alleviating anxiety, ensuring patient comfort, and facilitating ventilator synchrony. However, both over-sedation and under-sedation are associated with adverse outcomes such as prolonged mechanical ventilation, increased ICU length of stay, delirium, and long-term cognitive impairment [1, 2].

Historically, deep sedation was favored to minimize patient distress and prevent recall of traumatic ICU experiences. However, recent evidence has shifted this paradigm toward lighter sedation strategies. The 2024 BMJ clinical review on ICU sedation emphasizes analgosedation—an approach prioritizing pain control before sedation—and recommends targeting light sedation using short-acting agents while avoiding benzodiazepines when possible. These strategies are associated with improved outcomes, including reduced delirium, earlier mobilization, and shorter ICU stays.

The Society of Critical Care Medicine (SCCM) and other international bodies now recommend protocolized sedation, including daily sedation interruption and sedation scales such as the Richmond Agitation-Sedation Scale (RASS) or Sedation-Agitation Scale (SAS), to guide titration.

A 2024 systematic review and meta-analysis by Carreño Hernandez et al. evaluated protocolized sedation in ventilated ICU patients and found significant reductions in ICU mortality (RR: 0.80), ventilation days, and ICU stay duration compared to standard care. Subgroup analyses showed that both algorithm-based and daily interruption protocols were effective, with minimal heterogeneity. Importantly, the study used the GRADE framework to assess evidence quality, which was rated moderate for key outcomes.

Another recent cross-sectional study by Kode et al. (2024) highlighted the variability in sedation practices across ICUs and emphasized the need for standardized protocols to improve patient outcomes

Protocolized Sedation Strategies To address these risks, protocolized sedation strategies have been developed. These include algorithm-based titration and daily sedation interruption. A systematic review by Carreño Hernandez et al. demonstrated that protocolized sedation significantly reduced ICU mortality (RR: 0.80), ventilation days, and ICU stay duration compared to standard care. Subgroup analyses

showed that both algorithmic and daily interruption protocols were effective, with minimal heterogeneity across studies.

Choice of Sedative Agents The selection of sedative agents also plays a critical role in patient outcomes. Dexmedetomidine, for example, has been associated with reduced delirium and earlier extubation compared to benzodiazepines like midazolam. However, its higher cost and limited availability can be barriers in low-resource settings. Midazolam and propofol remain widely used, though they carry risks of prolonged sedation and hemodynamic instability.

Assessment Tools and Monitoring Validated sedation scales such as the Richmond Agitation-Sedation Scale (RASS) and the Sedation-Agitation Scale (SAS) are commonly used to assess sedation depth. These tools help guide titration and ensure patients are neither over- nor under-sedated. However, their consistent application across ICUs remains a challenge, particularly in settings with limited staff training or high patient loads.

Methodological Approaches in Previous Studies Most studies on sedation protocols have employed randomized controlled trials (RCTs), observational cohort studies, or systematic reviews. RCTs often compare protocolized sedation with usual care, measuring outcomes such as ICU mortality, duration of mechanical ventilation, incidence of delirium, and ICU length of stay [1,2]. Observational studies provide insights into real-world practices and outcomes, especially in settings where RCTs are not feasible.

Methodological Challenges Several methodological challenges have been identified in sedation research:

- Patient heterogeneity: ICU populations vary widely in terms of diagnoses, comorbidities, and sedation needs, complicating comparisons across studies.
- Blinding difficulties: It is often challenging to blind clinicians and patients to sedation protocols, introducing potential bias.
- Variability in sedation targets: Different studies use different sedation depth targets, making it difficult to standardize outcomes.
- Resource limitations: In low-income settings, limited access to sedative agents, monitoring equipment, and trained personnel can affect protocol adherence and data quality.

- Ethical considerations: Altering sedation practices in critically ill patients raises ethical concerns, particularly when withholding or modifying standard care.

In Ethiopia and similar low-resource environments, the implementation of standardized sedation protocols is often hindered by drug shortages, inconsistent monitoring, and limited training. Studies conducted in such settings are scarce, highlighting a significant gap in the literature. Research tailored to these contexts is essential to develop feasible, cost-effective sedation strategies that improve outcomes without overburdening already strained healthcare systems.

Shehabi et al. (2013) conducted a multicenter cohort study across Malaysian ICUs, revealing that early deep sedation (RASS $\leq$ -3) was independently associated with delayed extubation, increased hospital mortality, and higher 180-day mortality [1,2].

Jackson et al. (2010) emphasized that both over-sedation and under-sedation negatively impact patient safety and resource use. Their systematic review highlighted inconsistencies in sedation definitions and monitoring tools, calling for standardized protocols [3,4].

The SAnDMAN Protocol (Mehta et al., 2022) represents an international audit aiming to assess real-world sedation, analgesia, and delirium management. Preliminary findings suggest wide variability in practice and limited adherence to evidence-based guidelines [9].

Firdie (2021) explored physician knowledge and attitudes in Addis Ababa, Ethiopia, revealing gaps in awareness and inconsistent practices regarding sedation and delirium management in ICUs.

Ceric et al. (2022) and Hutton et al. (2015) proposed protocols for systematic reviews and network meta-analyses to compare sedation strategies. These efforts aim to provide robust comparative data to guide clinical decision-making and policy development.

Kode et al. (2024) conducted a cross-sectional evaluation of sedation protocols, finding that structured approaches correlated with better patient outcomes, including reduced ICU length of stay.

The literature underscores the critical importance of individualized, protocol-driven sedation and analgesia in the ICU. Light sedation, when feasible, is associated with improved outcomes. However, achieving optimal sedation requires standardized tools, interdisciplinary collaboration, and ongoing education. Bridging the gap between evidence and practice remains a key challenge for critical care teams worldwide.

3.Objective

3.1 General Objective

To assess the current sedation practices among critically ill patients admitted to intensive care units (ICUs) in selected hospitals in Addis Ababa, Ethiopia.

3.2 Specific Objectives

1. To identify the types of sedative agents commonly used in ICU settings for critically ill patients in Addis Ababa.
2. To evaluate the frequency and method of sedation monitoring, including the use of validated assessment tools such as RASS or SAS.

4.Methodology

4.1 Study Area

The study area for this study is Tikur Anbessa specialized Hospital Intensive Care Unit. Tikur Anbessa Specialized Hospital is opened in 1972 G.C. TASH is a teaching university Hospital for both clinical and preclinical training of most disciplines. Beside it has a specialized clinical service that are usually not available in other public or private institutions. It is a referral hospital with around 700 beds, various departments, faculties, residents and fellows under specialty and subspecialty training in the school of Medicine.

The hospital launched a digital recording system in 2018, where the clinical data and other pertinent profiles of the patients were stored and retrieved when needed. It has different units and subunits in major being the ICU (Intensive Care Unit) which houses 4 different sub classification which include medical ICU, surgical ICU, pediatric ICU and Cardiac ICU. Which our study will be focused on Medical and Surgical ICU.

4.2 Study period

The study period was conducted from July 01, 2025 up to September 30, 2025

4.3 Study Design

A hospital based prospective observational cohort study was conducted to observe current sedation practices in real time without altering standard care.

4.4 Source and study population

Source population were consisting of all adult patients admitted to the intensive care units (ICUs) of TASH Addis Ababa, Ethiopia during the study period. Study population was including critically ill adult patients (≥14 years) who are admitted to the ICU, require sedation for mechanical ventilation for at least 24 hours, and Meet inclusion criteria based on clinical stability and consent.

4.5 Sampling size

The sample size was calculated using the single population proportion formula, assuming a 95% The sample size was initially calculated using the single population proportion formula, yielding a theoretical sample size of 150 patients. Given the limited ICU admission pool of 100 patients over the study period, the finite population correction was applied:

$$n = \frac{(Z_a/2)^2 pq}{d^2}$$

🔍 Where:

- (n_0) = initial sample size (before any correction)
- (Z) = Z-score corresponding to the desired confidence level
  - For 95% confidence → (Z = 1.96)
- (p) = estimated proportion of the population with the characteristic of interest
  - If unknown, use (p = 0.5) for maximum sample size
- (d) = margin of error (precision)

- Commonly set at (d = 0.05)

n = (150) (1 + (149)(100)) = (150)(2.49) =60

To account for potential non-response or incomplete data, a 15% non-response rate was added:

n = (60)(1 - 0.15) = (60)(0.85) = 71

➤ Final sample size: 71 patients

This sample size is both statistically sound and feasible given the expected ICU admissions during the study period

4.6 Sampling technique

Consecutive sampling was used to enroll every eligible patient who meets the inclusion criteria during the study period until the required sample size is reached. All critically ill patients admitted to the ICU in the study period was followed consecutively enrolled will followed through the study period.

4.7 Eligibility criteria

4.7.1 Inclusion Criteria

- Age ≥ 14 years
- Admitted to the ICU and expected to require sedation for ≥ 24 hours.
- Receiving mechanical ventilation during ICU stay.
- Managed using a standardized sedation protocol implemented as part of the study.
- Able to provide informed consent (or consent obtained from a legally authorized representative, if applicable).

4.7.2 Exclusion Criteria

- Severe neurological conditions requiring deep or continuous sedation (e.g., traumatic brain injury, status epilepticus).
- Chronic cognitive impairment or baseline neurological disorders that interfere with sedation assessment.
- Sedation duration < 24 hours or expected ICU stay < 24 hours.
- Transferred from another ICU with unknown prior sedation practices.
- Known allergy or contraindication to the sedative agents used in the protocol.
- Pregnant or lactating women, due to altered pharmacokinetics and ethical considerations.

4.8 Study variables

4.8.1 Independent Variable

- Use of a standardized sedation protocol

4.8.2 Dependent variables

- Duration of mechanical ventilation
- Length of ICU stay
- Incidence of delirium
- ICU mortality
- Sedation-related complications

Confounding Variables

- Age
- Sex
- APACHE II or SOFA score (severity of illness)
- MPM II score (estimated length of ICU stay)
- Primary diagnosis/reason for ICU admission
- Comorbidities (e.g., diabetes, hypertension, chronic lung disease)
- Type and dose of sedative agents used
- Use of analgesics or neuromuscular blockers
- Baseline cognitive status

4.9 Data Collection

A Structured Data Collection Tool were used to create a standardized case report form (CRF) or checklist by using a questionnaire in Google form and data will be collected by a trained ICU staff Nurse or physician and collected data were extracted and interpreted based on the variables addressed.

4.10 Data Quality Control

A One-day Training was given to data collectors. The collected data were checked for completeness and consistency on each day of data collection. Supervision and monitoring were made every day by the assigned supervisors and principal investigators

4.11 Data Analysis

Data were checked manually for completeness and then was entered into Epi-data version 3.1 and was analyzed using SPSS version 26. During the analysis P- value < 0.05 with 95% confidence interval (CI) for OR (odds ratio) was used in judging the significance of the associations. Bivariate analysis between dependent and independent variables were performed using binary logistic regression. Multivariable analysis was done to control for possible confounding variable. Data was presented using tables, graphs and charts

4.12 Operational Definition

Sedation Protocol - A structured, evidence-based approach to administering and titrating sedative medications in ICU patients, typically guided by sedation scales (e.g., RASS) and including practices such as daily sedation interruption. In this study, this refers specifically to the standardized protocol implemented during the observation period.

Sedative Agent - Pharmacologic substance administered to reduce anxiety, agitation, or discomfort in ICU patients. Common agents include midazolam, propofol, ketamine, diazepam and dexmedetomidine. Recorded as name, dose, and route of administration.

Sedation depth - The level of consciousness or responsiveness of a patient under sedation, measured using the Richmond Agitation-Sedation Scale (RASS):

- Ranges from +4 (combative) to –5 (unarousable)
- Target range for light sedation: RASS –2 to 0

Duration of mechanical ventilation - The total number of consecutive days a patient remains on invasive mechanical ventilation, from intubation to successful extubation or death.

Length of ICU Stay - the number of calendar days from ICU admission to ICU discharge or death.

Delirium - An acute, fluctuating disturbance in attention and cognition, assessed using a validated tool such as the Confusion Assessment Method for the ICU (CAM-ICU). Recorded as present or absent during ICU stay.

Sedation-Related Complications - Any adverse events directly attributable to sedative use, including:

- Hypotension:
- Bradycardia:
- Self-extubation:

ICU mortality – Death occurring during the ICU stay, recorded as a binary outcome (Yes/No).

APACHE II Score - severity-of-illness score calculated within 24 hours of ICU admission, used to adjust for baseline risk.

The APACHE II score is calculated using a combination of physiological measurements, age, and chronic health status—all taken within the first 24 hours of ICU admission.

Acute Physiology Score (12 variables)

Each is scored from 0 to 4 points based on how abnormal the value is:

1. Temperature (core, °C)
2. Mean Arterial Pressure (MAP) (mmHg)
3. Heart Rate
4. Respiratory Rate
5. Oxygenation
    - If $FiO_2 \geq 0.5$: use A–a gradient
    - If $FiO_2 < 0.5$: use PaO_2
6. Arterial pH
7. Serum Sodium (mmol/L)
8. Serum Potassium (mmol/L)
9. Serum Creatinine (mg/dL)
    - *Double points if acute renal failure is present*
10. Hematocrit (%)
11. White Blood Cell Count ($\times 10^3/\mu L$)
12. Glasgow Coma Scale (GCS)

Age Points

Points are added based on the patient's age:

- ≤ 44 years: 0 points
- 45–54 years: 2 points
- 55–64 years: 3 points
- 65–74 years: 5 points

- ≥ 75 years: 6 points

Chronic Health Points

Add points if the patient has severe chronic organ insufficiency or is immunocompromised:

- 5 points: Non-operative or emergency post-op patients
- 2 points: Elective post-op patients

Conditions include:

- Severe liver disease (e.g., cirrhosis with portal hypertension)
- NYHA Class IV heart failure
- Chronic respiratory failure
- Dialysis-dependent renal failure
- Immunosuppression (e.g., chemotherapy, AIDS)

Mortality Probability Model II (MPM II) - is a scoring system used in intensive care units (ICUs) to estimate a patient's risk of hospital mortality based on clinical data collected at specific time points—most commonly at ICU admission (MPM0), and then at 24, 48, and 72 hours into the ICU stay.

MPM II uses a set of 15 easily obtainable variables to assess illness severity. These include:

- Age
- Heart rate ≥150 bpm
- Systolic blood pressure ≤90 mmHg
- Mechanical ventilation at admission
- Coma or deep stupor (GCS 3–5)
- Acute or chronic renal failure
- Metastatic cancer
- Cirrhosis
- Cardiac dysrhythmia
- Gastrointestinal bleeding
- Intracranial mass effect

- Cerebrovascular incident
- CPR prior to ICU admission
- Medical or emergency surgical admission
- Urine output

Each variable is assigned a binary value (yes/no) and weighted using a logistic regression formula to calculate the predicted probability of death. The model is calibrated to reflect real-world ICU outcomes and has shown good discrimination (AUC > 0.83) in validation studies.

Comorbidities - Pre-existing chronic conditions (e.g., diabetes, hypertension, COPD) documented in the patient's medical record. Recorded as present/absent for each.

4.13 Ethical Consideration

Ethical clearance was obtained from institutional review board of College Health Science AAU. Patients were informed about the aim, benefit and possible inconvenience of the study. They will be assured the information they give was confidential. Before data collection begins, verbal consent was obtained and participants can withdraw at any time if the need arises.

5.Results

5.1 Sociodemographic characteristics of the ICU patients

The ICU cohort consisted predominantly of young to middle-aged adults (mean age 42.4 ± 17.5 years) and males (63.9%). The leading reasons for ICU admission were respiratory conditions (respiratory failure and ARDS combined), followed by neurological/neurosurgical causes. A majority of patients required prolonged ventilatory support, with more than half (52.8%) intubated for over five days. Comorbidities were common, most frequently diabetes (23.6%), hypertension (19.4%), and cardiac disease (16.7%).

Table 1. Sociodemographic characteristics of the ICU patients at TASH, 2025

Mean age (SD), years	42.4 (17.5)	
Variable	frequency	Percent
Age of the ICU patients		
14-30	22	30.6
31-45	22	30.6
46-60	15	20.8
>60	13	18.1
Sex		
Male	46	63.9
female	26	36.1
Respiratory conditions (Respiratory failure + ARDS)	30	41.7
ARDS	11	15.3
Neurological / Neurosurgical	14	19.4
Cardiac / Hemodynamic	4	5.6
Renal / Metabolic	3	4.2
Hematologic / Oncologic	5	6.9
Gastrointestinal / Surgical	6	8.3
Trauma / Burns	3	4.2
Endocrine	4	5.6
Toxicology	1	1.4
Rheumatologic / Autoimmune	1	1.4
Obstetric / Gynaecologic	1	1.4
Days of intubation and mechanical ventilation after admission		
<3day	9	12.5
3day	14	19.4
5day	7	9.7
>5day	38	52.8
Uk	4	5.6
List of comorbidities		

Diabetes	17	23.6
hypertension	14	19.4
COPD	3	4.2
CKD	4	5.6
RVI	3	4.2
Cardiac disease	12	16.7

5.2 Sedation Practice related characteristics of the ICU patients

Among the ICU patients with recorded sedation practices, ketamine was the most frequently used sedative agent (25%), followed by propofol (16.7%), ketofol (13.9%), midazolam (5.6%), and diazepam (2.8%). Ketamine was administered at doses ranging from 0.1 mg/kg to 2 mg/kg, while propofol was used at 0.5–1 mg/kg, and diazepam at an infusion rate of 45 mL/hr. Continuous infusion was the predominant administration route among documented cases (36.1%), whereas 9.7% received sedation via intravenous boluses. Light sedation (RASS –2 to 0) was the most commonly targeted initial sedation level (30.6%), with deep sedation (RASS ≤ –3) applied in 9.7% of patients. Regarding documented durations, sedation was maintained for 48 hours in 8.3% of patients, 72 hours in 6.9%, more than 72 hours in 9.7%, and only 2.8% received sedation for 24 hours.

Table 2. Sedation Practice related characteristics of the ICU patients

Variable	frequency	Percent
Sedative agents used		
Midazolam	4	5.6
Propofol	12	16.7
Ketamine	18	25.0
ketofol	10	13.9
Diazepam	2	2.8
Not documented	26	36.1
Route of administration		
IV bolus	7	9.7
continuous infusion	26	36.1
Not documented	39	54.2
Initial sedation goal		
Deep (RASS<=-3	7	9.7
Light (RASS -to 0	22	30.6
Not documented	43	59.7
Duration of sedation		
24hrs	2	2.8
48hrs	6	8.3
72hrs	5	6.9
>=72hrs	7	9.7
Not documented	51	70.8

5.3 Monitoring and Assessment of the study participants

Among the ICU patients with documented monitoring and assessment practices, sedation scales were used in 40.3% of cases, while 9.7% had no sedation scale applied. The Richmond Agitation–Sedation Scale (RASS) was the predominant tool utilized (41.7%), with only a small proportion assessed using the Sedation Agitation Scale (SAS) (1.4%). Regarding the frequency of sedation assessment, 12.5% of patients were evaluated daily, and 4.2% were assessed each shift. Daily sedation interruption was practiced in 6.9% of cases, whereas 2.8% had no interruption and 5.6% had sedation maintained without planned interruption.

Table 3. Monitoring and Assessment of the stud participants

Variable	frequency	Percent
sedation scale		
no	7	9.7
yes	29	40.3
not assessed	1	1.4
Not documented	35	48.6
Types of scale		
RASS	30	41.7
SAS	1	1.4
Not documented	41	56.9
Frequency of sedation assessment		
Each shift	3	4.2
Daily	9	12.5
Not assessed	1	1.4
Not documented	59	81.9
Daily sedation interruption		
No	2	2.8
Yes	5	6.9
not performed	4	5.6
Not documented	61	84.7

5.4 **Sedation Outcomes and Events of the ICU patients**

Among the ICU patients with documented outcomes, nearly half required mechanical ventilation for 3–7 days (47.2%), while 19.4% required ventilation for 8–15 days and an equal proportion for more than 15 days; only 13.9% were ventilated for fewer than 3 days. A similar distribution was observed for ICU length of stay, with most patients staying 3–7 days (34.7%), followed by 8–15 days and more than 15 days (each 29.2%). The occurrence of delirium was rare, documented in only 1.4% of patients. Sedation-related complications were also infrequently recorded, with hypotension noted in 1.4% and 5.6% having

no complications among those assessed. Total hospital stay, including ICU, commonly ranged from 7–15 days (27.8%) or 16–30 days (26.4%), while 31.9% remained hospitalized for more than 30 days. At 30-day follow-up, 27.8% of patients showed clinical improvement, 9.7% remained unchanged, and 6.9% worsened, while mortality reached 55.6%.

Table 4. Sedation Outcomes and Events of the ICU patients

Variable	frequency	Percent
Duration of mechanical ventilation		
<3day	10	13.9
3-7	34	47.2
8-15	14	19.4
>15	14	19.4
Length of ICU stay		
<3day	10	6.9
3-7	34	34.7
8-15	14	29.2
>15	14	29.2
Occurrence of delirium		
yes	1	1.4
Sedation related complication		
hypotension	1	1.4
None	4	5.6
Not documented	67	93.1
Total duration of stay in the hospital including ICU		
<-7	10	13.9
7-15	20	27.8
16-30	19	26.4
>30	23	31.9
30 Days patient outcomes		
Same	7	9.7
Improved	20	27.8
Worsened	5	6.9
Deceased	40	55.6

5.5. Factors associated with ICU mortality

Table 5. Bivariable (Unadjusted) Logistic Regression for 30-day Mortality

Variable	Crude OR (COR)	95% CI	P value
Age	1.04	1.00 – 1.07	0.026
Sex (Male vs Female)	0.56	0.20 – 1.62	0.284
Sedation scale documented (Yes vs No)	0.71	0.26 – 1.96	0.508
Daily sedation interruption (Yes vs No)	0.69	0.10 – 4.65	0.706
Deep sedation (RASS ≤ −3) (Yes vs No)	3.58	0.61 – 21.10	0.159
Benzodiazepine use (Yes vs No)	1.94	0.41 – 9.14	0.402

Increasing age and deep sedation (RASS ≤ −3) showed an association with higher odds of 30-day mortality. Deep sedation met the screening criterion ($p \leq 0.25$) and was selected for multivariable analysis.

Table 6. Multivariable Logistic Regression for 30-day Mortality

Variable	Adjusted OR (AOR)	95% CI	P value
Age	1.04	1.00 – 1.07	0.026
Deep sedation (RASS ≤ −3) (Yes vs No)	3.93	0.56 – 27.63	0.168
Benzodiazepine use (Yes vs No)	1.88	0.33 – 10.61	0.476

After adjustment, increasing age remained independently associated with higher 30-day mortality. Deep sedation (RASS ≤ −3) showed a clinically meaningful increase in the odds of mortality, although

statistical significance was not reached. Benzodiazepine use was retained in the model due to strong clinical relevance but was not independently associated with mortality. The wide confidence intervals likely reflect limited sample size and poor documentation of sedation practices.

Bivariable logistic regression analysis was performed to assess the association between selected demographic and sedation-related variables and 30-day mortality. Variables with a p value ≤ 0.25 in the bivariable analysis were considered eligible for multivariable logistic regression. In addition, benzodiazepine use was retained in the multivariable model a priori due to its established clinical relevance in ICU sedation practices and its potential impact on patient outcomes. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported, and a p value < 0.05 was considered statistically significant.

In the bivariable analysis, increasing age was significantly associated with higher 30-day mortality (COR 1.04; 95% CI: 1.00–1.07; p = 0.026). Deep sedation (RASS ≤ -3) was associated with increased odds of mortality and met the predefined screening criterion for inclusion in the multivariable model (COR 3.58; 95% CI: 0.61–21.10; p = 0.159). Sex, sedation scale documentation, daily sedation interruption, and benzodiazepine use were not significantly associated with mortality on unadjusted analysis.

In the multivariable logistic regression model including age, deep sedation (RASS ≤ -3), and benzodiazepine use, increasing age remained independently associated with higher 30-day mortality (AOR 1.04; 95% CI: 1.00–1.07; p = 0.026). Deep sedation demonstrated a clinically meaningful increase in the odds of mortality (AOR 3.93; 95% CI: 0.56–27.63), although this association did not reach statistical significance. Benzodiazepine use was not independently associated with 30-day mortality after adjustment.

Variable	Category	COR	95% CI	P value
Age (years)	Categorical	1.04	1.00 – 1.07	0.026
Sex	Female = 0	1.00	—	—
	Male = 1	0.56	0.20 – 1.62	0.284
Sedation scale documented	No = 0	1.00	—	—
	Yes = 1	0.71	0.26 – 1.96	0.508
Daily sedation interruption	No = 0	1.00	—	—
	Yes = 1	0.69	0.10 – 4.65	0.706
Sedation depth	Light sedation (RASS −2 to 0) = 0	1.00	—	—
	Deep sedation (RASS ≤ −3) = 1	3.58	0.61 – 21.10	0.159
Benzodiazepine use	No = 0	1.00	—	—
	Yes = 1	1.94	0.41 – 9.14	0.402

Table 7. Bivariable (Unadjusted) Logistic Regression Analysis of Factors Associated with 30-day Mortality

Table 8. Multivariable Logistic Regression Analysis of Factors Associated with 30-day Mortality

Variable	Category	AOR	95% CI	P value
Age (years)	Categorical	1.04	1.00 – 1.07	0.026
Sedation depth	Light sedation (RASS −2 to 0) = 0	1.00	—	—
	Deep sedation (RASS ≤ −3) = 1	3.93	0.56 – 27.63	0.168
Benzodiazepine use	No = 0	1.00	—	—
	Yes = 1	1.88	0.33 – 10.61	0.476

Footnote

Binary logistic regression analysis was performed. Categorical variables were coded as follows: female sex = 0, male = 1; no sedation scale documentation = 0, yes = 1; no daily sedation interruption = 0, yes = 1; light sedation (RASS −2 to 0) = 0, deep sedation (RASS ≤ −3) = 1; and no benzodiazepine use = 0, benzodiazepine use = 1. Age was analyzed as a continuous variable. Variables with $p \leq 0.25$ in bivariable analysis were entered into the multivariable model, and benzodiazepine use was retained *a priori* due to clinical relevance. Odds ratios are presented with 95% confidence intervals, and a p value < 0.05 was considered statistically significant.

6.Discussion

This study provides important insights into sedation practices among mechanically ventilated ICU patients at Tikur Anbessa Specialized Hospital and highlights key gaps in monitoring, documentation, and adherence to evidence-based sedation strategies. The findings are particularly relevant in the context of low-resource settings, where standardized sedation protocols and continuous monitoring may be inconsistently implemented.

The ICU population in this study consisted predominantly of young to middle-aged adults, with respiratory failure, ARDS, and neurological conditions being the most common indications for ICU admission. This case mix is comparable to other observational ICU studies conducted in both high- and low-income settings, where respiratory and neurological illnesses frequently necessitate prolonged mechanical ventilation and sedation support [1,4].

Ketamine was the most frequently used sedative agent, followed by propofol and ketofol. This contrasts with practice patterns in high-income countries, where propofol and dexmedetomidine are commonly preferred due to their shorter duration of action and lower delirium risk [2,21]. However, the predominance of ketamine use in this study reflects contextual factors such as drug availability, cost, and its favorable hemodynamic profile, which is particularly advantageous in critically ill patients with shock or hemodynamic instability [11,16]. The documented dosing ranges for ketamine and propofol were within accepted therapeutic limits, suggesting appropriate agent selection despite the absence of standardized protocols.

A major finding of this study was the low utilization of structured sedation monitoring tools. Less than half of the patients had documented sedation scale assessments, and daily sedation interruption was rarely practiced. This is inconsistent with international recommendations, including the SCCM PADIS guidelines and recent BMJ clinical reviews, which emphasize routine sedation assessment using validated tools such as RASS and the implementation of daily sedation interruption to avoid oversedation and improve outcomes [2,21]. Similar deficiencies in sedation monitoring have been reported in other observational studies, particularly in resource-limited environments [5,6].

Evidence from the literature strongly supports protocolized sedation strategies. A recent systematic review and meta-analysis by Carreño Hernández et al. demonstrated that protocolized sedation significantly reduced ICU mortality, duration of mechanical ventilation, and ICU length of stay compared with usual care [7]. The low adherence to such strategies observed in the present study highlights a critical gap between evidence and practice, which may contribute to prolonged ventilation and poor outcomes.

In the multivariable logistic regression analysis, increasing age remained independently associated with higher 30-day mortality. This finding is consistent with prior studies demonstrating that advanced age is a strong predictor of mortality in critically ill patients due to reduced physiological reserve and increased comorbidity burden [1,4]. Deep sedation (RASS ≤ -3) was associated with a clinically meaningful increase in the odds of mortality, although statistical significance was not reached. This direction of association aligns with the findings of Shehabi et al., who demonstrated that early deep sedation was independently associated with delayed extubation and increased short- and long-term mortality [4]. The lack of statistical significance in the present study is likely

attributable to limited sample size, wide confidence intervals, and incomplete sedation documentation rather than absence of a true effect.

Benzodiazepine use was retained in the multivariable model because of its established clinical relevance. Although no independent association with mortality was observed, this should be interpreted cautiously. Prior studies and reviews have consistently linked benzodiazepine-based sedation with higher rates of delirium, prolonged mechanical ventilation, and worse neurocognitive outcomes [1,2,21]. In this study, the low frequency of documented benzodiazepine use and limited data on cumulative dosing may have reduced the ability to detect an association.

The reported incidence of delirium and sedation-related complications was remarkably low. Given the limited use of delirium assessment tools such as CAM-ICU, this likely reflects under-recognition rather than true low prevalence. Previous studies have reported delirium rates ranging from 30% to 80% among mechanically ventilated ICU patients when systematic screening is employed [1,22]. Similar challenges in delirium detection have been documented in Ethiopian ICUs, where gaps in training and tool availability contribute to inconsistent assessment [6].

The 30-day mortality rate observed in this study was high compared with global benchmarks. This finding likely reflects a combination of illness severity, delayed presentation, limited ICU resources, and suboptimal sedation monitoring. International audits such as the SAnDMAN study have demonstrated wide variability in sedation, analgesia, and delirium practices across ICUs, with poorer adherence to guidelines associated with worse outcomes [3]. The present findings are consistent with these observations and underscore the need for context-specific interventions.

Overall, this study highlights that while appropriate sedative agents are being used, sedation practices are compromised by poor monitoring, inadequate documentation, and limited protocol adherence. Addressing these gaps through standardized sedation protocols, staff training, and routine use of validated assessment tools may represent achievable and impactful strategies to improve outcomes in Ethiopian ICUs.

7.Conclusion

This study assessed sedation practices among mechanically ventilated critically ill patients at Tikur Anbessa Specialized Hospital and identified important gaps in sedation monitoring, documentation, and adherence to evidence-based sedation strategies. Although commonly used sedative agents such as ketamine and propofol were administered within acceptable therapeutic ranges, sedation management was largely unstructured, with limited use of validated sedation assessment tools and infrequent implementation of daily sedation interruption.

The study demonstrated a high 30-day mortality rate, and multivariable logistic regression analysis identified increasing age as an independent predictor of mortality. Deep sedation (RASS ≤ -3) was associated with higher odds of mortality, suggesting a potentially harmful effect, although statistical significance was not achieved. This finding is consistent with existing literature linking deep sedation to worse ICU outcomes and highlights the clinical importance of avoiding unnecessary deep sedation. Benzodiazepine use was not independently associated with mortality; however, interpretation is limited by low exposure frequency and incomplete documentation.

The low reported incidence of delirium and sedation-related complications likely reflects under-assessment rather than true absence, given the infrequent use of validated monitoring tools. Overall, the findings indicate that while sedative drug selection is generally appropriate, deficiencies in monitoring, documentation, and protocol adherence may contribute to prolonged mechanical ventilation, extended ICU stays, and poor patient outcomes.

This study provides valuable local evidence on sedation practices in a resource-limited ICU setting and underscores the need for system-level interventions to improve sedation management and patient safety.

8.Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Implement Protocolized Sedation Practices

   Standardized sedation protocols aligned with international guidelines should be adopted, emphasizing light, analgesia-first sedation and avoidance of unnecessary deep sedation. Protocols should include clear sedation targets and structured titration strategies.

2. Strengthen Sedation Monitoring and Documentation

   Routine use of validated sedation assessment tools such as the Richmond Agitation–Sedation Scale (RASS) should be integrated into daily ICU practice. Sedation depth, duration, route of administration, and sedation-related events should be consistently documented.

3. Promote Daily Sedation Interruption

   Daily sedation interruption should be implemented when clinically appropriate to reduce oversedation, shorten mechanical ventilation duration, and facilitate earlier neurological assessment.

4. Improve Delirium Assessment

   Validated delirium screening tools, such as the Confusion Assessment Method for the ICU (CAM-ICU), should be incorporated into routine patient evaluation to improve detection and management of ICU delirium.

5. Enhance Staff Training and Awareness

   Regular training programs for ICU physicians and nurses should be conducted to improve knowledge and adherence to evidence-based sedation, analgesia, and delirium management practices.

6. Future Research

Further studies with larger sample sizes and longer follow-up periods are recommended to better evaluate the impact of sedation depth, benzodiazepine exposure, and protocolized sedation on clinical outcomes in Ethiopian ICUs. Interventional studies assessing the implementation of structured sedation protocols are particularly encouraged.

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Table 5. Factors associated with 30-day mortality (binary logistic regression, N=72)

Variable	AOR	95% CI	P
Age (per 1-year increase)	1.02	0.99 – 1.06	0.122
Sex (Male vs Female)	0.48	0.16 – 1.41	0.184
Sedation scale documented (Yes vs No)	0.72	0.23 – 2.21	0.565
Daily sedation interruption (Yes vs No)	0.59	0.08 – 4.29	0.605
Deep sedation (RASS ≤ −3) (Yes vs No)	3.96	0.52 – 30.07	0.183
Benzodiazepine used (Yes vs No)	0.19	0.02 – 2.03	0.168

Interpretation: After adjustment, older age showed a small increase in the odds of 30-day mortality per year, while deep sedation (RASS ≤ −3) showed higher odds of mortality; however, none of the covariates reached statistical significance ($p<0.05$), likely due to the modest sample size and low counts for some exposures (e.g., daily sedation interruption and benzodiazepine use).