



NEPAL  
INTENSIVE CARE  
RESEARCH FOUNDATION

# NICRF REPORT

2020-2025



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## Abbreviations

- AMR -- Antimicrobial Resistance
- APACHE II -- Acute Physiology and Chronic Health Evaluation II
- BMCTH -- Birat Medical College & Teaching Hospital
- BNH -- Birat Nursing Home
- BPKIHS -- B.P. Koirala Institute of Health Sciences
- CCAA -- Critical Care Asia and Africa
- CHE -- Catastrophic Health Expenditure
- CMC -- Chitwan Medical College & Teaching Hospital
- CRF -- Case Report Form
- CSH -- Civil Service Hospital
- DDD -- Defined Daily Dose
- EQ-5D-5L -- EuroQol 5-Dimensions 5-Levels questionnaire
- EQUIPS-ICU -- Evidence-based Quality Improvement for Prescribing Stewardship in ICU
- eTropICS -- Electronic Tropical Intensive Care Score
- GMC -- Gandaki Medical College Teaching Hospital & Research Centre
- HADS -- Hospital Anxiety and Depression Scale
- HAMS -- Hospital for Advanced Medicine and Surgery
- HFNC -- High Flow Nasal Cannula
- ICNARC -- Intensive Care National Audit & Research Centre
- ICOPE -- ICU-related Out of Pocket Expenses
- IES-R -- Impact of Events Scale-Revised
- IPC -- Infection Prevention and Control
- ISARIC -- International Severe Acute Respiratory and Emerging Infection Consortium
- JAMA -- Journal of the American Medical Association
- JAMIA -- Journal of the American Medical Informatics Association
- LOGIC -- Linking of Global Intensive Care
- LAMA -- Leave Against Medical Advice
- LMIC -- Low- and Middle-Income Country
- Mega-ROX -- Mega Randomised Registry Trial Comparing Conservative vs. Liberal Oxygenation Targets
- MMTH -- Manmohan Memorial Medical College and Teaching Hospital
- MORU -- Mahidol Oxford Tropical Medicine Research Unit
- MRINZ -- Medical Research Institute of New Zealand
- NAAMII-- Nepal Applied Mathematics and Informatics Institute for Research
- NHRC -- Nepal Health Research Council
- NICRF -- Nepal Intensive Care Research Foundation
- OOPE -- Out-of-Pocket Expenditure
- Om -- Om Hospital and Research Center
- PI-- Principal Investigator
- PTSD -- Post-Traumatic Stress Disorder
- QI -- Quality Improvement
- RCT -- Randomized Controlled Trial
- RE-AIM -- Reach, Effectiveness, Adoption, Implementation, and Maintenance Framework
- REMAP-CAP -- Randomized, Embedded, Multifactorial, Adaptive Platform for Community-Acquired Pneumonia
- RRT -- Renal Replacement Therapy
- SARI -- Severe Acute Respiratory Infection
- SGNHC -- Shahid Gangalal National Heart Center
- Short-IQCODE -- Short Informant Questionnaire on Cognitive Decline in the Elderly
- SMR -- Standardised Mortality Ratio
- SOFA -- Sequential Organ Failure Assessment
- TUTH -- Tribhuvan University Teaching Hospital

# Executive Summary

Over the past five years (2020–2025), Nepal Intensive Care Research Foundation (NICRF) has evolved into a nationally recognized organization dedicated to critical care research and capacity building. NICRF is a key partner in Critical Care Asia–Africa (CCAA) Network, a Wellcome-funded initiative advancing critical care research and quality improvement across low- and middle-income countries. Guided by its mission to improve the quality of intensive care in Nepal through evidence generation, NICRF has expanded the Nepal ICU Registry nationwide and led the implementation of several international clinical trials across diverse hospital settings.

NICRF has partnered with more than 18 major hospitals, established international collaborations, and contributed to landmark global research initiatives such as REMAP-CAP and Mega-ROX. Through its registry-based approach, NICRF has generated real-time data to inform quality improvement, while simultaneously building a sustainable research infrastructure.

Key achievements from 2020–2025 include:

- Establishment of the ICU Registry in 18 hospitals across Nepal
- Active participation in international clinical trials (e.g., REMAP-CAP, Mega-ROX)
- Completion of observational, retrospective, and prospective studies on ICU capacity, disease epidemiology, COVID-19 response, disease-specific outcomes, antimicrobial use, and more
- Engagement of over 150 ICU clinicians, nurses, and coordinators in research and capacity-building activities
- Partnerships with leading institutions including Critical Care Asia and Africa (CCAA), Monash University, MRINZ, the Mahidol Oxford Tropical Medicine Research Unit, and Pfizer Inc.
- Contribution to peer-reviewed publications in international journals
- Organization of research training workshops in collaboration with NHRC and international partners

Looking ahead, NICRF remains committed to strengthening critical care systems in Nepal through innovation, collaboration, and research that shapes both practice and policy.

## About NICRF

Nepal Intensive Care Research Foundation (NICRF), established on 20 March 2020 (Chaitra 7, 2076 B.S.), is a not-for-profit organization dedicated to strengthening critical care in Nepal through research, data-driven systems, and clinical capacity-building. NICRF is a key partner of the Critical Care Asia–Africa (CCAA) Network, a Wellcome-funded initiative advancing critical care research and quality improvement across low- and middle-income countries. Through this partnership, Nepal has aligned its ICU registry and trial platforms with an international federation, enabling active contributions to global learning and research.



## Vision and Mission

- Vision: A health system where all critically ill patients in Nepal receive high-quality, evidence-based care, supported by robust data systems and strong research capacity.
- Mission: To improve the quality, accessibility, and outcomes of critical care in Nepal through research, surveillance, and innovation.

## Core Objectives

- Establish and implement the Nepal ICU Registry and Surveillance System.
- Assess ICU capacity in terms of infrastructure, logistics, and human resources.
- Describe the epidemiology, clinical course, and outcomes of ICU patients.
- Strengthen networks for knowledge sharing, cost analysis, and system planning.
- Support pandemic preparedness and SARI surveillance.
- Generate evidence for policy and resource allocation.
- Promote and facilitate registry-based research.

## Governance and Leadership

NICRF is led by a multidisciplinary team of doctors, nurses, researchers, and professionals. Its governance model ensures strong strategic direction, project management, and oversight of research integrity and ethics.

## **NICRF-CCAA Collaboration**

NICRF is a partner with the Critical Care Asia and Africa (CCAA) network, a Wellcome Trust-funded regional collaboration that brings together institutions from across Asia and Africa to strengthen intensive care research in low- and middle-income countries. At the heart of this partnership lies the development of electronic ICU registries, which allow hospitals to collect, store, and analyze patient data in a consistent and reliable way. Building on this platform, NICRF launched Nepal's first national ICU registry in 2020, enabling real-time, cloud-based data collection across multiple hospitals and creating a robust foundation for benchmarking and quality improvement. Nepal ICU Registry now operates in more than 18 hospitals and over 30 critical care units across the country. The registry is supported by a network of over 150 trained research assistants, coordinators, and clinicians, who ensure the collection of high-quality, real-time data. This infrastructure has allowed NICRF to play an active role in landmark global trials such as REMAP-CAP, Mega-ROX, and EQUIPS-ICU, and to engage with international partners on adaptive platform studies.

### **Building a Regional ICU Network**

Through its role in CCAA, NICRF has also contributed to the establishment of a large South and South-East Asian ICU network. Nepal's registry experience has shaped the development of a setting-adapted electronic ICU registry that is now serving as a model for other countries in the region.

### **Evaluating ICU Performance**

NICRF has contributed to the evaluation of ICU performance across the network, integrating quantitative outcomes with qualitative assessments of care delivery. Teams in Nepal worked alongside regional partners to identify barriers and enablers of quality ICU care, generating insights that are contextually relevant to South Asia. This joint work informs both local improvement efforts and regional benchmarking. In parallel, NICRF engages through the LOGIC (Linking of Global Intensive Care) network, which enables international benchmarking of ICU performance. This connection strengthens Nepal's ability to compare outcomes globally and apply best practices across diverse settings.

### **Capacity Building and Training**

NICRF collaborated in hosting and participating in workshops on quality improvement (QI skills), contributing to the training of ICU teams and enabling them to design and deliver their own improvement initiatives. NICRF investigators also collaborated and contributed to specialized training programmes that prepare sites for participation in international clinical trials, ensuring Nepal is positioned to take part in registry-embedded and adaptive platform studies coordinated through CCAA.

## Policy and Global Impact

NICRF registry data have also supported pandemic preparedness and surveillance, contributing to COVID-19 and SARI studies. Data have also informed antimicrobial stewardship and infection prevention priorities, directly aligning with CCAA's quality improvement agenda. NICRF's EQUIPS-ICU study on antibiotic prescribing demonstrates Nepal's active role in this emerging global priority. Beyond Nepal, NICRF has contributed to south-to-south collaboration, sharing registry expertise with emerging networks in Ghana, Kenya, and Ethiopia. This positions Nepal not only as a participant but as a regional leader in LMIC-driven registry science.

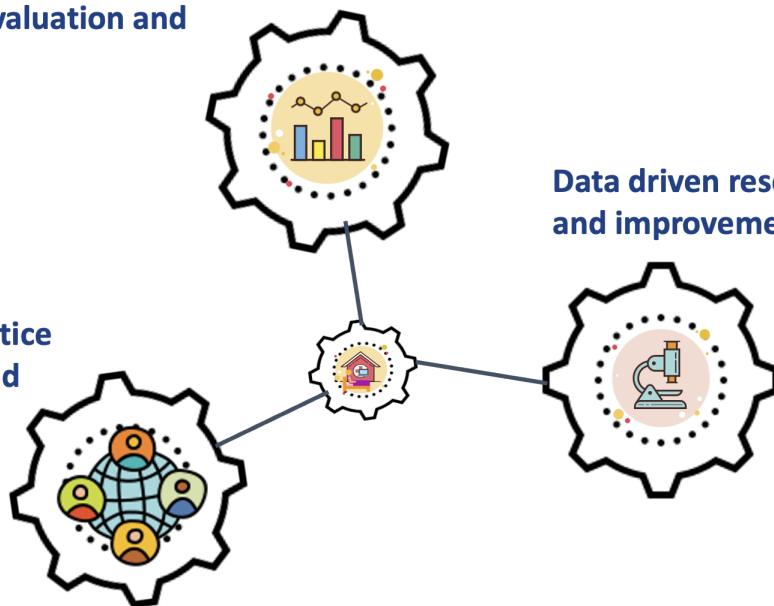
## Looking Ahead

The NICRF-CCAA collaboration continues to expand opportunities for research and capacity-building in Nepal. By embedding registry science into routine care, promoting antimicrobial stewardship, and fostering a culture of quality improvement, this partnership is shaping the future of critical care in Nepal, the wider region, and globally.

**Continuous data for evaluation and improvement**

**A community of practice skilled in research and improvement**

**Data driven research and improvement**



# NICRF Board Members

The Board upholds NICRF's core values of integrity, collaboration, innovation, and excellence in critical care research and practice in Nepal.



**Dr. Archan Adhikari**  
*President*



**Dr. Bashu Dev Parajuli**  
*Vice President*



**Dr. Kiran Raj Pandey**  
*Treasurer*



**Dr. Amit Sharma Bhattarai**  
*General Secretary*



**RN Asmita Pokhrel**  
*Executive Member*

# Advisory and Executive Team

The Advisory and Executive Team drives the day-to-day operations of NICRF, managing registry, research projects, data systems, training programs, mentorship, and stakeholder engagement.



**Dr. Diptesh Aryal**  
*Executive Director*



**Dr. Hem Raj Paneru**  
*Research Director*



**Prof. Dr. Subhash P. Acharya**  
*Advisor*



**Subekshya Luitel**  
*Project Manager*



**Dr. Sushila Paudel, RN**  
*Research Coordinator*



**RN Rakshya Bastola**  
*Research Coordinator*



**RN Sambriddhi Thapaliya**  
*Research Coordinator*



**Dr. Surendra Bhusal**  
*Data Analyst/Statistician*



**Er. Thomas Basyal**  
*Sr. Machine Learning  
Research Scientist/  
Data Engineer*



**Er. Saishna Budhathoki**  
*Sr. Machine Learning  
Research Scientist/  
Data Engineer*

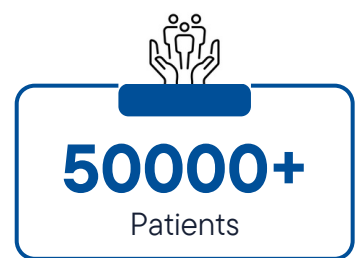
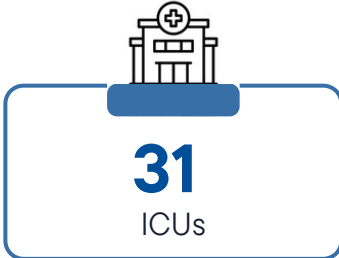
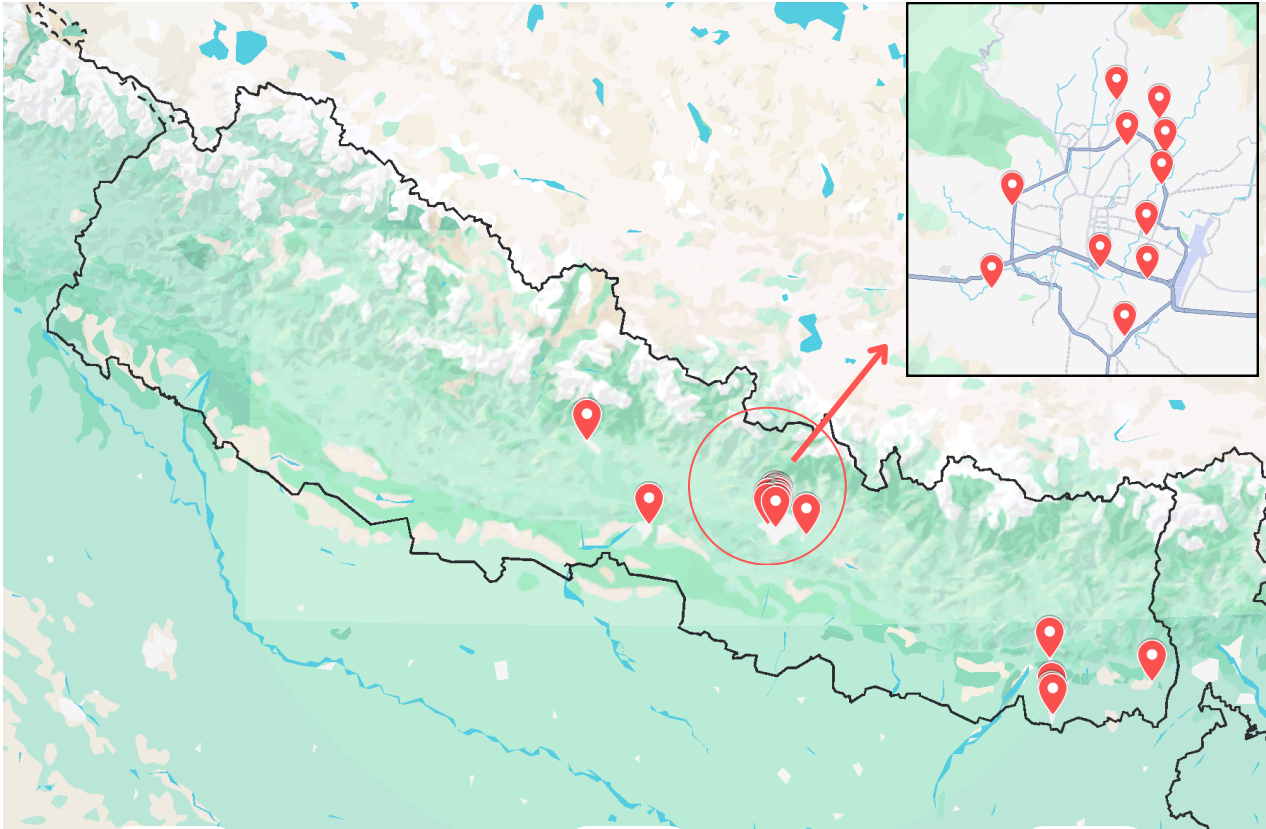


**CA Ananda Adhikari**  
*Financial Advisor*

## Former Board & Team members

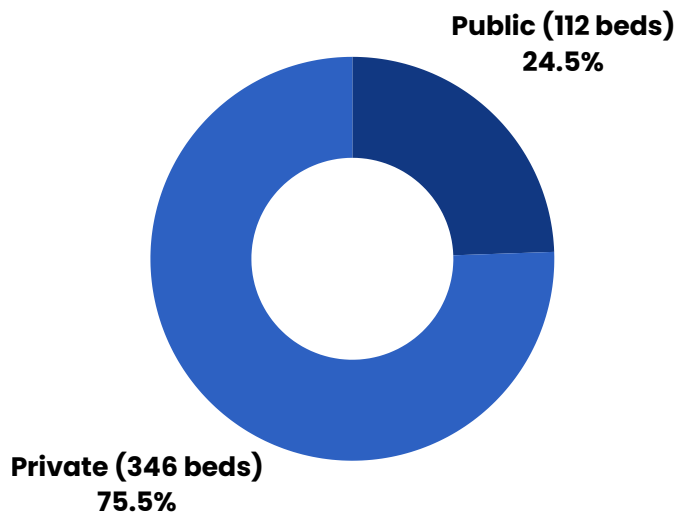
- Dr Sushil Khanal
- Dr Pradeep Raj Regmi
- Dr Isha Amatya
- RN Kanchan Koirala
- Riju Dhakal
- RN Roshni Shrestha
- Shashwat Acharya

# WHERE WE OPERATE



NICRF collaborates with a broad network of national and international institutions to advance projects, research, and capacity building in critical care. At present, it operates in 19 hospitals across Nepal, with 3 additional hospitals having participated in the past. The registry spans in 31 critical care units, covering 458 ICU beds and over 50,000 patient records. This work is supported by a dedicated network of over 150 trained research assistants, coordinators, and clinicians.

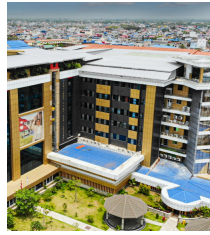
## ICU Beds Ownership:



# National Collaborators



**B & B Hospital**  
*Gwarko, Lalitpur*



**B & C Medical College Teaching  
Hospital & Research Center**  
*Birtamod, Jhapa*



**Birat Medical College  
& Teaching Hospital**  
*Biratnagar, Morang*



**Birat Nursing Home**  
*Biratnagar, Morang*



**B.P. Koirala Institute  
of Health Sciences**  
*Dharan, Sunsari*



**Chitwan Medical College  
& Teaching Hospital**  
*Bharatpur, Chitwan*



**Civil Service Hospital**  
*Minbhawan, Kathmandu*



**Dhulikhel Hospital**  
*Dhulikhel, Kavrepalanchok*



**Frontline Hospital**  
*Old Baneshwor, Kathmandu*



**Gandaki Medical College Teaching  
Hospital & Research Centre**  
*Pokhara, Kaski*



**Grande International Hospital**  
*Dhapasi, Kathmandu*



**HAMS Hospital**  
*Dhumbarahi, Kathmandu*



**Kirtipur Hospital**  
*Kirtipur, Kathmandu*



**Manmohan Memorial Medical College  
and Teaching Hospital**  
*Swayambhu, Kathmandu*



**Neuro Cardio and  
Multispecialty Hospital**  
*Biratnagar, Morang*



**Norvic International Hospital  
& Medical College**  
*Thapathali, Kathmandu*



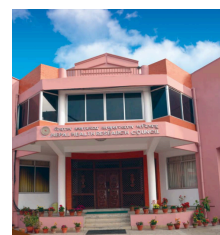
**Om Hospital and  
Research Center**  
*Chabahil, Kathmandu*



**Shahid Ganalal  
National Heart Center**  
*Bansbari Road, Kathmandu*



**Tribhuvan University  
Teaching Hospital**  
*Maharajgunj, Kathmandu*



**Nepal Health  
Research Council**  
*Ramshah Path, Kathmandu*

## FORMER PARTICIPATING HOSPITALS

- Karuna Hospital, Budhanilkantha, Kathmandu, Nepal
- Nidan Hospital, Pulchowk, Lalitpur
- Nepal Medicit Hospital, Bhaishepati, Lalitpur

## INTERNATIONAL COLLABORATORS

- Monash University, Building 3A, Wellington Road, Clayton VIC 3800, Australia
- Collaboration for Research, Implementation and Training in Critical Care In Asia and Africa (CCAA)
- Mahidol–Oxford Tropical Medicine Research Unit (MORU), Thailand Ratchawithi Road, Bangkok, Thailand
- Medical Research Institute of New Zealand (MRINZ), Wellington Hospital, Riddiford Street, Newtown, Wellington 6021, New Zealand
- Pfizer Inc., New York, NY 10001-2192, United States

## ETHICAL COMPLAINTS

All NICRF activities are conducted under formal Memoranda of Understanding (MoUs) with each participating hospital, ensuring ethical oversight and compliance. NICRF strictly adheres to ethical standards and regulations, guided by the Nepal Health Research Council (NHRC).



Figure: MoU signed with Nepal Health Research Council

# CCAA–NICRF Research Prioritisation

NICRF, as part of the CCAA network, contributes to a research prioritization exercise using the James Lind Alliance method. Patients, families, and clinicians across Asia and Africa were consulted through surveys and workshops to identify unanswered questions in intensive care. Over a thousand responses were refined into themes such as infection control, antimicrobial resistance, ICU capacity, affordable care, and long-term recovery. A final virtual workshop, with balanced representation from all groups, reached consensus on a Top 10+1 list. These priorities now guide future critical care research in resource-limited settings.

## Collaboration for Research, Implementation & Training in Critical care, Asia- Africa Priority Setting Partnership



**Respondents**  
24.9% patients & carers



**Suggestions merged & summarised**



**Questions prioritised**



**Participating country health systems**

- 1 How can cost effectiveness of critical care services in ICU be improved?
  - 2 What are the socio-economic impacts of ICU care for patients & families?
  - 3 What strategies are effective in the early recognition of the critically ill patients?
  - 4 How can ICU infection control & isolation management be improved?
  - 5 How can psychological & physical recovery following critical illness be improved?
  - 6 Which patients will most benefit from ICU care?
  - 7 How effective are known antimicrobial stewardship strategies in ICU context?
  - 8 How can outcomes of epidemic & emerging infectious diseases in ICU be improved?
  - 9 What are current perceptions & practices regarding end of life care in ICUs?
  - 10 How can effective management of shock in the ICU be improved?
  - 11 How can management and outcomes of priority endemic infectious diseases in ICU be improved?
- <https://www.jla.nihr.ac.uk/priority-setting-partnerships/critical-care-asia-and-africa/>

**Cost & economic impacts.**  
Value for providers & patients

**Infectious diseases, antimicrobial stewardship and infection control**

**Psychological outcomes for patients and families. Staff psychological safety**

**Long term functional recovery and end of life care**

**Priority Outcomes:**  
Effectiveness  
Cost benefit  
Population specific effects

**77% concordance in priorities between health care priorities and patients-family members**

## Nepal ICU Registry and Surveillance System

A registry is an organized system for collecting uniform data to evaluate outcomes and improve the quality of healthcare. Globally, ICU registries such as the UK's ICNARC and the US IMPACT project have demonstrated their value in benchmarking quality and improving outcomes. In low- and middle-income countries (LMICs) like Nepal, where ICU services remain underdeveloped, mortality is high, and resources are limited, registries play an even more critical role. The Nepal Intensive Care Research Foundation (NICRF) leads the first national ICU Registry in Nepal, systematically capturing information on ICU admissions, treatments, and outcomes. This enables hospitals to monitor performance, strengthen patient care, and support evidence-based decision-making. The NICRF ICU Registry platform also helps address the gaps by:

- Tracking ICU capacity and utilization (beds, ventilators, and admissions)
- Standardizing data collection across hospitals
- Supporting timely quality improvement initiatives
- Facilitating clinical research and trials through a reliable data platform
- Enabling collaboration among hospitals, policymakers, and international partners

The registry is adapted from a successful clinician co-designed ICU registry from Asian Critical Care network. Data collection begins upon a patient's admission and continues daily until discharge. Each participating hospital appoints a trained data collector responsible for entering the patient's information into a secure, password-protected NICRF server. The data submitted remains the property of the contributing institution, with access restricted to authorized personnel. To ensure data accuracy and reliability, the registry incorporates automated validation rules, on-site reviews, and remote checks by the central NICRF team. Data is stored locally in Nepal and is not incorporated into external databases. Beyond national use, de-identified data is shared with trusted collaborators such as the Critical Care Asia & Africa Network, Monash University, and the Mahidol Oxford Tropical Medicine Research Unit (MORU), allowing benchmarking across LMICs and contributing to large-scale global research (e.g., REMAP-CAP, Mega-ROX). The collaborative network, led by NICRF with support from Wellcome and the MORU, provides resources, training, and academic supervision to healthcare workers, and all registry activities are conducted in strict adherence to ethical principles and regulations, guided by the Nepal Health Research Council (NHRC).

The NICRF ICU Registry thus serves as a cornerstone for quality improvement, research, and policy development in critical care in Nepal, offering a sustainable model for strengthening health systems and improving outcomes for critically ill patients. We are excited to work with long-standing collaborators and forge new partnerships with those seeking to improve acute and critical care in the region. We look forward to welcoming you to the network.

## Clinical Trial : Randomized Embedded Multifactorial Adaptive Platform Trial (REMAP-CAP)

Randomized, Embedded, Multifactorial, Adaptive Platform for Community-Acquired Pneumonia (REMAP-CAP) is an international adaptive platform trial designed to improve outcomes for patients admitted to intensive care with community-acquired pneumonia. Unlike traditional clinical trials that test one or two interventions sequentially, REMAP-CAP allows multiple treatment domains to be tested simultaneously and adapts allocation based on emerging evidence, ensuring patients are more likely to receive promising treatments. With more than 300 sites in 25+ countries, REMAP-CAP is one of the largest global ICU platform trials. During the COVID-19 pandemic, the trial rapidly expanded to include a dedicated REMAP-COVID platform, which evaluated treatments specific to COVID-19. Results from these domains have influenced global management of severe respiratory infections. Nepal joined REMAP-CAP as part of its expanding critical care research capacity. Five hospitals across the country are active trial sites:

- HAMS Hospital
- Grande International Hospital
- Chitwan Medical College,
- Nepal Medciti Hospital (Former Site)
- Tribhuvan University Teaching Hospital.

By participating, Nepal contributes to groundbreaking international research, ensuring that evidence from low- and middle-income countries is represented in shaping critical care practices worldwide.

### Recruitment Status in Nepal (as of 31<sup>st</sup> August, 2025):

Intervention Domain	Total Recruited	Withdrawn	Status
Therapeutic Anticoagulation (vs. standard prophylaxis)	98	0	Recruitment stopped
Vitamin C	371	0	Recruitment stopped
Ivermectin	0	0	Recruitment stopped
Antiplatelet	131	0	Recruitment stopped
Influenza Antiviral	2	0	Ongoing
Corticosteroid	24	0	Ongoing
Total	626	0	

## Clinical Trial: The Mega Randomized Registry Trial comparing Conservative vs Liberal Oxygenation Targets (MegaRox)

The Mega Randomised Registry Trial Comparing Conservative vs. Liberal Oxygenation Targets (Mega-ROX) is the world's largest clinical trial in critical care, designed to answer an essential question: what is the safest and most effective oxygen strategy for critically ill patients requiring mechanical ventilation?

Mega-ROX is a multi-centre, randomized, registry-embedded, single-blinded clinical trial comparing conservative oxygen therapy (lower oxygen targets) with liberal oxygen therapy (higher oxygen targets) in mechanically ventilated ICU patients. Excess oxygen can cause harm, while too little oxygen can be life-threatening, yet the optimal balance remains uncertain. This trial seeks to determine the impact of these two strategies on patient survival and outcomes.

Nepal has been an active contributor to Mega-ROX through NICRF's research network. Nine hospitals across the country have participated as trial sites:

- Grande International Hospital
- HAMS Hospital
- Nepal Medicit Hospital (former site)
- Birat Nursing Hospital
- B&B Hospital
- Karuna Hospital (former site)
- Om Hospital

### Recruitment Status in Nepal (as of 31<sup>st</sup> August, 2025):

<b>Intervention Domain</b>	<b>Total recruitments</b>	<b>Total withdrawn</b>	<b>Status</b>
Conservative Oxygen Targets	242	0	Recruitment ongoing
Liberal Oxygen Targets	266	0	Recruitment ongoing
Total	508	0	

## Research Activities of the ICU Registry Network (2020–2025)

Title	Principal Investigator	Status	Journal	Year
Operationalisation of the Randomized Embedded Multifactorial Adaptive Platform for COVID-19 trials in a low and lower-middle income critical care learning health system	Dr Diptesh Aryal	Published	Wellcome Open Research	2021
Therapeutic Anticoagulation with Heparin in Critically Ill Patients with Covid-19	REMAP-CAP Investigators	Published	The New England Journal of Medicine	2021
Performance evaluation of a multinational data platform for critical care in Asia	CCAA Investigators	Published	Wellcome Open Research	2022
Effect of Antiplatelet Therapy on Survival and Organ Support-Free Days in Critically Ill Patients With COVID-19: A Randomized Clinical Trial	REMAP-CAP Investigators	Published	JAMA	2022
Development of a quality indicator set to measure and improve quality of ICU care in low- and middle-income countries	CCAA Investigators	Published	Intensive Care Medicine	2022
Incidence, risk and impact of unplanned ICU readmission on patient outcomes and resource utilisation in tertiary level ICUs in Nepal: A retrospective registry-based study	Dr Diptesh Aryal	Published	Wellcome Open Research	2022
Epidemiology of critically ill patients in intensive care units in Nepal: a retrospective observational study	Dr Diptesh Aryal	Published	Wellcome Open Research	2023
Feasibility and Acceptability of Implementing a Practice Guideline for use of High Flow Nasal Cannula in Critically Ill Patients who have Hypoxemia: a Multi-centre Study in Nepal	Dr Diptesh Aryal	Published	Wellcome Open Research	2023

## Research Activities of the ICU Registry Network (2020–2025)

Title	Principal Investigator	Status	Journal	Year
Protocol and statistical analysis plan for the mega randomised registry trial comparing conservative vs. liberal oxygenation targets in adults with sepsis in the intensive care unit (Mega-ROX Sepsis)	Mega-Rox Investigators	Published	Critical Care and Resuscitation	2023
Intravenous Vitamin C for Patients Hospitalized With COVID-19: Two Harmonized Randomized Clinical Trials	The LOVIT-COVID Investigators	Published	Journal of the American Medical Association	2023
National ICU Registries as Enablers of Clinical Research and Quality Improvement	LOGIC and JIPAD Members	Published	Critical Care Medicine	2024
Critical care services in Bagmati province of Nepal: A cross sectional survey	Dr Diptesh Aryal	Published	Wellcome Open Research	2024
Point-prevalence survey of antimicrobial use in intensive care units in Nepal	Dr. Sabin Koirala	Published	Antimicrobial Stewardship & Healthcare Epidemiology.	2024
The burden of anxiety, depression, and stress, along with the prevalence of symptoms of PTSD, and perceptions of the drivers of psychological harms, as perceived by doctors and nurses working in ICUs in Nepal during the COVID-19 pandemic; a mixed method evaluation	Dr Shirish KC	Published	BMC Health Services Research	2024
Incidence and outcome of Acute Kidney Injury in patients admitted in level III ICU in Nepal. A retrospective, observational study	Dr Suraj Adhikari	Published	Journal of Nepalese Society of Critical Care Medicine	2024

## Research Activities of the ICU Registry Network (2020–2025)

Title	Principal Investigator	Status	Journal	Year
Admission time and outcomes of patients admitted to Intensive Care Unit in a tertiary hospital in Nepal	Dr Ashmita Paudel	Published	Journal of Nepalese Society of Critical Care Medicine	2024
Empiric gram negative antibiotics usage among critically ill patients across 14 ICUs of Nepal: A registry-based retrospective cohort study	Dr Maniraj Neupane	Published	Wellcome Open Research	2024
Comparison of clinical characteristics and outcomes between COVID-19 survivors and non-survivors: a retrospective observational study	Dr Diptesh Aryal	Published	Wellcome Open Research	2024
Implementation of a registry enabled national critical care follow-up service in Nepal: Lessons learnt	Dr Hem Raj Paneru	Published	Journal of critical care	2025
Using the Observational Medical Outcomes Partnership Common Data Model for a multi-registry intensive care unit benchmarking federated analysis: lessons learned	Mega-Rox Investigators	Published	JAMIA Open	2025
Demographic, Clinical Profile, and Outcome of Guillain-Barré Syndrome Patients in ICU: A Single Center, Retrospective Study	Dr Kishor Khanal	Published	Med Phoenix	2025
Clinical characteristics of surgical patients admitted in ICUs of Nepal: A Registry based Cross sectional study	Dr Surendra Bhusal	Published	Wellcome Open Research	2025
Epidemiology of critically ill patients in Intensive Care Units in Dhulikhel Hospital, Nepal: a retrospective observational study	Dr Kalpana Khabuja	Published	Kathmandu University Medical Journal	2025
Evidence based Quality Improvement for Prescribing Stewardship in ICU (EQUIPS-ICU): protocol for type III hybrid implementation-effectiveness study	Dr Duncan Wagstaff	Published	Implementation Science	2025

## Research Activities of the ICU Registry Network (2020–2025)

<b>Title</b>	<b>Principal Investigator</b>	<b>Status</b>	<b>Journal</b>
Pattern of Use of Antibiotics and Their Consumption in An Intensive Care Unit of a Tertiary Care Hospital In Nepal	RN Resha Dangol	Completed	On Progress
Reasons for Leave Against Medical Advice from an Intensive Care Unit of a Tertiary Level Hospital	RN Karuna Thapa	Completed	On Progress
Determinants of mortality of non-ventilated patients admitted to ICU at selective hospitals of Nepal: A Secondary data analysis	Dr Raju Shrestha	Completed	On Progress
Epidemiology and outcomes of patients hospitalized with Dengue: A prospective international observational cohort study	CCAA Investigators	completed	On Progress
ICU-related Out of Pocket Expenses (ICOPE) – a multinational prospective study in Nepal	CCAA Investigators	completed	On Progress
Obstetric admissions to intensive care units in Nepal: a retrospective registry-based data analysis	Dr Bashu Dev Parajuli	Ongoing	-
Factors affecting mortality in critically ill patients at a level III ICU in Nepal: A registry based retrospective observational study	Dr Sachit Sharma	Ongoing	-
Outcomes of acute kidney injury requiring renal replacement therapy in ICU in a tertiary level teaching hospital in Nepal- a registry based retrospective study	Dr Bipin Karki	Ongoing	-
Factors associated with mortality in patients with multi drug resistant gram-negative bacterial isolates in intensive care units across Nepal: A multi-centric registry based study	Dr Sachit Sharma	Ongoing	-
Evaluating the implementation and effectiveness of nurse-led discharge checklist and ICU follow-up intervention to reduce adverse events following ICU discharge in Nepal ICUs	Dr Diptesh Aryal	Ongoing	-
A Multicenter Retrospective Analysis of Sepsis in Intensive Care Units Across Nepal (2019-2024)	Prof. Dr. Subhash P. Acharya	Ongoing	-
A Machine Learning Sepsis Prediction Algorithm for Intended Intensive Care Unit Use	NICRF & NAAMI	Ongoing	

# Operationalisation of the Randomized Embedded Multifactorial Adaptive Platform for COVID-19 trials in a low and lower-middle income critical care learning health system

Aryal D, Beane A, Dondorp AM, Green C, Haniffa R, et al. Operationalisation of the Randomized Embedded Multifactorial Adaptive Platform for COVID-19 trials in a low and lower-middle income critical care learning health system. Wellcome Open Res. 2021 Jan 28;6:14. doi: 10.12688/wellcomeopenres.16486.1. PMID: 33604455; PMCID: PMC7883321.

The Randomized Embedded Multifactorial Adaptive Platform (REMAP-CAP) adapted for COVID-19) trial is a global adaptive platform trial of hospitalised patients with COVID-19. We describe implementation in three countries under the umbrella of the Wellcome supported Low and Middle Income Country (LMIC) critical care network: Collaboration for Research, Implementation and Training in Asia (CCA). The collaboration sought to overcome known barriers to multi centre-clinical trials in resource-limited settings. Methods described focused on six aspects of implementation: i, Strengthening an existing community of practice; ii, Remote study site recruitment, training and support; iii, Harmonising the REMAP CAP- COVID trial with existing care processes; iv, Embedding REMAP CAP- COVID case report form into the existing CCA registry platform, v, Context specific adaptation and data management; vi, Alignment with existing pandemic and critical care research in the CCA. Methods described here may enable other LMIC sites to participate as equal partners in international critical care trials of urgent public health importance, both during this pandemic and beyond.

The screenshot displays the 'Remap Hospital Remap' interface. At the top, it shows patient information: Patient's name: S Test, Medical Record Number: 3456, Date: 01/12/2020, Time: 17:09:34, Length of stay: 20, Ventilator day: 1, Antibiotic day: 1, Apache II: 37, and Pneumonia. Below this is a navigation bar with tabs: Admission, Admission Assessment, SARI Admission Assessment, REMAP Admission Assessment (circled), SARI Daily Assessment, and REMAP Daily Assessment (circled). The main form contains various input fields and checkboxes for patient details and clinical status.

Patient's name* Enter field S Test	Medical record number* Enter field 3456	Age* Enter field 67	National identity number Enter field
Fee paying <input type="radio"/> Yes <input checked="" type="radio"/> No	Fee paying method [Dropdown]	Other description Enter field	Sex* <input checked="" type="radio"/> Male <input type="radio"/> Female <input type="radio"/> Intersex
Contact number Enter field	Date of hospital admission* Enter field 11/30/2020	Time of hospital admission* 17:09:30 [Clock] [now]	Date of ICU admission* Enter field 12/1/2020
Time of ICU admission* 17:09:34 [Clock] [now]	Readmission* <input type="radio"/> Yes <input checked="" type="radio"/> No	Date of previous discharge Enter field	Type of admission* <input checked="" type="radio"/> Non operative <input type="radio"/> Post operative

Connection status: true All items have been synced dd version: remap.10.15.test2 app version: 2.1.0

Figure: Integration of the REMAP trial domain specific Case Report Forms (CRF) into the CCA registry

## Therapeutic Anticoagulation with Heparin in Critically Ill Patients with Covid-19

REMAP-CAP Investigators; ACTIV-4a Investigators; ATTACC Investigators; Goligher EC, Bradbury CA, McVerry BJ, Lawler PR, Berger JS, et al. Therapeutic Anticoagulation with Heparin in Critically Ill Patients with Covid-19. *N Engl J Med.* 2021 Aug 26;385(9):777-789. doi: 10.1056/NEJMoa2103417. Epub 2021 Aug 4. PMID: 34351722; PMCID: PMC8362592.

**Background:** Thrombosis and inflammation may contribute to morbidity and mortality among patients with coronavirus disease 2019 (Covid-19). We hypothesized that therapeutic-dose anticoagulation would improve outcomes in critically ill patients with Covid-19.

**Methods:** In an open-label, adaptive, multiplatform, randomized clinical trial, critically ill patients with severe Covid-19 were randomly assigned to a pragmatically defined regimen of either therapeutic-dose anticoagulation with heparin or pharmacologic thromboprophylaxis in accordance with local usual care. The primary outcome was organ support-free days, evaluated on an ordinal scale that combined in-hospital death (assigned a value of -1) and the number of days free of cardiovascular or respiratory organ support up to day 21 among patients who survived to hospital discharge.

**Results:** The trial was stopped when the prespecified criterion for futility was met for therapeutic-dose anticoagulation. Data on the primary outcome were available for 1098 patients (534 assigned to therapeutic-dose anticoagulation and 564 assigned to usual-care thromboprophylaxis). The median value for organ support-free days was 1 (interquartile range, -1 to 16) among the patients assigned to therapeutic-dose anticoagulation and was 4 (interquartile range, -1 to 16) among the patients assigned to usual-care thromboprophylaxis (adjusted proportional odds ratio, 0.83; 95% credible interval, 0.67 to 1.03; posterior probability of futility [defined as an odds ratio <1.2], 99.9%). The percentage of patients who survived to hospital discharge was similar in the two groups (62.7% and 64.5%, respectively; adjusted odds ratio, 0.84; 95% credible interval, 0.64 to 1.11). Major bleeding occurred in 3.8% of the patients assigned to therapeutic-dose anticoagulation and in 2.3% of those assigned to usual-care pharmacologic thromboprophylaxis.

**Conclusions:** In critically ill patients with Covid-19, an initial strategy of therapeutic-dose anticoagulation with heparin did not result in a greater probability of survival to hospital discharge or a greater number of days free of cardiovascular or respiratory organ support than did usual-care pharmacologic thromboprophylaxis. (REMAP-CAP, ACTIV-4a, and ATTACC ClinicalTrials.gov numbers, [NCT02735707](#), [NCT04505774](#), [NCT04359277](#), and [NCT04372589](#)).

# Performance evaluation of a multinational data platform for critical care in Asia

Collaboration for Research, Implementation and Training in Critical Care - Asia Investigators, Pisani L, Rashan T et al. Performance evaluation of a multinational data platform for critical care in Asia [version 2; peer review: 2 approved]. Wellcome Open Res 2022, 6:251 (<https://doi.org/10.12688/wellcomeopenres.17122.2>)

## **Background:**

The value of medical registries strongly depends on the quality of the data collected. This must be objectively measured before large clinical databases can be promoted for observational research, quality improvement, and clinical trials. We aimed to evaluate the quality of a multinational intensive care unit (ICU) network of registries of critically ill patients established in seven Asian low- and middle-income countries (LMICs).

## **Methods:**

The Critical Care Asia federated registry platform enables ICUs to collect clinical, outcome and process data for aggregate and unit-level analysis. The evaluation used the standardised criteria of the Directory of Clinical Databases (DoCDat) and a framework for data quality assurance in medical registries. Six reviewers assessed structure, coverage, reliability and validity of the ICU registry data. Case mix and process measures on patient episodes from June to December 2020 were analysed.

## **Results:**

Data on 20,507 consecutive patient episodes from 97 ICUs in Afghanistan, Bangladesh, India, Malaysia, Nepal, Pakistan and Vietnam were included. The quality level achieved according to the ten prespecified DoCDat criteria was high (average score 3.4 out of 4) as was the structural and organizational performance -- comparable to ICU registries in high-income countries. Identified strengths were types of variables included, reliability of coding, data completeness and validation. Potential improvements included extension of national coverage, optimization of recruitment completeness validation in all centers and the use of interobserver reliability checks.

## **Conclusions:**

The Critical Care Asia platform evaluates well using standardised frameworks for data quality and equally to registries in resource-rich settings.

## Performance evaluation of a multinational data platform for critical care in Asia

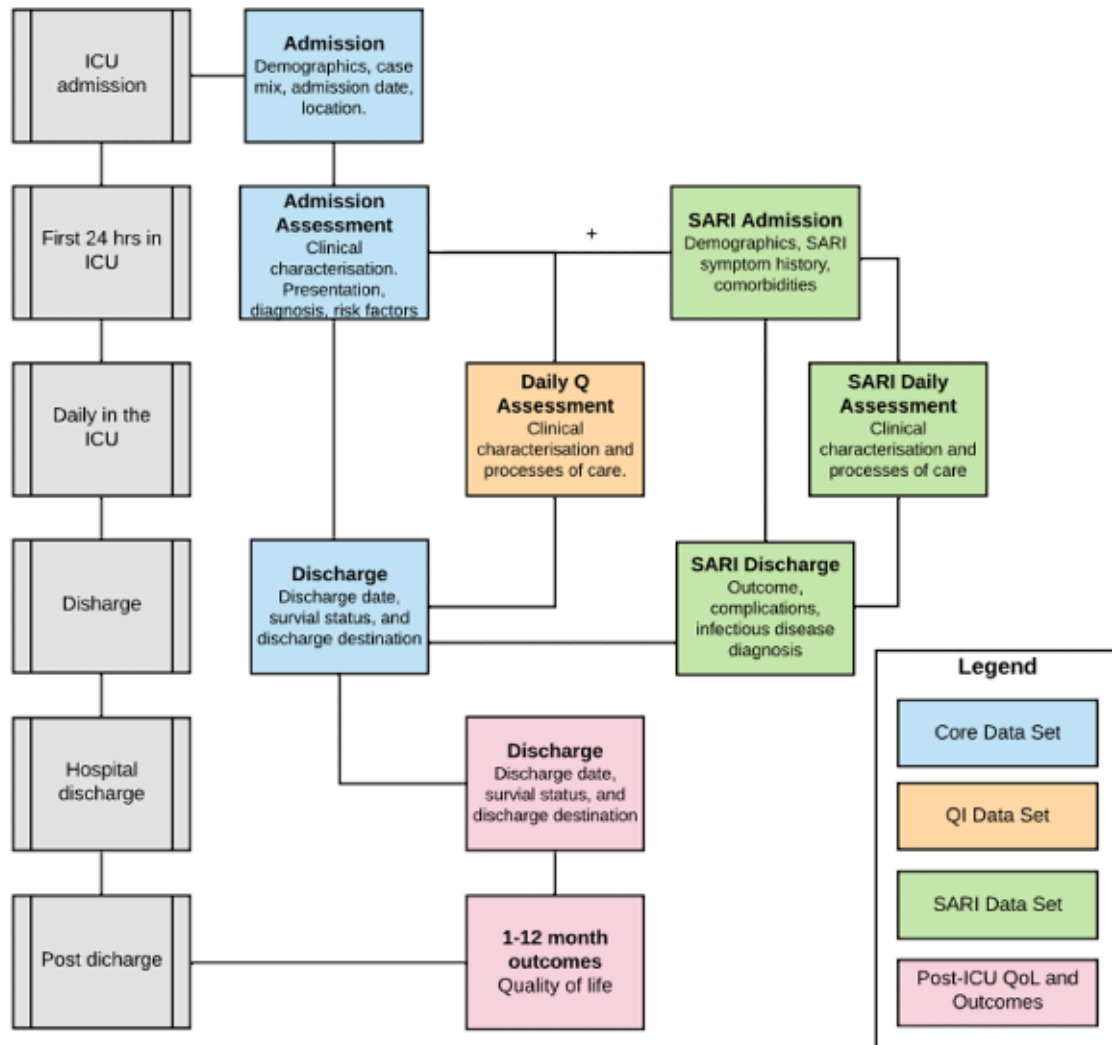


Figure: Critical Care Asia (CCA) registries modular data structure

## Effect of Antiplatelet Therapy on Survival and Organ Support–Free Days in Critically Ill Patients With COVID-19

REMAP-CAP Writing Committee for the REMAP-CAP Investigators. Effect of Antiplatelet Therapy on Survival and Organ Support–Free Days in Critically Ill Patients With COVID-19: A Randomized Clinical Trial. *JAMA*. 2022;327(13):1247–1259. doi:10.1001/jama.2022.2910

**Importance:** The efficacy of antiplatelet therapy in critically ill patients with COVID-19 is uncertain.

**Objective:** To determine whether antiplatelet therapy improves outcomes for critically ill adults with COVID-19.

**Design, Setting, and Participants:** In an ongoing adaptive platform trial (REMAP-CAP) testing multiple interventions within multiple therapeutic domains, 1557 critically ill adult patients with COVID-19 were enrolled between October 30, 2020, and June 23, 2021, from 105 sites in 8 countries and followed up for 90 days (final follow-up date: July 26, 2021).

**Interventions** Patients were randomized to receive either open-label aspirin (n = 565), a P2Y12 inhibitor (n = 455), or no antiplatelet therapy (control; n = 529). Interventions were continued in the hospital for a maximum of 14 days and were in addition to anticoagulation thromboprophylaxis.

**Main Outcomes and Measures:** The primary end point was organ support–free days (days alive and free of intensive care unit–based respiratory or cardiovascular organ support) within 21 days, ranging from –1 for any death in hospital (censored at 90 days) to 22 for survivors with no organ support. There were 13 secondary outcomes, including survival to discharge and major bleeding to 14 days. The primary analysis was a bayesian cumulative logistic model. An odds ratio (OR) greater than 1 represented improved survival, more organ support–free days, or both. Efficacy was defined as greater than 99% posterior probability of an OR greater than 1. Futility was defined as greater than 95% posterior probability of an OR less than 1.2 vs control. Intervention equivalence was defined as greater than 90% probability that the OR (compared with each other) was between 1/1.2 and 1.2 for 2 noncontrol interventions.

**Results:** The aspirin and P2Y12 inhibitor groups met the predefined criteria for equivalence at an adaptive analysis and were statistically pooled for further analysis. Enrollment was discontinued after the prespecified criterion for futility was met for the pooled antiplatelet group compared with control. Among the 1557 critically ill patients randomized, 8 patients withdrew consent and 1549 completed the trial (median age, 57 years; 521 [33.6%] female). The median for organ support–free days was 7 (IQR, –1 to 16) in both the antiplatelet and control groups (median-adjusted OR, 1.02 [95% credible interval {CrI}, 0.86-1.23]; 95.7% posterior probability of futility). The proportions of patients surviving to hospital discharge were 71.5% (723/1011) and 67.9% (354/521) in the antiplatelet and control groups, respectively (median-adjusted OR, 1.27 [95% CrI, 0.99-1.62]; adjusted absolute difference, 5% [95% CrI, –0.2% to 9.5%]; 97% posterior probability of efficacy).

Among survivors, the median for organ support-free days was 14 in both groups. Major bleeding occurred in 2.1% and 0.4% of patients in the antiplatelet and control groups (adjusted OR, 2.97 [95% CrI, 1.23-8.28]; adjusted absolute risk increase, 0.8% [95% CrI, 0.1%-2.7%]; 99.4% probability of harm).

**Conclusions and Relevance:** Among critically ill patients with COVID-19, treatment with an antiplatelet agent, compared with no antiplatelet agent, had a low likelihood of providing improvement in the number of organ support-free days within 21 days.

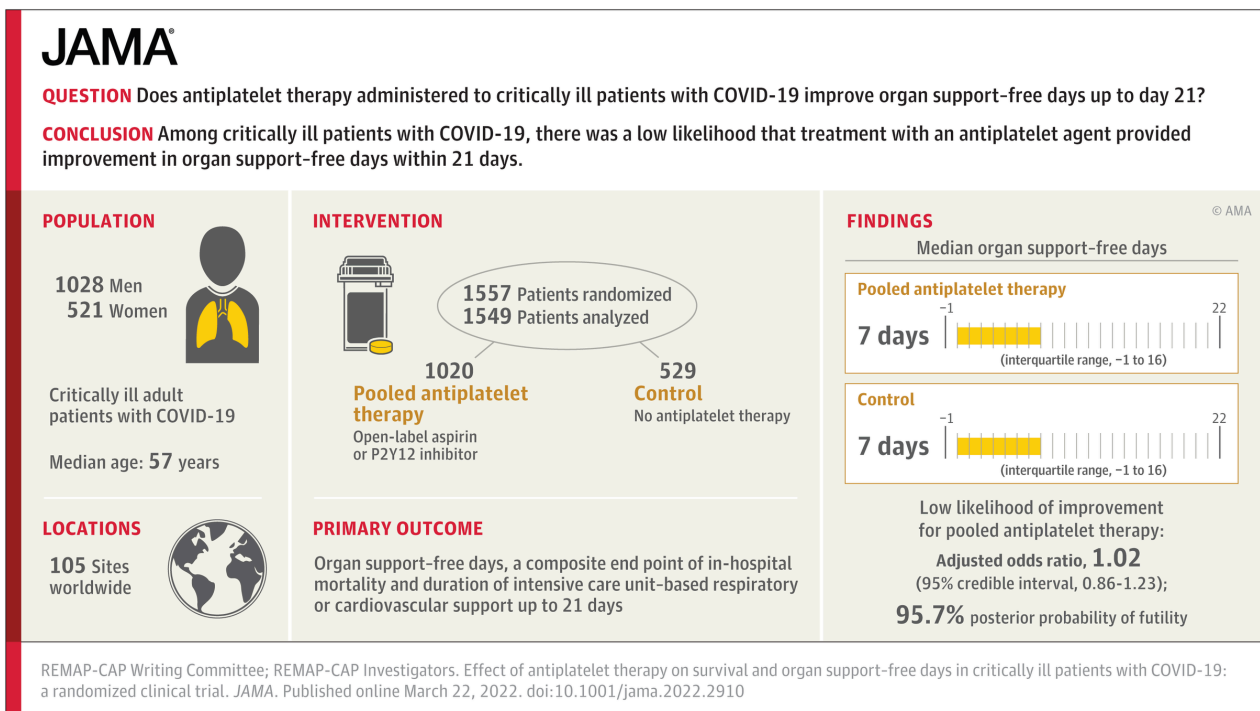


Figure: Visual Abstract

## Development of a quality indicator set to measure and improve quality of ICU care in low- and middle-income countries

Pari V; Collaboration for Research Implementation, Training in Critical Care, Asia Africa 'CCAA'. Development of a quality indicator set to measure and improve quality of ICU care in low- and middle-income countries. *Intensive Care Med.* 2022 Nov;48(11):1551-1562. doi: 10.1007/s00134-022-06818-7. Epub 2022 Sep 16. PMID: 36112158; PMCID: PMC9592651.

**Purpose:** To develop a set of actionable quality indicators for critical care suitable for use in low- or middle-income countries (LMICs).

**Methods:** A list of 84 candidate indicators compiled from a previous literature review and stakeholder recommendations were categorised into three domains (foundation, process, and quality impact). An expert panel (EP) representing stakeholders from critical care and allied specialties in multiple low-, middle-, and high-income countries was convened. In rounds one and two of the Delphi exercise, the EP appraised (Likert scale 1–5) each indicator for validity, feasibility; in round three sensitivity to change, and reliability were additionally appraised. Potential barriers and facilitators to implementation of the quality indicators were also reported in this round. Median score and interquartile range (IQR) were used to determine consensus; indicators with consensus disagreement (median < 4, IQR ≤ 1) were removed, and indicators with consensus agreement (median ≥ 4, IQR ≤ 1) or no consensus were retained. In round four, indicators were prioritised based on their ability to impact cost of care to the provider and recipient, staff well-being, patient safety, and patient-centred outcomes.

**Results:** Seventy-one experts from 30 countries (n = 45, 63%, representing critical care) selected 57 indicators to assess quality of care in intensive care unit (ICU) in LMICs: 16 foundation, 27 process, and 14 quality impact indicators after round three. Round 4 resulted in 14 prioritised indicators. Fifty-seven respondents reported barriers and facilitators, of which electronic registry-embedded data collection was the biggest perceived facilitator to implementation (n = 54/57, 95%) Concerns over burden of data collection (n = 53/57, 93%) and variations in definition (n = 45/57, 79%) were perceived as the greatest barrier to implementation.

**Conclusion:** This consensus exercise provides a common set of indicators to support benchmarking and quality improvement programs for critical care populations in LMICs.

### CCAA\_Prioritised\_ICU\_Indicators

Domain	Indicator name	Definition
Foundation	Patient to nurse ratio [40]	Number of nurses or nurse technicians by the total number of patients on a given day (24 h). Numerator: Number of nurses on duty a given day (24 h). Denominator: Number of patients on a given day (24 h). Nurse is defined as a registered nurse or registered Intensive Care Unit (ICU) technician as per national regulations, irrespective of ICU training or background.
Foundation	Intensivist staffing to bed ratio [1]	Number of Full-Time Equivalent (FTE) clinical specialists (i.e., completed speciality training) divided by the total number of ICU beds. Numerator: number of FTE consultant-grade doctors with regular daytime direct clinical care commitments, irrespective of primary medical specialty background, where they are solely responsible for patients admitted to ICU. Denominator is the total number of available ICU beds.
Foundation	Level of intensive care experience of nursing staff [41]	Percentage of nurses on a given shift with a (nationally) recognised qualification in critical care and have experience working in the ICU for at least 1 year. Numerator: Number of nurses on shift in the ICU who are qualified and have at least 1 year of ICU experience. Denominator: Total number of nurses working same shift.
Foundation	ICU medical night coverage [42]	Percentage of night shifts where a dedicated non-consultant grade doctor is immediately available to the ICU and assigned only to ICU with no other work commitment for a shift, per 100 night shifts the ICU is open. Numerator: night shifts where a dedicated (non-consultant grade doctor) resident in the ICU and assigned only to ICU with no other work commitment multiplied by 100. Denominator: available night shifts that ICU is open.
Foundation	Availability of continuous SpO <sub>2</sub> , HR and NIBP monitoring in ventilated patients	Daily proportion of mechanically ventilated patients who have access to continuous oxygen saturation monitoring, heart rate (HR) and Non-Invasive Blood Pressure (NIBP) monitoring. Expressed as a percentage. Numerator: number of ventilated patients with all of oxygen saturation, Heart rate and NIBP continuously applied on a given day. Denominator: all ventilated ICU patients on the same day. Includes both invasive and non-invasively ventilated patients.
Processes	Duration of mechanical ventilation [43]	The length of ventilatory support > 2 weeks (or 10 days if transitioning to a tracheotomy for weaning). Excludes patients who are dependent on mechanical ventilation as a result of respiratory and/or neuromuscular disorders.
Processes	Incidence of nosocomial bloodstream infection [44]	Percentage of ICU patients who fulfil criteria for nosocomial blood infection as a proportion of all ICU admissions. Defined as: recognized pathogen cultured from one or more blood cultures and organism cultured from blood is not related to an infection at another site OR fever (> 38 °C), or hypotension (MAP < 60 or administration of vasoactive therapy).
Processes	Incidence of ventilator-associated pneumonia [45]	Modified Clinical Pulmonary Infection Score definition (CPIS).
Processes	Pressure injury [46]	Percentage of ICU patients with pressure injury as a proportion of the number of patients in the ICU. Numerator: number of ICU patients identified with pressure injury (any body site). Denominator: all ICU patients. Pressure injuries categorised according to anatomical location—to be specified.
Processes	Incidence of ICU-acquired drug-resistant organism of interest (DRI) [47]	Rate of ICU patients who develop positive culture for DRI (with new clinical signs of infection) ≥ 48 h after ICU admission, not known to have a DRI before ICU admission. Expressed per 1000 patient-days at risk. Numerator: number of ICU patients who develop positive microbiological culture for DRI ≥ 48 h after ICU admission. Denominator: patient-days at risk (total ICU patient-days minus ICU days of those already known to have a DRI).
Quality Impacts	Patients discharged from ICU due to lack of funds (novel)	Percentage of ICU admissions discharged alive from ICU due to lack of funds. Numerator: number of patients discharged alive from ICU due to lack of funds in the time period. Denominator: all alive discharges from ICU.
Quality Impacts	ICU length of stay [48]	Median (Interquartile Range—IQR) number of days patients are in the ICU. Measured per care encounter. Calculated using the interval (hours) between the date/time of ICU admission and the date/time of ICU discharge. Rounded to the nearest 1 decimal place.
Quality Impacts	Hospital length of stay [49]	Number of days between hospital admission and discharge (index length of stay).
Quality Impacts	Risk-adjusted ICU mortality (Standardised Mortality Ratio) [50]	Ratio between observed and predicted deaths stratified by risk. Numerator: observed ICU mortality rate (%). Denominator: risk-adjusted predicted ICU mortality rate (%), determined using APACHE II, SAPS III, or E-TropICS.

# Incidence, risk and impact of unplanned ICU readmission on patient outcomes and resource utilisation in tertiary level ICUs in Nepal: A retrospective registry-based study

Aryal D, Paneru HR, Koirala S et al. Incidence, risk and impact of ICU readmission on patient outcomes and resource utilisation in tertiary level ICUs in Nepal: A cohort study [version 3; peer review: 1 approved, 2 approved with reservations]. Wellcome Open Res 2025, 7:272 (<https://doi.org/10.12688/wellcomeopenres.18381.3>)

**Background:** Readmissions to Intensive Care Units (ICUs) result in increased morbidity, mortality, and ICU resource utilisation (e.g. prolonged mechanical ventilation), and as such, is a widely utilised metric of quality of critical care. Most of the evidence on incidence, characteristics, associated risk factors and attributable outcomes of readmission to ICU are from studies performed in high-income countries. This study explores the determinants of risk attributable to ICU readmission in four ICUs in Kathmandu, Nepal.

**Methods:** The registry reported data on case mix, severity of illness, in-ICU interventions (including organ support), ICU outcome, and readmission characteristics. Data were captured in all adult patients admitted between September 2019 and February 2021. Population and ICU encounter characteristics were compared between those with and without readmission. Independent risk factors for readmission were assessed using univariate analysis.

**Results:** In total 2955 patients were included in the study. Absolute ICU readmission rate was 5.69 % (n=168) for all four ICUs. Median time from ICU discharge to readmission was 3 days (IQR=8,1). Of those readmitted, 29.17% (n=49) were discharged at night following their index admission. ICU mortality was higher following readmission to ICU (p=0.016) and mortality was increased further in patients whose primary index discharge was at night (p= 0.019). Primary diagnosis, age, and use of organ support in the first 24hrs of index admission were all independently attributable risk factors for readmission.

**Conclusion:** ICU readmission rates were adversely associated with significantly poorer outcomes, increased ICU resource utilisation. Clinical and organisational characteristics influenced risk of readmission and outcome.

# Epidemiology of critically ill patients in intensive care units in Nepal: a retrospective observational study

Aryal D, Thakur A, Gauli B et al. Epidemiology of critically ill patients in intensive care units in Nepal: a retrospective observational study [version 1; peer review: 1 approved, 1 approved with reservations]. Wellcome Open Res 2023, 8:180 (<https://doi.org/10.12688/wellcomeopenres.19127.1>)

**Background:** Epidemiological data on critically ill patients is crucial for understanding resource utilisation, gaps in quality of care and for supporting surveillance of endemic or emerging diseases. We report the epidemiology of critically ill patients from 17 intensive care units (ICUs) in Nepal using an established and standardised ICU registry.

**Methods:** The ICU registry data is collected prospectively and includes data on case mix, severity, organ support and outcomes. We conducted a retrospective observational study with all adult ( $\geq 18$  years) critically ill patients admitted to 17 ICUs in Nepal between September 2019 and September 2022. We report on case mix, treatment received, severity of illness, standardised mortality rates (SMR), discharge outcomes and ICU service activity. Descriptive statistics were used to report the findings.

**Results:** Of the 18603 unique admissions, 14% were operative, with 35% emergency surgeries. Patients' median age was 57 (IQR 40-71) and 59% were male. Hypertension and diabetes were common comorbidities and pneumonia accounted for 26% of all admissions. During the ICU stay, 39% of patients received mechanical ventilation, 29% received vasoactive medication and 10% received renal replacement therapy. The median predicted risk of death was 0.1 (IQR 0.1-0.3) using APACHE II and 0.2 (IQR 0.1-0.4) using eTropICS. The median SMR was 0.7 (IQR 0.5-0.8) and 0.8 (IQR 0.6-1.4) using eTropICS and APACHE II, respectively. Median length of stay was 4 days (IQR 2-7). Eighteen percent died in the ICU; of those alive at discharge, 12% went home, 84% went to another department and 3% went to another hospital. COVID-19 was the most common notifiable disease reported (12% of all admissions). Median ICU turnover was 9% (IQR 6-14) with bed capacity ranging from 43-278.

**Conclusion:** These findings should guide forecasting and service planning to ensure ICUs can optimally care for critically ill patients in Nepal.

## Feasibility and Acceptability of Implementing a Practice Guideline for use of High Flow Nasal Cannula in Critically Ill Patients who have Hypoxemia: a Multi-centre Study in Nepal

Aryal D, Koirala K, Luitel S et al. Feasibility and acceptability of implementing a practice guideline for the use of high flow nasal cannula in critically ill patients who have hypoxemia: a multi-centre study in Nepal [version 1; peer review: 1 approved, 1 approved with reservations]. Wellcome Open Res 2023, 8:196 (<https://doi.org/10.12688/wellcomeopenres.19223.1>)

Practice guidelines have the potential to improve processes and outcomes of care if strategies to facilitate implementation include attention to feasibility and acceptability in the local setting. The purpose of this study was to evaluate the feasibility and acceptability of a guideline for using a high-flow nasal cannula (HFNC) in intensive care units (ICUs) that was introduced in Nepal. We measured the proportion of eligible patients in seven ICUs who received HFNC between September 14, 2020, and December 9, 2021. We compared measures of oxygenation between patients who successfully survived HFNC and those who did not. We used an electronic survey of healthcare workers to measure the guideline's acceptability, appropriateness, and feasibility. Out of the total (7,121) patients admitted to ICUs during the study period, 4,099 (57%) were eligible and 584 (14%) of the eligible patients received HFNC during the first three days (12% before and 14% after the introduction of the guideline). The median ROX time index (integral of ROX index ( $\text{PaO}_2/\text{FiO}_2 \times \text{respiratory rate}$ ) over time) of patients who were successfully treated with HFNC ( $n=146$ ) was greater than that of patients who failed HFNC ( $n= 42$ ; 0.8 vs. 0.04;  $p=0.001$ ). Respondents rated the HFNC guideline highly for acceptability, appropriateness, and feasibility. Introduction of the guideline was associated with a small increase in the use of HFNC, but the guideline was feasible, acceptable, and appropriate for use in clinical practice.

## Protocol and statistical analysis plan for the mega randomised registry trial comparing conservative vs. liberal oxygenation targets in adults with sepsis in the intensive care unit (Mega-ROX Sepsis)

Young PJ, Arabi YM, Bagshaw SM, Bellomo R, Fujii T, Haniffa R, Hodgson CL, Vijayaraghavan BKT, Litton E, Mackle D, Nichol AD, Kasza J; Mega-ROX Management Committee; Australian and New Zealand Intensive Care Society Clinical Trials Group; Crit Care Asia and Africa Network; Irish Critical Care Clinical Trials Group; Alberta Health Services Critical Care Strategic Clinical Network. Protocol and statistical analysis plan for the mega randomised registry trial research program comparing conservative versus liberal oxygenation targets in adults receiving unplanned invasive mechanical ventilation in the ICU (Mega-ROX). *Crit Care Resusc.* 2023 Oct 19;24(2):137-149. doi: 10.51893/2022.2.OA4. PMID: 38045600; PMCID: PMC10692627.

**Background:** The effect of conservative vs. liberal oxygen therapy on 90-day in-hospital mortality in adults with sepsis receiving unplanned invasive mechanical ventilation in the intensive care unit (ICU) is uncertain.

**Objective:** The objective of this study was to summarise the protocol and statistical analysis plan for the Mega-ROX Sepsis trial.

**Design, setting, and participants:** The Mega-ROX Sepsis trial is an international randomised clinical trial that will be conducted within an overarching 40,000-patient registry-embedded clinical trial comparing conservative and liberal ICU oxygen therapy regimens. We anticipate that between 10,000 and 13,000 patients with sepsis who are receiving unplanned invasive mechanical ventilation in the ICU will be enrolled in this trial.

**Main outcome measures:** The primary outcome is in-hospital all-cause mortality up to 90 days from the date of randomisation. Secondary outcomes include duration of survival, duration of mechanical ventilation, ICU length of stay, hospital length of stay, and the proportion of patients discharged home.

**Results and conclusions:** Mega-ROX Sepsis will compare the effect of conservative vs. liberal oxygen therapy on 90-day in-hospital mortality in adults with sepsis who are receiving unplanned invasive mechanical ventilation in the ICU. The protocol and a prespecified approach to analyses are reported here to mitigate analysis bias.

## Intravenous Vitamin C for Patients Hospitalized With COVID-19: Two Harmonized Randomized Clinical Trials

The LOVIT-COVID Investigators, on behalf of the Canadian Critical Care Trials Group, and the REMAP-CAP Investigators. Intravenous Vitamin C for Patients Hospitalized With COVID-19: Two Harmonized Randomized Clinical Trials. *JAMA*. 2023;330(18):1745–1759. doi:10.1001/jama.2023.21407

**Objective:** To determine whether vitamin C improves outcomes for patients with COVID-19.

**Design, Setting, and Participants** Two prospectively harmonized randomized clinical trials enrolled critically ill patients receiving organ support in intensive care units (90 sites) and patients who were not critically ill (40 sites) between July 23, 2020, and July 15, 2022, on 4 continents.

**Interventions:** Patients were randomized to receive vitamin C administered intravenously or control (placebo or no vitamin C) every 6 hours for 96 hours (maximum of 16 doses).

**Main Outcomes and Measures:** The primary outcome was a composite of organ support–free days defined as days alive and free of respiratory and cardiovascular organ support in the intensive care unit up to day 21 and survival to hospital discharge. Values ranged from –1 organ support–free days for patients experiencing in-hospital death to 22 organ support–free days for those who survived without needing organ support. The primary analysis used a bayesian cumulative logistic model. An odds ratio (OR) greater than 1 represented efficacy (improved survival, more organ support–free days, or both), an OR less than 1 represented harm, and an OR less than 1.2 represented futility.

**Results:** Enrollment was terminated after statistical triggers for harm and futility were met. The trials had primary outcome data for 1568 critically ill patients (1037 in the vitamin C group and 531 in the control group; median age, 60 years [IQR, 50-70 years]; 35.9% were female) and 1022 patients who were not critically ill (456 in the vitamin C group and 566 in the control group; median age, 62 years [IQR, 51-72 years]; 39.6% were female). Among critically ill patients, the median number of organ support–free days was 7 (IQR, –1 to 17 days) for the vitamin C group vs 10 (IQR, –1 to 17 days) for the control group (adjusted proportional OR, 0.88 [95% credible interval {CrI}, 0.73 to 1.06]) and the posterior probabilities were 8.6% (efficacy), 91.4% (harm), and 99.9% (futility). Among patients who were not critically ill, the median number of organ support–free days was 22 (IQR, 18 to 22 days) for the vitamin C group vs 22 (IQR, 21 to 22 days) for the control group (adjusted proportional OR, 0.80 [95% CrI, 0.60 to 1.01]) and the posterior probabilities were 2.9% (efficacy), 97.1% (harm), and greater than 99.9% (futility). Among critically ill patients, survival to hospital discharge was 61.9% (642/1037) for the vitamin C group vs 64.6% (343/531) for the control group (adjusted OR, 0.92 [95% CrI, 0.73 to 1.17]) and the posterior probability was 24.0% for efficacy. Among patients who were not critically ill, survival to hospital discharge was 85.1% (388/456) for the vitamin C group vs 86.6% (490/566) for the control group (adjusted OR, 0.86 [95% CrI, 0.61 to 1.17]) and the posterior probability was 17.8% for efficacy.

**Conclusions and Relevance:** In hospitalized patients with COVID-19, vitamin C had low probability of improving the primary composite outcome of organ support–free days and hospital survival.

## National ICU Registries as Enablers of Clinical Research and Quality Improvement

Linking of Global Intensive Care (LOGIC) and Japanese Intensive care Patient Database (JIPAD) Working Group; Salluh JIF, Quintairos A, Dongelmans DA, Aryal D, Bagshaw S, Beane A, Burghi G, López MDP, Finazzi S, Guidet B, Hashimoto S, Ichihara N, Litton E, Lone NI, Pari V, Sendagire C, Vijayaraghavan BKT, Haniffa R, Pisani L, Pilcher D. National ICU Registries as Enablers of Clinical Research and Quality Improvement. *Crit Care Med.* 2024 Jan;52(1):125–135. doi:10.1097/CCM.0000000000006050.

**Objectives:** Clinical quality registries (CQRs) have been implemented worldwide by several medical specialties aiming to generate a better characterization of epidemiology, treatments, and outcomes of patients. National ICU registries were created almost 3 decades ago to improve the understanding of case-mix, resource use, and outcomes of critically ill patients. This narrative review describes the challenges, proposed solutions, and evidence generated by National ICU registries as facilitators for research and quality improvement.

**Data Sources:** English language articles were identified in PubMed using phrases related to ICU registries, CQRs, outcomes, and case-mix.

**Study Selection:** Original research, review articles, letters, and commentaries, were considered.

**Data extraction:** Data from relevant literature were identified, reviewed, and integrated into a concise narrative review.

**Data Synthesis:** CQRs have been implemented worldwide by several medical specialties aiming to generate a better characterization of epidemiology, treatments, and outcomes of patients. National ICU registries were created almost 3 decades ago to improve the understanding of case-mix, resource use, and outcomes of critically ill patients. The initial experience in European countries and in Oceania ensured that through locally generated data, ICUs could assess their performances by using risk-adjusted measures and compare their results through fair and validated benchmarking metrics with other ICUs contributing to the CQR. The accomplishment of these initiatives, coupled with the increasing adoption of information technology, resulted in a broad geographic expansion of CQRs as well as their use in quality improvement studies, clinical trials as well as international comparisons, and benchmarking for ICUs.

**Conclusion:** ICU registries have provided increased knowledge of case-mix and outcomes of ICU patients based on real-world data and contributed to improve care delivery through quality improvement initiatives and trials. Recent increases in adoption of new technologies (i.e., cloud-based structures, artificial intelligence, machine learning) will ensure a broader and better use of data for epidemiology, healthcare policies, quality improvement, and clinical trials.

## Critical care services in Bagmati province of Nepal: A cross sectional survey

Aryal D, Luitel S, Paudel S et al. Critical care services in Bagmati province of Nepal: A cross sectional survey [version 4; peer review: 6 approved, 1 approved with reservations]. Wellcome Open Research 2025, 8:575 (<https://doi.org/10.12688/wellcomeopenres.19932.4>)

**Background:** This study aimed to assess the current status of critical care services in 13 districts of Bagmati Province in Nepal, with a focus on access, infrastructure, human resources, and intensive care unit (ICU) services.

**Methods:** A cross-sectional survey was conducted among healthcare workers employed in 87 hospitals having medical/surgical ICUs across Bagmati Province. Data were collected through structured questionnaires administered via face-to-face and telephone surveys. Descriptive analysis was used for data analysis, involving frequencies and percentages.

**Results:** From 87 hospitals, a total of 123 ICUs were identified in the province, providing 1167 beds and 615 functioning ventilators. The average ICU bed availability per 100,000 population was 19, ranging from 3.6 in Makwanpur to 33.9 in Kathmandu. Out of 13 districts, 95% of beds were concentrated in just four districts, while six had no ICU facilities. Of the available facilities, 69.9% were owned by private entities. One-to-one nurse-to-ventilated bed ratio was maintained by 63.4% of ICUs during daytime, and 62.6% at nighttime. Furthermore, 74.8% of ICUs had consultants trained in critical care medicine. While essential equipment availability was higher in Bagmati province, gaps existed in the availability of oxygen plants and isolation rooms. Similarly, many ICUs offered continuous medical education and cardiopulmonary resuscitation (CPR) training, but improvements were necessary in clinical audits, antibiotic stewardship programs, and research engagement.

**Conclusion:** Disparities in critical care resources were evident across districts in Bagmati Province, highlighting the need for a balanced and decentralized approach to ensure equitable access to care. Although there were disparities, numerous ICUs were effectively carrying out multiple critical care procedures. This study suggests conducting a nationwide mapping of ICU resources, prioritizing infrastructure development, optimizing resource allocation, and establishing national protocols.

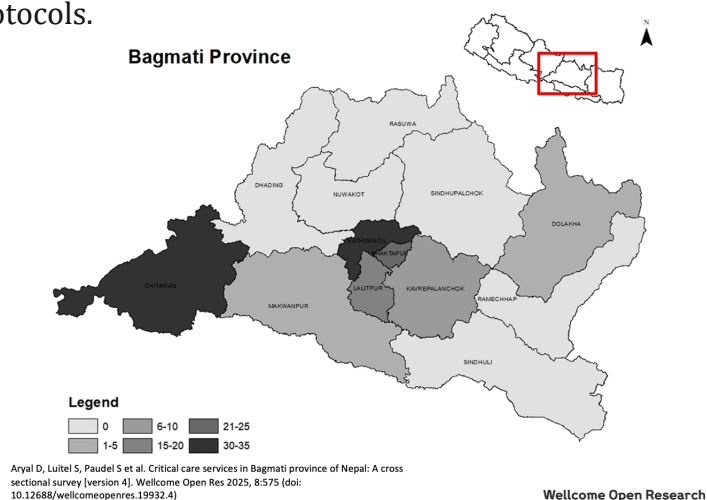


Figure: ICU distribution by administrative regions

## Point-prevalence survey of antimicrobial use in intensive care units in Nepal

Koirala S, Dahal A, Paneru HR, et al. Point-prevalence survey of antimicrobial use in intensive care units in Nepal. *Antimicrobial Stewardship & Healthcare Epidemiology*. 2024;4(1):e78. doi:10.1017/ash.2024.83

### **Objective:**

This study aimed to investigate the prevalence and practices of antibiotic use in intensive care units (ICUs) in Nepal and to identify potential areas for implementing antimicrobial stewardship programs.

### **Design:**

A point prevalence survey was conducted to characterize and quantify the antimicrobial utilization in level III ICUs of Nepal.

### **Methods:**

Data on antibiotic prescription rates, reasons for prescribing antibiotics, and prescribing practices were collected and analyzed. The prevalence of antimicrobial resistance was also assessed.

### **Results:**

The antibiotic prescribing rate was found to be very high, with 92.85% of patients in ICU on antibiotics. Prolonged surgical prophylaxis was the most common reason for prescribing antibiotics. Empirical therapy accounted for 67.5% of all antibiotic prescriptions. Prescribing practices were poor, with low adherence to guidelines and best practices. Broad-spectrum antibiotics were commonly used even for surgical prophylaxis or community-acquired infections. High resistance was observed against commonly used antibiotics.

### **Conclusions:**

The study underscores the urgent need for effective antimicrobial stewardship programs in ICUs of Nepal. Implementing robust stewardship programs could help optimize antibiotic utilization, improve patient outcomes, and combat the global threat of antimicrobial resistance. The findings serve as a stepping stone toward understanding and improving antibiotic prescribing practices in ICUs of Nepal.

## **The burden of anxiety, depression, and stress, along with the prevalence of symptoms of PTSD, and perceptions of the drivers of psychological harms, as perceived by doctors and nurses working in ICUs in Nepal during the COVID-19 pandemic; a mixed method evaluation**

KC, S., Gooden, T.E., Aryal, D. et al. The burden of anxiety, depression, and stress, along with the prevalence of symptoms of PTSD, and perceptions of the drivers of psychological harms, as perceived by doctors and nurses working in ICUs in Nepal during the COVID-19 pandemic; a mixed method evaluation. *BMC Health Serv Res* 24, 450 (2024). <https://doi.org/10.1186/s12913-024-10724-7>

The COVID-19 pandemic resulted in significant physical and psychological impacts for survivors, and for the healthcare professionals caring for patients. Nurses and doctors in critical care faced longer working hours, increased burden of patients, and limited resources, all in the context of personal social isolation and uncertainties regarding cross-infection. We evaluated the burden of anxiety, depression, stress, post-traumatic stress disorder (PTSD), and alcohol dependence among doctors and nurses working in intensive care units (ICUs) in Nepal and explored the individual and social drivers for these impacts. We conducted a mixed-methods study in Nepal, using an online survey to assess psychological well-being and semi-structured interviews to explore perceptions as to the drivers of anxiety, stress, and depression. Participants were recruited from existing national critical care professional organisations in Nepal and using a snowball technique. The online survey comprised of validated assessment tools for anxiety, depression, stress, PTSD, and alcohol dependence; all tools were analysed using published guidelines. Interviews were analysed using rapid appraisal techniques, and themes regarding the drivers for psychological distress were explored. 134 respondents (113 nurses, 21 doctors) completed the online survey. Twenty-eight (21%) participants experienced moderate to severe symptoms of depression; 67 (50%) experienced moderate or severe symptoms of anxiety; 114 (85%) had scores indicative of moderate to high levels of stress; 46 out of 100 reported symptoms of PTSD. Compared to doctors, nurses experienced more severe symptoms of depression, anxiety, and PTSD, whereas doctors experienced higher levels of stress than nurses. Most (95%) participants had scores indicative of low risk of alcohol dependence. Twenty participants were followed up in interviews. Social stigmatisation, physical and emotional safety, enforced role change and the absence of organisational support were perceived drivers for poor psychological well-being. Nurses and doctors working in ICU during the COVID-19 pandemic sustained psychological impacts, manifesting as stress, anxiety, and for some, symptoms of PTSD. Nurses were more vulnerable. Individual characteristics and professional inequalities in healthcare may be potential modifiable factors for policy makers seeking to mitigate risks for healthcare providers.

## Incidence and outcome of Acute Kidney Injury in patients admitted in level III ICU in Nepal. A retrospective, observational study

Adhikari, S., Koirala, S., Pandey, S., & Karki, A. (2024). Incidence and outcome of Acute Kidney Injury in patients admitted in a level III ICU in Nepal: A retrospective, observational study. *Journal of Nepalese Society of Critical Care Medicine*, 2(2), 8–12. <https://doi.org/10.3126/jnsccm.v2i2.67666>

**Background and aims:** Acute kidney injury (AKI) is associated with increased mortality, morbidity, and hospital stay. AKI is seen in 20-60% of patients admitted to the intensive care unit (ICU), and mortality is as high as 50% if not managed timely. Burden of AKI is more in developing countries as compared to the developed ones. There is a paucity of published literature regarding incidence and outcome of AKI in critically ill patients from lower-middle income countries like Nepal. This study aimed to determine the incidence and outcome of AKI in patients admitted to a level III ICU in Nepal.

**Methods:** This observational study was conducted in the ICU of Hospital for Advanced Medicine and Surgery (HAMS) Hospital, Kathmandu, Nepal. Data over a period of one year was curated from ICU registry. Eligible patients were screened and the incidence of AKI in ICU admitted patients along with their outcomes (length of ICU stay, need of RRT and ICU mortality) were observed.

**Results:** Among 881 patients admitted to the ICU, 660 patients were enrolled for analysis. Of them, 14.2% of patients developed AKI during ICU stay, out of which 5.3% received RRT and 19.1% died. The median (IQR) length of ICU stay for those who developed AKI was 4 (3-7) days. The 34.0% patients who developed AKI had sepsis.

**Conclusion:** Patients admitted to ICU in this study have high incidence of AKI. In patients who developed AKI, sepsis was the leading cause of ICU admission.

## Admission time and outcomes of patients admitted to intensive care unit in a tertiary hospital in Nepal: an observational study

Paudel, A., Acharya, S. P., Shrestha, G. S., Shrestha, P. S., Paneru, H. R., & Sharma, S. (2024). Admission time and outcomes of patients admitted to intensive care unit in a tertiary hospital in Nepal: an observational study. *Journal of Nepalese Society of Critical Care Medicine*, 2(1), 4–9. <https://doi.org/10.3126/jnsccm.v2i1.62092>

**Background and aims:** Time of admission to the intensive care unit may have a significant impact on the outcome. However, there is scarcity of published literature regarding admission hours and outcomes from low-income and middle-income countries like Nepal. The aim of this study was to compare the outcome of patients admitted to intensive care units at office hours and off hours.

**Methods:** This observational study was conducted in the intensive care units of Tribhuvan University Teaching Hospital, Kathmandu, Nepal. Data from 1 January 2020 to 31 December 2022, over a period of three years, were curated from the ICU registry. Patients were divided into two groups based on the time of admission to intensive care unit: 1) office hours (from 9:00 am till 4:59 pm that day) and 2) off hours (5:00 pm to 8:59 am next day, including Saturdays and public holidays).

**Results:** Among 3733 patients admitted to ICU, 3242 patients were enrolled for analysis. There were no significant differences in mortality rate as well as average duration of mechanical ventilation between two groups. The average length of stay was however longer by 1 day among patients admitted during off hours compared to office hours.

**Conclusion:** The time of admission in ICU has no significant effect on the outcome of patients. Off hour ICU admission is not associated with poor patient outcomes compared to office hours.

## Empiric gram negative antibiotics usage among critically ill patients across 14 ICUs of Nepal: A registry-based retrospective cohort study

Neupane M, Bhusal S, Amatya I et al. Empiric gram-negative antibiotics usage among critically ill patients across 13 ICUs of Nepal: A retrospective cohort study [version 2; peer review: awaiting peer review]. Wellcome Open Res 2024, 9:573 (<https://doi.org/10.12688/wellcomeopenres.22948.2>)

**Background:** This study aims to investigate the associations between patient characteristics and the receipt of empiric broad-spectrum gram-negative antimicrobials among adult patients admitted to ICUs in Nepal.

**Methods:** A retrospective cohort study was conducted in 13 ICUs in Nepal between January 1st, 2020, and December 31st, 2022. Empiric antibiotic use was defined as receiving gram-negative antibiotics within the first two days of ICU admission without evidence of infection from culture. Patient characteristics between patients receiving narrow-spectrum antibiotics and broad-spectrum gram-negative antibiotics were compared. Continuous variables were compared using mean and standard deviation, with mean differences and 95% confidence intervals calculated. Categorical variables were compared using the chi-square test. A multi-level multivariable regression model assessed the relationship between selected variables and broad-spectrum antibiotic usage, treating admitting ICU as a random factor.

**Results:** Among 12,349 eligible patients, 8720 (70.6%) received Empiric gram-negative antibiotics. Of those, 3240 (37.15%) received empiric narrow-spectrum gram-negative antibiotics, and 5480 (62.8%) received Empiric broad-spectrum gram-negative antibiotics. Patients receiving broad-spectrum gram-negative antibiotics were older (57.4 vs 53.8 yrs); had higher mean heart rates (97.3 vs 89.5 bpm), respiratory rates (24 vs 21.9), a fraction of inspired oxygen (50% vs 40%), blood sugar levels (163.4 vs 153.9 mg/dl), total leucocyte counts (12,685 vs 10,647 cells/cu mm) and serum creatinine (2.06 vs 1.03 umol/l) compared to narrow spectrum antibiotics. Similarly, patients receiving broad-spectrum gram-negative antibiotics had lower systolic blood pressure (122.6 vs 126.5 mm Hg), partial pressure of oxygen (96.7 vs 105.3), and pH (7.33 vs 7.36) compared to narrow-spectrum antibiotics. On multivariable regression; patients with readmission, cardiac support, and mechanical ventilation were more likely to receive broad-spectrum antibiotics.

**Conclusion:** The rate of empiric broad-spectrum gram-negative antibiotics usage in intensive care units is significantly high and associated with features of increased severity of illness.

## Comparison of clinical characteristics and outcomes between COVID-19 survivors and non-survivors: a retrospective observational study

Aryal D, Bhattarai S, Paudel S et al. Comparison of clinical characteristics and outcomes between COVID-19 survivors and non-survivors: a retrospective observational study [version 2; peer review: 1 approved]. Wellcome Open Res 2024, 9:204 (<https://doi.org/10.12688/wellcomeopenres.20919.2>)

**Background:** To compare the clinical characteristics of COVID-19 survivors and non-survivors who were transferred from general wards to the critical care units in four tertiary hospitals of Nepal.

**Methods:** This study utilized electronic data from the National Intensive Care Unit (ICU) registry managed by the Nepal Intensive Care Research Foundation (NICRF). A retrospective observational study was conducted among 78 eligible COVID-19 patients admitted to the intensive care units of four different hospitals between 2020 and 2022. The Mann-Whitney U test was used to compare each continuous variable between the survivors and non survivors, while Pearson's chi-squared test was used to examine the association between each categorical variable and outcome.

**Results:** Among 78 cases of COVID-19 studied, 29 (37.1%) had died, and 49 (62.8%) had recovered. The median age of the patient was 57.5 years, with a higher percentage of males (66.6%). Hypertension (41%) and diabetes (26.9%) were common comorbidities, whereas pneumonia (41%) and acute respiratory distress syndrome (19.2%) were common complications. Most patients required oxygen therapy (96.2%). Corticosteroids (76.9%) and anticoagulants (83.3%) were commonly administered medications. Median of mean arterial pressure was 85 mm Hg [ IQR- 79.2 - 99.5] in non-survivors and 93.3 mm Hg [IQR- 86.6 - 102.6 ] in survivors which was significantly different between the two groups ( $p=0.04$ ). Nine of the patients had cardiac dysfunction on ICU admission, of which none survived ( $p=0.001$ ). Out of ten patients requiring inotropes or vasopressors, only two survived ( $p=0.001$ ).

**Conclusions:** Non-survivor COVID patients had lower mean arterial pressure on admission to intensive care units. A higher proportion of patients with cardiac dysfunction and requiring inotropes or vasopressors could not survive.

## Implementation of a registry enabled national critical care follow-up service in Nepal: Lessons learnt

Paneru HR, Gauli B, Aryal D, Khanal K, Koirala S, Acharya SP, et al. Implementation of a registry enabled national critical care follow-up service in Nepal: Lessons learnt. *Journal of Critical Care*. 2026 Feb;91:155213. <https://doi.org/10.1016/j.jcrc.2025.155213>

Survivors of critical illness often face long-term physical, psychological, and cognitive complications, yet structured follow-up services are lacking in low- and middle-income countries like Nepal. This study aimed to design, implement, and evaluate a registry-enabled national critical care follow-up service tailored to the Nepalese context.

The NICRF integrated a telephone-based follow-up service into its existing national ICU registry. Co-designed with intensivists, nurses, psychologists, researchers, and patient representatives, the service monitored recovery using validated tools: Hospital Anxiety and Depression Scale (HADS), Impact of Events Scale-Revised (IES-R), EQ-5D-5L, and Short-IQCODE. Assessments were scheduled at 30, 90, 180, and 365 days post-discharge. ICU nurses recruited patients and collected baseline data, while centralized clinician-researchers conducted follow-up calls. A clinical psychologist was available for referrals. Between May–November 2024, seven ICUs participated, enrolling 761 patients from 913 eligible cases. Follow-up completion was 80% among reachable patients, with loss to follow-up of 19.9% at 30 days and 22.2% at 90 days. Three patients required onward referral to community psychiatric facilities. Integration within the NICRF registry enabled real-time monitoring, training, and data quality checks.

This registry-embedded, telephone-based follow-up service is feasible, resource-efficient, and scalable in a resource-limited setting. It provides a replicable model for improving ICU survivorship care in Nepal and similar contexts by capturing long-term outcomes and facilitating referrals. Further evaluation is warranted to inform interventions that mitigate psychological distress and enhance quality of life among ICU survivors.

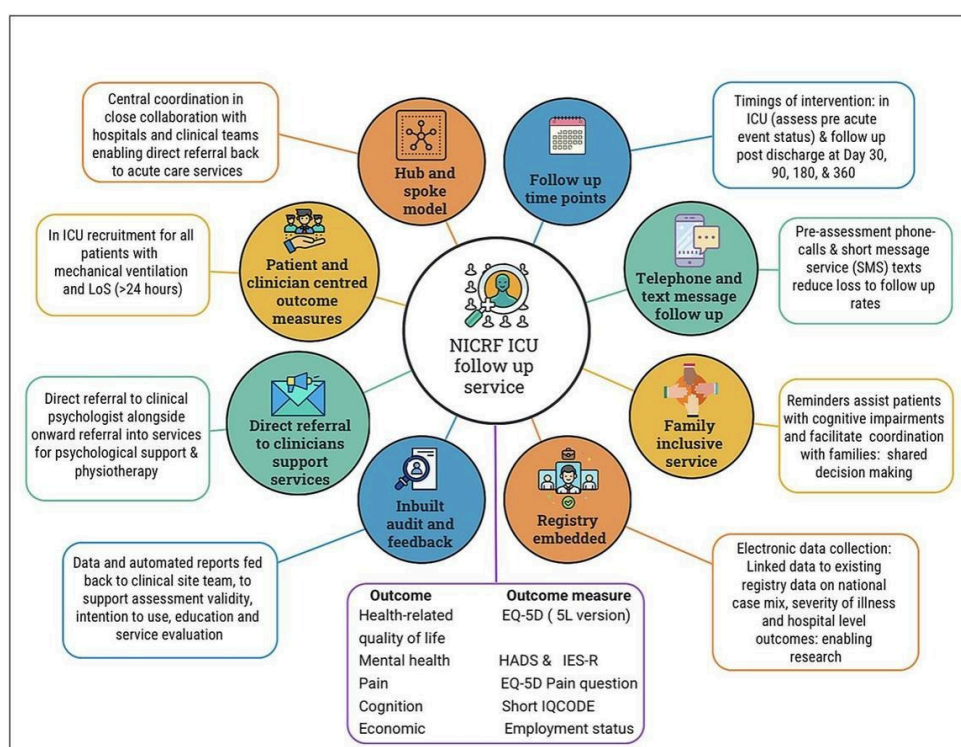


Figure: Infographic summary of ICU follow up service in Nepal

# Using the Observational Medical Outcomes Partnership Common Data Model for a multi-registry intensive care unit benchmarking federated analysis: lessons learned

Aasiyah Rashan, Daniel P Püttmann, Nicolette F de Keizer, Dave A Dongelmans, Ronald Cornet, Otavio Ranzani, Wangari Waweru-Siika, Matthew Smith, Steve Harris, Abi Beane, Ferishta Bakhshi-Raiez, Collaboration for Research, Implementation and Training in Critical Care—Asia and Africa Investigators, and the Dutch National Intensive Care Registry, Using the Observational Medical Outcomes Partnership Common Data Model for a multi-registry intensive care unit benchmarking federated analysis: lessons learned, JAMIA Open, Volume 8, Issue 4, August 2025, ooaf052, <https://doi.org/10.1093/jamiaopen/ooaf052>

## Objective

Federated analysis is a method that allows data analysis to be performed on similar datasets without exchanging any data, thus facilitating international research collaboration while adhering to strict privacy laws. This study aimed to evaluate the feasibility of using federated analysis to benchmark mortality in 2 critical care quality registry databases converted to the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM), describing challenges to and recommendations for performing federated analysis on data transformed to OMOP CDM.

## Materials and Methods

To identify as many challenges as possible and to be able to complete the benchmarking phase, a 2-step approach was taken during implementation. The first step was a naive implementation to allow challenges to surface naturally; the second step was developing solutions for the encountered challenges. Expected patient mortality risk was calculated by applying the Acute Physiology and Chronic Health Evaluation II (APACHE II) model to data from OMOP CDM databases containing adult ICU encounters between July 1, 2019 and December 31, 2022. An analysis script was developed to calculate comparable, registry level standardized mortality ratios. Challenges were recorded and categorized into predefined categories: “data preparation,” “data analysis plan,” and “data interpretation.” Challenges specific to the OMOP CDM were further categorized using published steps from an existing generic harmonization process.

## Results

A total of 7 challenges were identified, 4 of which were related to data preparation, 1 to data analysis, and 1 to data interpretation. Out of all 7 challenges, 4 stemmed from decisions made during the implementation of OMOP CDM. Several recommended solutions were distilled from the naive approach.

## Discussion

Federated analysis facilitated by a CDM is a feasible option for critical care quality registries. However, future analysis is influenced by decisions made during the CDM implementation process. Thus, prior publication of data dictionaries and the use of metadata to communicate data handling and data source classification during CDM implementation will improve the efficiency and accuracy of subsequent analysis.

# Demographic, Clinical Profile, and Outcome of Guillain-Barré Syndrome Patients in ICU: A Single Center, Retrospective Study

Khanal, K., Poudel, S., Shrestha, P., & Aryal, S. (2025). Demographic, Clinical Profile, and Outcome of Guillain-Barré Syndrome Patients in ICU: A Single Center, Retrospective Study. *Med Phoenix*, 10(1), 9–14.  
<https://doi.org/10.3126/medphoenix.v10i1.82570>

## Introduction:

Guillain-Barré Syndrome (GBS) is an acute, immune-mediated peripheral neuropathy causing progressive muscle weakness and, in severe cases, respiratory failure requiring intensive care unit (ICU) admission. The study was conducted with the aim to analyze the demographic profile, clinical presentation, treatment modalities, and outcomes of GBS patients admitted to a tertiary-level ICU in Nepal.

## Materials and Methods:

A retrospective study was conducted over five years (January 2020 to December 2024). The data were obtained through the National Intensive Care Registry Foundation (NICRF) platform.

## Results:

A total of 30 patients were included. Males constituted the majority of the study population (83.4%, n=25), with a mean age of 52.97 years (SD=22.36), mostly in the age group of 61–80 years. Clinically, 83.3% (n=25) presented with progressive limb weakness, while 23% (n=7) had sensory deficits or other symptoms. Acute inflammatory demyelinating polyradiculoneuropathy (AIDP) was present in 50% (n=15) of patients, followed by acute motor axonal neuropathy (AMAN) 26.7% (n=8), acute motor and sensory axonal neuropathy (AMSAN) 13.3% (n=4), and Miller Fisher Syndrome 10% (n=3). Respiratory tract infections 23.3% (n=7) and diarrhea 16.67% (n=5) were the most common antecedent events. Treatment primarily involved intravenous immunoglobulin (IVIg) 66.67% (n=20), while 33.33% (n=10) required mechanical ventilation (mean duration 8.5 days). Mortality rate was 6.7% (n=2).

## Conclusion:

This study shows a male predominance, with AIDP as the primary GBS subtype. The most common type of treatment administered was intravenous immunoglobulin (IVIg).

# Clinical characteristics of surgical patients admitted in ICUs of Nepal: A Registry based Cross sectional study

Bhusal S, Amatya I, Paudel S et al. Clinical Characteristics and Outcomes of Surgical Patients Admitted to Intensive Care Units. [version 1; peer review: awaiting peer review]. Wellcome Open Res 2025, 10:199 (<https://doi.org/10.12688/wellcomeopenres.23478.1>)

**Background:** Patients are often admitted to intensive care units (ICUs) after surgery for advanced monitoring and management that are usually unavailable in general wards. This study aimed to examine the characteristics of postoperative patients admitted to ICUs and their outcomes.

**Methods:** A retrospective observational study was conducted across 18 ICUs in Nepal from January 1, 2020, to December 31, 2023. Data were obtained from the registry maintained by the Nepal Intensive Care Research Foundation (NICRF). Surgical patients aged over 16 years with ICU stays of at least 8 hours were included. Demographics, types of surgical procedures, comorbidities, readmission rates, and mortality rates were analyzed. Continuous variables were reported as mean  $\pm$  standard deviation or median with interquartile range, while categorical variables were expressed as frequencies and percentages.

**Results:** Of the 29,148 patients admitted to the ICUs during the study period, 4,755 (16.31%) were surgical patients, and 4,509 were included in the analysis after exclusions. Among these, 2,973 (65.9%) were admitted directly from operating theaters, while 1,080 (23.9%) were admitted from wards. The average vital signs and blood test results were within normal ranges. The readmission rate was higher for patients admitted from wards (11%) compared to those from operating theaters (3.66%). Overall mortality for surgical patients was 9%, with significantly higher mortality among those admitted from wards (15.8%) than from operating theaters (6%). Surgical patients constituted a substantial proportion of ICU admissions.

**Conclusion:** Patients admitted directly from operating theaters experienced better outcomes, including lower readmission and mortality rates, compared to those admitted from wards. These findings underscore the need for targeted interventions to improve outcomes for patients transferred from wards.

## Epidemiology of critically ill patients in Intensive Care Units in Dhulikhel Hospital, Nepal: a retrospective observational study

Kharbuja C, Ranjit K, Aryal S, Sapkota D, Paudyal P, Bajracharya G. Epidemiology of Critically Ill Patients in Intensive Care Units in Dhulikhel Hospital, Nepal: a retrospective observational study. Kathmandu Univ Med J. 2025. <http://kumj.com.np/issue/90/216-221.pdf>

### **Background:**

Critical care involves the management of acutely ill patients at risk of organ failure. The burden of critical illness is a major public health concern, particularly in low and middle income countries like Nepal where access to intensive care services is limited.

### **Objective:**

To identify the clinical profile of patients admitted to the Level III Intensive Care Unit at Dhulikhel Hospital.

### **Method:**

Data over a period of six months were collected from the ICU registry. Severity and mortality risks were assessed using APACHE II and eTropics scoring systems. Clinical profiles and outcomes were analyzed using SPSS version 25. An independent samples t test was used to compare continuous variables between two independent groups. A p value < 0.05 was considered statistically significant.

### **Result:**

A total of 486 patients were included in the study, of whom 57% were male. The median age was 55 years (IQR: 41-69). Most patients were admitted from the emergency room (52.7%). Patients with medical conditions had a higher ICU admission compared to surgical patients. The majority of patients (63.6%) were transferred to the ward followed by discharge to home (16.2%). Non routine discharges included treatment withdrawal in 89 (18.3%) and patient leaving against medical advice 53 patients (11%). The overall mortality rate was 11.3%.

### **Conclusion:**

This study shows that most admissions were male, with median age of 55 years and medical cases were more prevalent than surgical cases. The observed mortality rate may underestimate mortality due to high rate of treatment withdrawal discharges.

## Evidence based QUality Improvement for Prescribing Stewardship in ICU (EQUIPS-ICU): protocol for type III hybrid implementation-effectiveness study

Wagstaff, D., Amuasi, J., Arfin, S., Aryal D et al. Evidence based QUality Improvement for Prescribing Stewardship in ICU (EQUIPS-ICU): protocol for type III hybrid implementation-effectiveness study. *Implementation Sci* 20, 12 (2025). <https://doi.org/10.1186/s13012-024-01413-4>

**Background:** Approximately half of all antimicrobial prescriptions in intensive care units (ICUs) may be inappropriate, including those prescribed when not needed, in unnecessary combinations or for longer durations than needed. Inappropriate prescribing is costly, exposes patients to unnecessary side-effects and drives population-level antimicrobial resistance, the prevalence and consequences of which are greatest in low- and middle-income countries. However, the implementation of interventions to improve the appropriateness of antimicrobial prescribing has been variable and requires further study.

**Methods:** We propose a type III hybrid implementation/effectiveness interventional cohort trial in 35 ICUs in up to 11 low- and middle- income countries. The study intervention is a structured review of antimicrobial prescriptions as recommended by the World Health Organisation. Strategies to support stakeholder-led implementation include development of local protocols, registry-enabled audit and feedback, and education. Evaluation of implementation, and the determinants of its success, is informed by the RE-AIM framework and the Consolidated Framework for Implementation Research respectively. The primary outcome is a composite measure of fidelity, reach and adoption. Secondary outcomes describe the effectiveness of the intervention on improving antimicrobial prescribing. Qualitative interviews will assess relevant implementation acceptability, adaptations and maintenance. A baseline survey will investigate ICU-level antimicrobial stewardship structures and processes.

**Discussion:** This study addresses global policy priorities by supporting implementation research of antimicrobial stewardship, and strengthening associated healthcare professional competencies. It does this in a setting where improvement is sorely needed: low- and middle- income country ICUs. The study will also describe the influence of pre-existing antimicrobial stewardship structures and processes on implementation and improve understanding about the efficacy of strategies to overcome barriers to implementation in these settings.

**Trial registration:** This study protocol has been registered with ClinicalTrials.gov (ref NCT06666738) on 31 Oct 2024. <https://clinicaltrials.gov/study/NCT06666738?term=NCT06666738&rank=1>.

In Nepal, 9 centers affiliated with NICRF ICU Registry Network are currently involved in the EQUIPS-ICU study:

- HAMS Hospital
- B & B Hospital
- Kirtipur Hospital
- Civil Service Hospital
- Birat Nursing Home
- Birat Medical College Teaching Hospital
- Tribhuvan University Teaching Hospital
- B & C Medical College Teaching Hospital
- Nepal Medciti Hospital (Former site)

The intervention involves a structured review of each antimicrobial prescription within 48 hours of commencement. The review focuses on the indication, route, duration, and planned stop date of the antimicrobial therapy. The trained ICU team integrates these reviews into daily practice.

Adult patients (>18 years) admitted to the participating ICUs are included, and their data are extracted from the existing ICU registries and case report forms to capture patient characteristics, clinical outcomes, and process indicators such as antimicrobial density, redundancy, and treatment duration. Qualitative insights are gathered through interviews with ICU Champions.

Baseline data collection occurred during months 1–3, during which data pertaining to current antimicrobial utilisation and prescribing appropriateness was captured daily through the Care Quality Registries (CQR), E-CRF and site survey. During this pre-implementation period, the Champions and RAs undertook online education and received training from the project team in review processes and orientation to the data. At month 4, ICU teams commenced the protocolised review in their ICU.

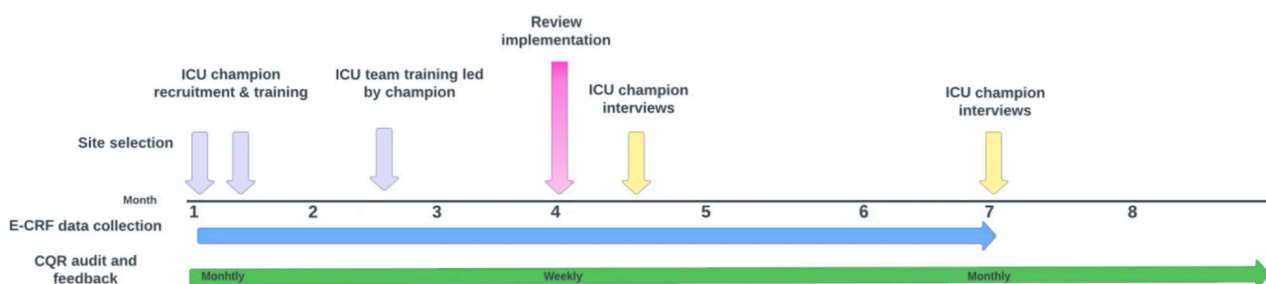


Figure: Study timeline

## Pattern of Use of Antibiotics and Their Consumption in an Intensive Care Unit of a Tertiary Care Hospital in Nepal (ongoing)

PI: RN Resha Dangol

**Background:** Critically ill patients are highly vulnerable to nosocomial infections, resulting in frequent use of broad-spectrum antibiotics. Misuse and overuse of antimicrobials contribute to rising antimicrobial resistance (AMR), which prolongs ICU stays, increases treatment costs, and elevates mortality. In Nepal, data on antibiotic prescribing patterns and consumption in ICUs are limited.

**Objective:** To assess the pattern, consumption, and cost of antibiotic use in the intensive care unit (ICU) of a tertiary care hospital in Nepal.

**Methods:** A retrospective quantitative study was conducted at a tertiary hospital ICU/HCU in Kathmandu from January to December 2022. All patients admitted for >24 hours who received antibiotics were included. Prescription records (kardex) and pharmacy databases were reviewed. Antibiotic consumption was calculated as Defined Daily Dose (DDD) per 100 bed days using the ATC/DDD system.

**Results:** Of 734 admissions, 471 patients (64.17%) received antibiotics; 68% were male. The most prescribed antibiotics were Piperacillin-Tazobactam (52%), Meropenem (38%), Ceftriaxone (34%), and Azithromycin (34%). DDD per 100 bed days declined from 147.58 in Jan–Mar to 101 in Oct–Dec. Reserved antibiotics such as Polymyxin B and Tigecycline also showed decreased use. The majority of patients (55%) stayed 1–5 days in ICU, and some received more than five antibiotics during admission.

**Conclusion:** Broad-spectrum antibiotics dominate prescribing practices in the ICU, with consumption decreasing over the study period. These findings highlight the need for robust antimicrobial stewardship programs and surveillance to promote rational antibiotic use and curb resistance in Nepalese critical care settings.

## Reasons for Leave Against Medical Advice (LAMA) from an Intensive Care Unit of a Tertiary Level Hospital (Ongoing)

PI: RN Karuna Thapa

**Background:** Leaving Against Medical Advice (LAMA) is common among ICU patients and associated with adverse outcomes, increased healthcare costs, and mortality. In Nepal, limited evidence exists on the underlying causes of LAMA.

**Methods:** A mixed-method study was conducted in three ICUs of a tertiary hospital from April–September 2023. Consecutive patients who left against medical advice were included. Clinical and demographic data were extracted from the NICRF ICU registry, while family members were interviewed using semi-structured questionnaires and open-ended questions. Quantitative data were analyzed using SPSS 20.0 and qualitative data using thematic analysis.

**Results:** Among 75 LAMA patients, mean age was 60.5 years; 67% were male and 84% uninsured. The median ICU stay was 5 days, and 64% were mechanically ventilated. Primary reasons for LAMA included poor prognosis (38.7%), financial constraints (25.3%), prolonged treatment, dissatisfaction, and family or spiritual considerations. Qualitative themes highlighted lack of hope for recovery, physician advice, financial distress, family reunification, spiritual practices, and dissatisfaction with ICU/hospital services.

**Conclusion:** LAMA is frequent in Nepalese ICUs, driven mainly by poor prognosis and financial burden, particularly among uninsured patients. Addressing these factors through improved insurance coverage, patient counseling, better hospital services, and enhanced communication can reduce premature discharges and improve outcomes.

## Determinants of mortality of non-ventilated patients admitted to ICU at selective hospitals of Nepal: A Secondary data analysis (ongoing)

PI: Dr Raju Shrestha

**Background:** The Intensive Care Unit (ICU) is vital for critical care, yet mortality remains a pressing issue. While much critical care research focuses on mechanically ventilated patients, non-ventilated critically ill patients also face substantial mortality risks. This study aimed to identify key determinants of mortality among non-ventilated ICU patients in selected Nepalese hospitals.

**Methods:** A retrospective observational design was employed, utilizing secondary data from the Nepal Intensive Care Research Foundation (NICRF). The dataset included records from 13,093 non-ventilated ICU patients across 14 hospitals in Nepal, collected between 2019 and 2022. Statistical analysis involved the Mann-Whitney U test for continuous variables, Pearson's chi-squared test for categorical variables, and binary logistic regression analysis to identify predictors of mortality.

**Results:** The overall ICU mortality rate was 11.1% (1,455 deaths). Deceased patients were significantly older than survivors (mean age 61.45 vs. 54.38 years,  $p < 0.001$ ). Multivariable regression identified several independent predictors of mortality: antibiotic use (OR = 2.17), cardiovascular support (OR = 3.04), vasoactive therapy (OR = 2.99), ICU readmission (OR = 1.74), and unplanned admission (OR = 0.30 for planned,  $p < 0.05$ ). Admission from the operating theater was associated with the highest mortality risk (OR = 8.81), while admission from ICU/HDU or wards had lower odds compared to emergency admissions. Severe respiratory comorbidity, hypertension, type 2 diabetes, chronic kidney disease requiring dialysis, and moderate to severe hepatic disease were also significantly associated with mortality.

**Conclusion:** Mortality among non-ventilated ICU patients in Nepal is influenced by both clinical severity and admission characteristics. These findings highlight the importance of proactive monitoring of high-risk patients, improved discharge planning, and strengthened perioperative care to enhance survival outcomes in critical care settings.

## **Epidemiology and outcomes of patients hospitalized with Dengue: A prospective international observational cohort study (ongoing)**

CCAA Investigators

Dengue infection remains a major global health challenge, with no proven evidence-based treatments currently available. To enable future clinical trials of supportive and targeted therapies, it is essential to first establish a clear understanding of Dengue's epidemiology in hospital and ICU settings. This prospective, international observational cohort study aimed to describe the clinical presentation, demographics, illness severity, treatments, and outcomes of Dengue patients admitted to hospitals and ICUs, and to identify treatment-related predictors of survival.

The study is being conducted across hospitals and ICUs within the Critical Care Asia Africa (CCAA) and International Severe Acute Respiratory and Emerging Infection Consortium (ISARIC) networks. All patients admitted with Dengue over a one-year period are enrolled, with data collected using standardized case report forms (CRFs).

Analyses will be guided by a pre-published Statistical Analysis Plan (SAP), applying descriptive methods, logistic regression, and modern causal inference techniques. The findings will provide crucial insights to inform the design of future interventional trials and guide improved care for Dengue patients worldwide through broad dissemination.

## **ICU-related Out of Pocket Expenses (ICOPE) – a multinational prospective study in Nepal (Ongoing)**

CCAA Investigators

ICU admissions are often sudden, unpredictable, and prolonged, resulting in significant financial burden for patients and families. In low- and middle-income countries (LMICs), ICU care is typically financed through a mix of public funding, limited insurance, and substantial out-of-pocket expenditure (OOPE). For many households, these costs rapidly escalate into debt and may reach catastrophic health expenditure (CHE). The ICOPE study aimed to quantify ICU-related OOPEs in both public and private sectors, identify context-specific drivers of OOPE and CHE, and explore coping mechanisms and sources of financial support.

This prospective observational cohort study was conducted in ICUs across the Critical Care Asia Africa (CCAA) network, including Nepal. Data were collected through in-hospital follow-up until ICU discharge or death, with additional follow-ups at 30 days and 6 months for survivors. Caregivers provided data when patients were unable to participate.

A standardized case report form (CRF) was integrated into the CCAA ICU registry to ensure consistency across sites. Data analysis (ongoing) includes descriptive statistics, regression modeling, and comparative analyses to identify determinants of OOPE and CHE. The study's findings will provide crucial evidence to inform policies aimed at reducing financial hardship from critical illness in LMICs.

## Proposal- Obstetric admissions to intensive care units in Nepal: a retrospective registry-based data analysis

PI: Dr Bashu Dev Parajuli

Obstetric admissions to intensive care units (ICUs) in low- and middle-income countries, including Nepal, are under-researched. Maternal health remains a priority, but complications such as postpartum hemorrhage, pre-eclampsia, and sepsis continue to negatively affect outcomes. This study aims to analyze the incidence, outcomes, and predictors of mortality and morbidity among obstetric ICU admissions in Nepal through a retrospective registry-based data analysis using de-identified data from the National Registry of Critical Care of Nepal. The cohort will include women aged 15-49 years admitted to ICUs between 2019 and 2024, classified as pregnant, postpartum, or with obstetric-related diagnoses. Data on demographics, ICU admission indications, comorbidities, mechanical ventilation, severity scores (APACHEII, SOFA), and maternal and fetal outcomes will be analyzed. The study will compare obstetric and nonobstetric ICU admissions within the same age group, and statistical analyses, including chi-square tests, t tests, and logistic regression, will assess trends in ICU admission, length of stay, and in-hospital mortality. The findings are expected to inform future studies, improve resource allocation, and support strategies to enhance maternal health in Nepal, contributing to global efforts to reduce maternal mortality.

## Proposal- Factors Affecting Mortality in Critically Ill Patients at a Level III ICU in Nepal: A Registry-Based Retrospective Observational Study

PI: Dr Sachit Sharma

**Background:** Mortality in intensive care units (ICUs) varies globally and is influenced by patient comorbidities, treatment factors, and hospital-acquired complications. In Nepal, limited data exist on determinants of ICU mortality.

**Objective:** To identify factors associated with mortality among critically ill patients admitted to a Level III ICU in Nepal.

**Methods:** A retrospective registry-based observational study will be conducted using data from Tribhuvan University Teaching Hospital (TUTH) covering a five-year period (Baisakh 2076 – Chaitra 2080). All patients aged  $\geq 18$  years admitted to the ICU will be included, excluding those with missing data. Variables include demographic factors, comorbidities, SOFA score at admission, use of mechanical ventilation, vasopressors, presence of hospital-acquired infections, length of ICU stay, and outcomes. Data will be analyzed using SPSS v20. Logistic regression will identify independent predictors of mortality, reported as odds ratios with 95% confidence intervals.

**Expected Results:** The study will determine key clinical and treatment-related predictors of ICU mortality, distinguishing modifiable and non-modifiable factors.

**Conclusion:** Findings will provide baseline evidence for prognostication and quality improvement in Nepalese ICUs, guiding resource allocation and clinical decision-making in critically ill populations.

## **Proposal- Outcomes of acute kidney injury requiring renal replacement therapy in ICU in a tertiary level teaching hospital in Nepal- a registry based retrospective study**

PI: Dr Bipin Karki

**Background:** Acute kidney injury (AKI) is common among critically ill patients, with many requiring renal replacement therapy (RRT). The development of AKI and subsequent need for RRT are strongly associated with adverse outcomes, including prolonged ICU stay and high mortality. While studies from high-income countries report comparatively lower mortality, evidence from low- and middle-income countries (LMICs) suggests much poorer outcomes, largely due to limited resources. In Nepal, few small-scale studies exist, and robust data on AKI requiring RRT are lacking.

**Objective:** To determine the outcomes of ICU patients undergoing RRT in a tertiary-level teaching hospital in Nepal, focusing on mortality rates and length of ICU stay.

**Methods:** This will be a retrospective, descriptive, registry-based study utilizing the electronic ICU registry managed by the Nepal Intensive Care Research Foundation (NICRF) and hospital records from Tribhuvan University Teaching Hospital (TUTH). All adult ICU patients (>18 years) who underwent RRT between January 2020 and December 2023 will be included, with exclusion of those who withdrew care, left against medical advice, or were discharged on request. Data on demographics, comorbidities, illness severity (APACHE II), type and timing of RRT, number of sessions, clinical parameters, and outcomes will be collected. Statistical analysis will be performed using SPSS, with  $p < 0.05$  considered significant.

**Expected Outcome:** The study will provide baseline evidence on mortality and ICU length of stay among patients requiring RRT in Nepal, contributing to the limited literature from LMIC settings. Findings will inform future strategies to improve ICU care and patient outcomes.

## **Proposal- Factors associated with mortality in patients with Multi-drug Resistant Gram-negative bacterial isolates in Intensive Care Units across Nepal: A multi-centric registry-based study**

PI: Dr Sachit Sharma

**Background:** Multi-drug resistant (MDR) Gram-negative bacterial infections are a growing challenge in intensive care units (ICUs), contributing to high mortality, prolonged hospital stays, and increased healthcare costs. In Nepal, updated multicentric data on outcomes and risk factors for mortality remain scarce.

**Objective:** To identify factors associated with mortality in ICU patients with MDR Gram-negative bacterial isolates across Nepal.

**Methods:** This registry-based retrospective observational study will include all patients  $\geq 18$  years admitted to ICUs registered with the Nepal Intensive Care Research Foundation (NICRF) from January 2020 to January 2025, with MDR Gram-negative isolates documented in microbiological specimens. Consecutive sampling will be used. Demographic, clinical, microbiological, and treatment-related variables will be analyzed. Statistical tests (t-test, Mann-Whitney U, Chi-square/Fisher's exact) and binary logistic regression will be applied to identify independent predictors of mortality.

**Expected Results:** The study will determine patient- and treatment-related factors influencing ICU mortality, including comorbidities, severity scores, organ involvement, and antibiotic regimens.

**Conclusion:** Findings will provide updated multicentric evidence on MDR Gram-negative infections in Nepalese ICUs, informing antimicrobial stewardship programs and strategies to reduce ICU mortality.

## **Proposal- Evaluating the implementation and effectiveness of nurse-led discharge checklist and ICU follow-up intervention to reduce adverse events following ICU discharge in Nepal ICUs**

PI: Dr. Diptesh Aryal

**Background:** Patients discharged from intensive care units (ICUs) in low-resource settings, including Nepal, face high risks of adverse events, unplanned readmissions, and mortality due to discoordination in care following step down, and greater resource constraints impeding recognition of deterioration. Transitional care interventions such as discharge checklists and follow-up protocols have been widely adopted in high income settings but remain poorly implemented in Nepal and other lower resource settings.

**Objective:** This study aims to evaluate the implementation effectiveness of a nurse-led ICU discharge checklist and follow-up intervention in Nepalese ICUs using a hybrid type 2 trial design. This hybrid implementation-effectiveness study will recruit up to 15 ICUs from those already affiliated with Nepal Intensive Care Research Foundation (NICRF).

**Methods:** The intervention consists of (1) a structured nurse-led checklist completed at the time of ICU-to-ward discharge and (2) a follow-up telephone call 48 hours postICU step down to assess treatment adherence and identify potential deterioration. A composite primary outcome for implementation effectiveness (reach, fidelity and adoption) will be evaluated using the REAIM framework. Secondary outcomes include unplanned ICU readmission rates, mortality, concordance with care plan, and referral to allied services. A concurrent qualitative process evaluation will aim to identify organizational and individual barriers and facilitators to implementation success. The study will be registry enabled, leveraging the existing registry infrastructure. The primary outcome is implementation with a threshold of 80% reach, fidelity and adoption combined. Secondary outcomes will assess intervention effectiveness and patient safety. This study will generate evidence on the implementability and effectiveness of an ICU discharge intervention in Nepal. Findings may inform scale up and national policy change. Implementation findings will advance future design and adaptations for service improvement in LMICs.

## A Multicenter Retrospective Analysis of Sepsis in Intensive Care Units Across Nepal (2019-2024)

PI: Prof. Dr. Subhash Prasad Acharya

**Background:** Sepsis remains a major cause of critical illness and death, particularly in low- and middle-income countries with limited ICU capacity and lack of standardized management protocols.

**Objective:** This study aims to describe the burden, treatment practices, and outcomes of adult sepsis in Nepal by conducting a multicenter retrospective analysis of ICU admissions from 2019 to 2024.

**Methods:** We will analyze registry and hospital data from adult patients (>18 years) with sepsis across multiple ICUs. Data include demographics, comorbidities, severity scores, treatments, and outcomes, with additional analysis of treatment patterns, regional variation, and resource utilization.

**Expected Outcomes:** The study will provide the first nationwide dataset on adult sepsis in Nepal, offering insights into incidence trends, clinical management, and outcomes. Findings will support evidence-based guidelines, resource planning, and quality improvement for sepsis care in Nepal's ICUs.

## A Machine Learning Sepsis Prediction Algorithm for Intended Intensive Care Unit Use

Investigators: NICRF & NAAMII

**Background:** Recent advances in machine learning (ML) have shown superior performance compared with traditional scoring systems like SOFA or SIRS, even in resource-limited environments, and models using routine physiological parameters have achieved promising accuracy.

**Objective:** NICRF, in Collaboration with Nepal Applied Mathematics and Informatics Institute for Research (NAAMII), aims to develop and evaluate a machine learning-based sepsis prediction algorithm adapted for Nepal's critical care context.

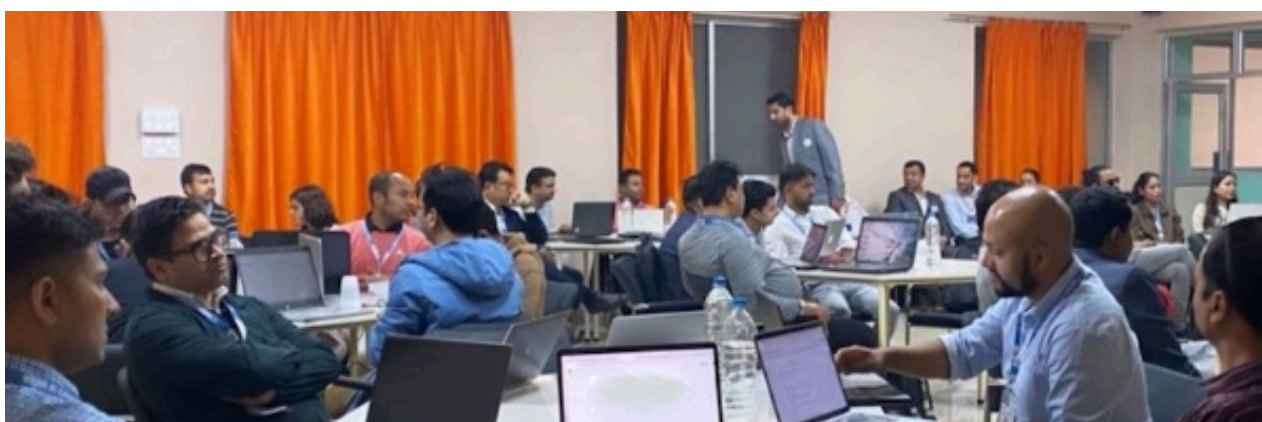
**Methods:** We will use routinely collected ICU registry data from multiple centers across Nepal, focusing on adult patients with sepsis. The study will combine epidemiological analysis with model development, testing ML algorithms on registry datasets to assess their feasibility and predictive performance in a low-resource ICU environment.

**Expected Outcomes:** This project will provide the first large-scale evidence on sepsis in Nepal and establish the foundation for a context-specific, ML-driven prediction tool. Findings will inform both national sepsis care strategies and future implementation of AI-based clinical decision support in resource-limited critical care settings.

# NICRF EVENTS

## Research Methodology Workshop – December 2023

In collaboration with the Nepal Society of Critical Care Medicine, Critical Care Nurses Association of Nepal, Birat Nursing Home Pvt. Ltd, and Birat Medical College Teaching Hospital, NICRF conducted a two-day Research Methodology Workshop (6–7 December 2023, Biratnagar) during the 5th National Conference of the Nepalese Society of Critical Care Medicine and 1st Eastern Critical Care Conclave. Forty-one participants, including doctors, residents, nurses, and faculty, engaged in group-based practical sessions to design research proposals, guided by national and international facilitators.



## Workshop on Health Research Methodology – September 2023

NICRF, in collaboration with the Nepal Health Research Council (NHRC), organized a two-day Training Workshop on Health Research Methodology (1–2 September 2023, Lalitpur). The workshop focused on enhancing participants' skills in proposal writing, scientific writing, and ethical considerations in health research, with the goal of strengthening research capacity across Nepal.



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## Workshop on COVID-19 Research Project in Nepal – June 2023

On 10 June 2023, NICRF hosted a workshop at Maxim’s Banquet, Lalitpur, involving 40 ICU healthcare professionals from various hospitals. The workshop explored the clinical care pathway and leadership approaches for COVID-19 patients from outpatient to ICU care in low-resource settings, with discussions centered on patient referral mechanisms, leadership practices, and system-level challenges.



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## Workshop on Quality Improvement – July 2022

NICRF conducted a Quality Improvement (QI) Workshop on 10 July 2022 at Grande International Hospital, Kathmandu, engaging 20–25 ICU nurses from across the registry network. Moderated by national and international experts, the workshop emphasized practical QI strategies to enhance ICU patient outcomes through interactive group discussions and case-based sessions.



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## Annual Review and Update Meeting – April 2021

NICRF’s inaugural event, the Annual Meeting 2021 (10 April 2021, Kathmandu), marked the foundation’s first major platform for bringing together critical care clinicians and researchers. Highlights included overviews of NICRF’s objectives, presentations on ICU Registry and REMAP-CAP clinical trials, and contributions from international collaborators Dr. Abi Beane and Dr. Rashan Haniffa. The event set the stage for NICRF’s long-term vision of advancing critical care research and quality improvement in Nepal.

## PhD Research Projects

The ICU Registry has also served as a research platform for doctoral-level academic work. Two scholars from our registry network have undertaken PhD studies. NICRF has supported PhD scholars by providing access to real-time clinical data, facilitate data collection, supervision and financial assistance.

Scholar Name	Thesis Title	Institution	Status
<b>Dr. Diptesh Aryal</b>	<i>Early Unplanned Intensive Care Unit Readmissions in Nepalese Hospitals: A Comprehensive Investigation of Incidence, Multilevel Risk Factors, and Their Impact on Critical Care Outcomes</i>	D'Or Institute for Research and Education (IDOR), Rio de Janeiro, Brazil	Completed (May 2025)
<b>Dr. Hem Raj Paneru</b>	<i>Establishing an ICU follow-up service to evaluate short- and long-term clinical, psychological, and cognitive outcomes in survivors of critical illness</i>	University of Edinburgh, UK	Ongoing

## Research Grants Support

As part of its commitment to nurturing the next generation of clinical researchers, NICRF has provided small grants to support investigator-led studies focused on critical care, ICU service delivery, and registry-based research.

Researcher Name	Research Title	Institution	Status
<b>Asso. Prof. Dr. Basanta Gauli</b>	<i>Clinical characteristics and outcomes of mechanically ventilated patients at adult ICU of Chitwan Medical College: a retrospective study</i>	Chitwan Medical College	Ongoing
<b>RN Karuna Thapa</b>	<i>Reasons for leave against medical advice from an intensive care unit of a tertiary level hospital</i>	Tribhuvan University Teaching Hospital	Completed
<b>Dr. Suraj Adhikari</b>	<i>Incidence and outcome of acute kidney injury in patients admitted in level III ICU in Nepal: a retrospective, observational study</i>	Hospital for Advanced Medicine & Surgery	Completed and published
<b>RN Resha Dangol</b>	<i>Pattern of use of antibiotics and their consumption in an intensive care unit of a tertiary care hospital in Nepal</i>	Grande International Hospital	Ongoing

## ICU REGISTRY NETWORK RESEARCH ASSISTANTS (PAST AND PRESENT)

SN	Organization	Name	SN	Organization	Name
1	B & B	Niruma Shakya	26	BMCTH	Monika Regmi
2	B & B	Shriya Shrestha	27	BMCTH	Sabina Kumari Rajbanshi
3	B & B	Anita Bashyal	28	BMCTH	Roshni Rijal
4	B & B	Prajina Malla	29	BMCTH	Aarti Gupta
5	B & B	Jeeya Deuja	30	BMCTH	Roshni Rajbanshi
6	B & B	Rajani Deshar	31	BMCTH	Nisha Kumari Chaudhary
7	B & B	Rabina Bajracharya	32	BMCTH	Manaslu Hamal
8	B & C	Kalpana Gurung	33	BMCTH	Namsam Rai
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10	B & C	Sita Dahal	35	BPKIHS	Sarisha Maharjan
11	B & C	Sushmita Dahal	36	BPKIHS	Sanu Kumari Bista
12	B & C	Pratima Sigdel	37	BPKIHS	Sandhya Khanal
13	B & C	Kiran Yadav	38	BPKIHS	Shalu Parajuli
14	B & C	Ganga Adhikari	39	CMC	Babita Ghimire
15	B & C	Merina	40	CMC	Asmita Kaini
16	B & C	Smita Khanal	41	CMC	Sangina Poudel
17	BNH	Bipana Chaudhary	42	CMC	Arati Rana
18	BNH	Nanu Waiba	43	CMC	Pooja Kunwar
19	BNH	Rita Das	44	CMC	Nisha Bhandari
20	BNH	Sarita Raut	45	CMC	Sharda Chaudhary
21	BNH	Sangita Wagle	46	CMC	Sarita Gurung
22	BNH	Simon Tuladhar	47	CSH	Rajani Shrestha
23	BNH	Om Prakash Mehta	48	CSH	Puja Gurung
24	BNH	Yagya Koirala	49	CSH	Renu Younjan
25	BNH	Rakshya Rai	50	CSH	Smita Dheke

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SN	Organization	Name	SN	Organization	Name
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52	CSH	Roshani Maharjan	77	SGNHC	Jyoti Thapa
53	CSH	Sunita Sharma	78	SGNHC	Sujata Ghimire
54	CSH	Shrijana Shrestha	79	Grande	Shreya Pathak
55	Dhulikhel	Alisha Bajracharya	80	Grande	Shreya Pathak
56	Dhulikhel	Indu Poudel	81	Grande	Sharmila Mali
57	Dhulikhel	Sujata Pasachhen	82	Grande	Pujan Rajbhandari
58	Dhulikhel	Bhawana Shrestha	83	Grande	Sabita Shrestha
59	Dhulikhel	Isha Shrestha	84	Grande	Radhika maharjan
60	Dhulikhel	Amu Shrestha	85	Grande	Bina Bhattarai
61	Frontline	Nishma Gurung	86	Grande	Sameena Amatya
62	Frontline	Prashansa Koirala	87	HAMS	Pratibha poudel
63	Frontline	Sanita Shrestha	88	HAMS	Prativa Thapa
64	Frontline	Srijana Kayastha	89	HAMS	Puja Bhandari
65	Frontline	Pemba Sherpa	90	HAMS	Anusha Karki
66	Frontline	Ashma Chaudhary	91	HAMS	Melina Gaha Thapa
67	SGNHC	Sharmila Thapa	92	HAMS	Urusha Adhikari
68	SGNHC	Samiksha Yadav	93	HAMS	Muna Kuchumani
69	SGNHC	Amisha Adhikari	94	HAMS	Angela Lamichhane Sherna
70	SGNHC	Sunita Shrestha	95	HAMS	Alina Lamichhane
71	SGNHC	Ritu swongamikha	96	HAMS	Sangita G.C
72	SGNHC	Gita Tamang	97	HAMS	Swastika phuyal
73	SGNHC	Ushna Shrestha	98	HAMS	Crystal Maharjan
74	SGNHC	Janaki Ayer	99	HAMS	Anusha Subedi
75	SGNHC	Sunita Pandey	100	HAMS	Bini kayastha

## ICU REGISTRY NETWORK RESEARCH ASSISTANTS (PAST AND PRESENT)

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103	HAMS	Srijana Kayastha	128	Neuro-Cardio	sunita shrestha
104	Karuna	Roshni Kafle	129	Neuro-Cardio	Sabina khapung
105	Karuna	Kalpana Gurung	130	Neuro-Cardio	Junu shrestha
106	Karuna	Sujita Shrestha	131	Neuro-Cardio	Komal yadav.
107	Karuna	Shila Shrestha	132	Neuro-Cardio	Shristina Tamang
108	Karuna	Roshni Rai	133	Neuro-Cardio	Anuska Shrestha
109	Kritipur	Prasanna Sigdel	134	Neuro-Cardio	Anjana Khadka
110	Kritipur	Rashila Mali	135	Neuro-Cardio	Yunisha Bhattarai
111	Kritipur	Trishna Maharjan	136	Nidan Hospital	Yashu Shrestha
112	Kritipur	Denika Maharjan	137	Nidan Hospital	Ang Pasang Sherpa
113	Kritipur	Sital Ale Magar	138	Nidan Hospital	Puspa Dura
114	Kritipur	Krishna Ranjit	139	Nidan Hospital	Radhika maharjan
115	Kritipur	Shama Maharjan	140	Nidan Hospital	Dilpana Maskey
116	Mediciti	Mili Maharjan	141	Nidan Hospital	Sabita Acharya
117	Mediciti	Manisha maharjan	142	Nidan Hospital	Subina Maharjan
118	Mediciti	Sudeshna Shakya	143	Om Hospital	Srijana Bam
119	Mediciti	Namrata Rai	144	Om Hospital	Manu Ale
120	Mediciti	Kaveri Thapa	145	Om Hospital	Roshni Karki
121	Mediciti	Kanchan Koirala	146	Om Hospital	Mandira Thapa
122	Mediciti	Archana Gurung	147	Om Hospital	Diksha Sthrestha
123	Mediciti	Krishna Dheke	148	Om Hospital	Richa Maharjan
124	Neuro-Cardio	Ranjita Chaudhary	149	Om Hospital	Ambika Yonjan
125	Neuro-Cardio	Reeta Chaudhary	150	Om Hospital	Roshani Sthrestha

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152	TUTH	Sabita Maharjan	166	TUTH	Eliza Shrestha
153	TUTH	Namrata Sthrestha	167	TUTH	Sunita Maharjan
154	TUTH	Kabita Sitoula	168	TUTH	Bishnu Basnet
155	TUTH	Bimala maka	169	TUTH	Priti Adhikari
156	TUTH	Sabi bajracharya	170	TUTH	Sakun Jirel
157	TUTH	Hisila Dangol	171	TUTH	Archana Rijal
158	TUTH	Manisha Shrestha	172	TUTH	Prabha Shrestha
159	TUTH	Shilpa Shrestha	173	TUTH	Asmita Pokhrel
160	TUTH	Rejina Shrestha	174	TUTH	saraswati sharma
161	TUTH	Sunita Bista	175	TUTH	Arati phuyal
162	TUTH	Laxmi Saru	176	TUTH	Radhika maharjan
163	TUTH	Pratiksha Budhathoki	177	TUTH	Binita bhattacharai
164	TUTH	Sukriti Ranjitkar	178	TUTH	Roshni thapa

## ICU REGISTRY NETWORK CLINICAL SITE LEADS (PAST AND PRESENT)

SN	Organization	Name	SN	Organization	Name
1	B & B	Dr. Sanjay Lakhey	18	HAMS	Dr. Sabin Koirala
2	B & B	Dr. Philip Shyam Rnanjit	19	Karuna	Dr. Shubha Kalyan Shrestha
3	B & B	Dr. Tamanna Bajracharya	20	Kirtipur	Dr. Praveen Giri
4	B & C	Dr. Raju Shrestha	21	Mediciti	Dr. Kishor Khanal
5	BMCTH, BNH	Prof. Dr. Lalit Kumar Rajbanshi	22	Neuro-Cardio	Dr. Ashish Jung Thapa
6	BPKIHS	Dr. Sabin Bhandari	23	Nidan	Dr. Anand Thakur
7	BPKIHS	Dr. Krishna Pokhrel	24	Nidan	Dr. Rupesh Gami
8	CSH	Dr. Pradip Tiwari	25	Nidan	Dr. Niroj Hirachan
9	CMC	Asso. Prof. Dr. Basanta Gauli	26	OM	Asso. Prof. Dr. Pramesh Sunder Shrestha
10	CMC	Prof. Dr. Shital Adhikari	27	OM	Dr. Utsav Pradhan
11	Dhulikhel	Dr. Sangina Ranjit	28	OM	Dr. Bipin Karki
12	Frontline, MMTH	Dr. Santosh Acharya	29	OM	Dr. Semanta Dahal
13	Frontline	Dr. Karun Upreti	30	SGNHC	Dr. Ashish Govind Amatya
14	Grande	Dr. Sushil Khanal	31	TUTH	Dr. Hem Raj Paneru
15	Grande	Dr. Saurabh Pradhan	32	TUTH	Prof. Dr. Subhash Prasad Acharya
16	Grande	Dr. Shirish Raj Joshi	33	TUTH	Dr. Sachit Sharma
17	Grande	Dr. Ankit Rimal	34	GMC	Prof. Dr. Yam Bahadur Roka

## Plain Language Summary

Over the past five years, Nepal Intensive Care Research Foundation (NICRF) has worked to improve the care of critically ill patients in Nepal. Its main focus has been creating and running the Nepal ICU Registry, a system that collects information about patients admitted to intensive care units (ICUs). This registry helps hospitals track how many patients they treat, what treatments they use, and what outcomes patients have. With this data, hospitals can identify gaps, improve quality, and compare results across the country.

By 2025, NICRF had partnered with 18 major hospitals and connected with global research networks. It has been part of large international studies such as REMAP-CAP, which looks at the best treatments for pneumonia and COVID-19, and Mega-ROX, which examines safe oxygen levels for critically ill patients. These efforts make sure that Nepal's experience is represented in global medical research, not just in high-income countries.

NICRF has also led studies on topics like COVID-19 care, dengue, antibiotic use, out-of-pocket costs for ICU care, and mental health challenges faced by ICU staff during the pandemic. It has shown that many ICU patients and their families face financial hardship, and that healthcare workers often struggle with stress and anxiety. Beyond research, NICRF has trained more than 150 doctors, nurses, and coordinators in research methods and quality improvement. It has also supported PhD students and small research projects, building the next generation of scientists in Nepal.

Looking ahead, NICRF aims to continue expanding the ICU Registry, strengthen hospital networks, and influence national policy. Its vision is simple but important: that every critically ill patient in Nepal should receive the best possible care, guided by evidence and supported by strong health systems.

## साधारण नेपालीमा सारांश

पछिल्लो पाँच वर्षमा, नेपाल इन्टेन्सिभ केयर रिसर्च फाउन्डेसन (NICRF) ले नेपालमा सिकिस्त बिरामीहरूको उपचारमा सुधार गर्न काम गरिरहेको छ। यसको मुख्य काम नेपाल आईसीयू रजिस्ट्री (Nepal ICU Registry) नामक तथ्याङ्क प्रणाली बनाएर, आईसीयूमा भर्ना भएका बिरामीहरूको जानकारी सङ्कलन गर्नु हो। यो रजिस्ट्रीको सहयोगले अस्पतालहरूलाई कति बिरामीको उपचार भयो, कुन उपचार विधि प्रयोग गरियो, र बिरामीको अवस्था कस्तो छ भन्ने कुरा थाहा पाउन सजिलो भएको छ। यसरी प्राप्त भएको तथ्याङ्कबाट अस्पतालहरूले आफ्नो कमजोरी पत्ता लगाउन, उपचारको गुणस्तर बढाउन, र देशभरका अन्य अस्पतालसँग आफ्नो नतिजा तुलना गर्न सक्छन्।

सन् २०२५ सम्ममा, NICRF ले १८ वटा ठूला अस्पतालसँग साझेदारी गरिसकेको छ र विश्वव्यापी अनुसन्धान सञ्जालहरूसँग पनि जोडिएको छ। यसले निमोनिया र कोभिड-१९ को उत्तम उपचार पत्ता लगाउने REMAP-CAP र सिकिस्त बिरामीका लागि सुरक्षित अक्सिजनको मात्राबारे अध्ययन गर्ने Mega-ROX जस्ता ठूला अन्तर्राष्ट्रिय अध्ययनहरूमा पनि भाग लिएको छ। यी प्रयासहरूले गर्दा नेपालको अनुभव पनि विश्वव्यापी चिकित्सा अनुसन्धानमा समावेश भएको छ।

NICRF ले कोभिड-१९ को उपचार, डेंगु, एन्टिबायोटिकको प्रयोग, आईसीयू उपचारमा लाग्ने खर्च र महामारीको बेला आईसीयूका कर्मचारीहरूको मानसिक स्वास्थ्य चुनौती जस्ता विषयहरूमा पनि अध्ययन गरेको छ। यसले धेरै आईसीयूका बिरामी र उनीहरूका परिवारले आर्थिक समस्या भोग्नुपरेको र स्वास्थ्यकर्मीहरू तनाव र चिन्ताबाट गुञ्जिरहेको देखाएको छ।

अनुसन्धानबाहेक, NICRF ले १०० भन्दा बढी डाक्टर, नर्स, र संयोजकहरूलाई अनुसन्धान विधि र गुणस्तर सुधारबारे तालिम दिएको छ। यसले पीएचडी विद्यार्थीहरू र साना अनुसन्धान परियोजनाहरूलाई पनि सहयोग गरेको छ, जसले गर्दा नेपालमा नयाँ वैज्ञानिकहरूको पुस्ता तयार हुँदैछ।

भविष्यमा, NICRF ले आईसीयू रजिस्ट्रीलाई अझ विस्तार गर्ने, अस्पताल सञ्जाललाई बलियो बनाउने, र राष्ट्रिय नीतिहरूमा प्रभाव पार्ने लक्ष्य राखेको छ। यसको दृष्टिकोण एकदमै सरल तर महत्त्वपूर्ण छ: नेपालमा प्रत्येक सिकिस्त बिरामीले प्रमाणमा आधारित र बलियो स्वास्थ्य प्रणालीको सहयोगमा सबैभन्दा राम्रो उपचार पाउनुपर्छ।



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