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EDITORIAL

From Counting Patients to Changing Care: Nepal's ICU Registry as a Learning Health System

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FROM INVISIBLE JOURNEYS TO VISIBLE LEARNING

Every intensive care unit remembers difficult cases: a young adult with sepsis arriving late after multiple referrals, an elderly patient ventilated for pneumonia, a trauma victim transferred across districts, or a patient with acute kidney injury needing dialysis while resources are stretched. These stories remain with clinicians. They shape bedside memory, team culture and, occasionally, hospital policy. Yet when such stories are not systematically captured, the health system learns only in fragments. Individual patients are remembered; the collective ICU journey remains unseen.

For Nepal, this is no longer an aspiration; it is an emerging reality. Over recent years, Nepal has moved from discussing the need for ICU data to building and using an ICU registry. The registry has produced evidence across epidemiology, quality, antimicrobial stewardship, service capacity, implementation science and survivorship.[1-6] These outputs show that the registry has already become a platform for local evidence generation, not merely a future project.

MORE THAN A DATABASE: WHAT AN ICU REGISTRY SHOULD DO

An ICU registry is a structured, standardized and longitudinal system for collecting clinical, process, resource and outcome data from critically ill patients. Its purpose is not simply to store data, but to create a feedback loop between patients, clinicians, hospitals and policy.

A useful ICU registry captures a minimum set of domains: demographics, admission source, diagnosis, comorbidities, severity of illness, organ support, mechanical ventilation, vasopressors, renal replacement therapy, sepsis and infection, antimicrobial use where feasible, ICU and hospital length of stay, ICU and hospital mortality, discharge destination, readmission and, increasingly, post-ICU outcomes. National ICU registries have been described as enablers of quality improvement and clinical research because they create real-world knowledge about case mix, resource use and outcomes at scale.[7]

NEPAL'S REGISTRY JOURNEY: FROM PROOF OF CONCEPT TO PUBLISHED EVIDENCE

Nepal's ICU registry experience has already passed the proof-of-concept stage. The multicenter epidemiology study using registry data from 17 ICUs demonstrated that standardized ICU data can be collected across diverse hospitals and used to describe case mix, severity, organ support and outcomes.[1] This replaced isolated impressions with a shared, evidence-based description of critical illness in Nepal. It also offers a useful lesson for other LMICs: meaningful ICU surveillance can begin before perfect digital infrastructure exists.

The registry has also generated focused clinical and health-system outputs. Registry-based work on unplanned ICU readmission converted a common bedside concern into measurable evidence about incidence, risk, patient outcomes and resource utilization.[2] A point-prevalence survey of antimicrobial use across Nepali ICUs provided a practical foundation for antimicrobial stewardship, guideline development and AMR-focused policy discussion.[3] A cross-sectional survey of critical care services in Bagmati Province expanded the lens from patients to systems by describing access, infrastructure, human resources and ICU services across hospitals.[4]

The registry has also supported implementation work. A multicenter study of a high-flow nasal cannula practice guideline showed how registry infrastructure can help evaluate feasibility and acceptability of practice change in Nepali ICUs.[5] More recently, a registry-enabled national critical care follow-up service in Nepal demonstrated that the registry can extend beyond ICU discharge and support survivorship, rehabilitation and learning after critical illness.[6] Together, these publications tell an important success story: Nepal's ICU registry has already produced epidemiological, quality, antimicrobial, implementation, service-capacity and follow-up outputs.

WHY REGISTRIES MATTER MORE IN LMIC CRITICAL CARE

In LMICs, the term 'ICU' does not describe a uniform model of care. ICUs may differ in staffing, monitoring, access to ventilators, renal replacement therapy, laboratory turnaround, infection prevention, rehabilitation and availability of trained nurses, intensivists, pharmacists and physiotherapists. Referral delays, out-of-pocket expenditure and variable admission thresholds influence who reaches the ICU and at what stage of illness. In this context, imported benchmarks may be helpful but can mislead if interpreted without case mix, resource availability, referral patterns, discharge barriers and admission policies.

This is why Nepal's registry is valuable. It creates a local denominator. It helps answer questions that matter to Nepali clinicians and leaders: who is admitted, from where, with what severity, receiving which forms of organ support, at what cost to the system, with what outcome and with what post-discharge trajectory? Without a registry, these questions remain episodic. With a registry, they become measurable, comparable and actionable.

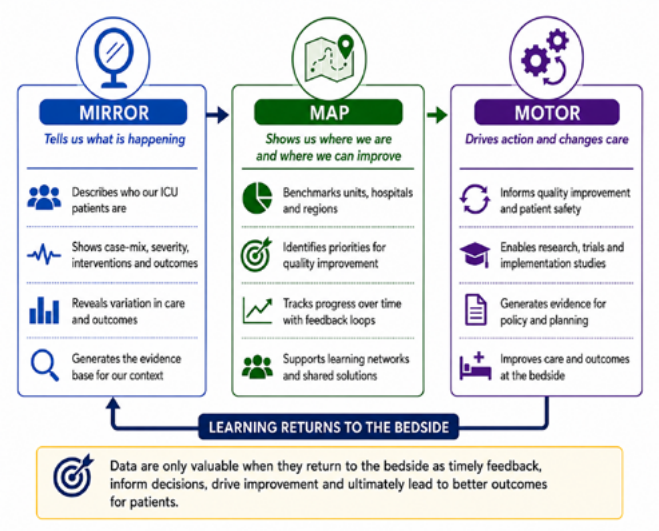

Figure 1. The LMIC ICU Registry Value Chain: Mirror, Map, Motor.

The most useful way to understand an ICU registry in an LMIC is as a mirror, a map and a motor (Figure 1). As a mirror, it shows what is actually happening: who is admitted, what illnesses are treated, what resources are used and what outcomes occur. As a map, it identifies variation, inequity, delays, resource gaps, preventable harm and priority areas for improvement. As a motor, it drives quality improvement, benchmarking, training, research, policy and accountability.

However, a registry does not automatically improve care. Data collection without feedback may become another administrative burden. A registry improves care only when linked to governance, audit, benchmarking, quality improvement and accountability (Figure 2). Data must travel back to the bedside. The cycle is incomplete if clinicians enter data but never receive useful reports, dashboards, comparisons or practical improvement questions.

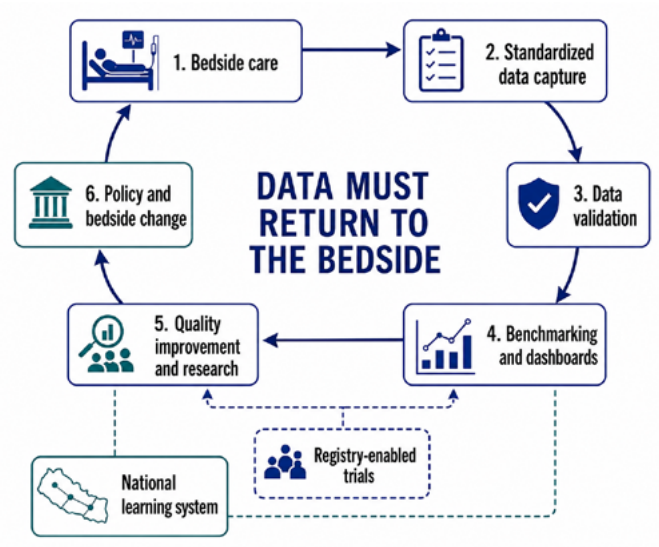

Figure 2. ICU Registry as a Learning Health System.

WHAT NEPAL CAN LEARN FROM OTHER REGISTRY SYSTEMS

The Brazilian experience demonstrates how a registry in a resource-variable middle-income setting can become a national platform for quality and research. The Epimed Monitor ICU Database has been described as a cloud-based national registry for adult ICU patients in Brazil.[8] The ORCHESTRA study used Brazilian ICU data to examine organizational characteristics, outcomes and resource use, showing how registry-linked data can move beyond counting patients to studying performance and efficiency.[9] During COVID-19, the UTIs Brasileiras experience showed how a national cloud-based registry could support surveillance, research and case-mix evaluation.[10]

South Asia offers equally relevant lessons. The Pakistan Registry of Intensive CarE (PRICE) illustrates how a clinician-designed registry can expand in a lower-middle-income country when the dataset is pragmatic and locally meaningful.[11] CRIT CARE ASIA and related multinational platform work show that LMIC critical care networks can build shared digital infrastructure, harmonized datasets, implementation learning and collaborative research capacity.[12,13] These examples reinforce Nepal's current trajectory: start with a feasible dataset, prove value through outputs, and then build toward quality improvement, benchmarking and trials.

The Linking of Global Intensive Care (LOGIC) initiative adds an important future direction. LOGIC links national ICU registries and large ICU databases to compare epidemiology, resource use, outcomes and performance across health systems.[14] It teaches three lessons for Nepal. First, benchmarking matters: ICUs should eventually compare themselves with similar units, regions and countries. Second, definitions matter: comparison is meaningful only when variables, outcome definitions and severity adjustment are harmonized. Third, interpretation matters: benchmarking must not become punitive ranking. Differences in mortality, ventilation use or length of stay may reflect referral pathways, illness severity, staffing, resource availability, discharge barriers and admission policies.

FROM REGISTRY OUTPUTS TO QUALITY IMPROVEMENT

Nepal's registry outputs now provide a foundation for a stronger quality improvement agenda. The epidemiology paper can inform minimum national ICU datasets and severity adjustment.[1] The readmission study can support discharge-readiness review and post-ICU transition protocols.[2] The antimicrobial survey can guide stewardship targets and ICU antibiotic dashboards.[3] The Bagmati critical care services survey can support bed planning, workforce advocacy and infrastructure mapping.[4] The HFNC implementation study can serve as a model for registry-supported practice guideline evaluation.[5] The follow-up service can help Nepal recognize that ICU outcomes do not end at discharge.[6]

The next step is to convert these publications into routines. Monthly ICU dashboards, morbidity and mortality meetings, audit cycles, bedside quality indicators, hospital leadership review and national benchmarking can convert numbers into improvement. Potential registry-linked projects include reducing unplanned ICU readmission, improving sepsis processes, monitoring ventilator-associated events, strengthening antimicrobial stewardship, tracking renal replacement therapy outcomes, identifying delays in ICU admission, measuring nurse-sensitive outcomes and evaluating post-ICU recovery.

International work on LMIC ICU quality indicators is particularly relevant here. A Delphi process involving critical care stakeholders from multiple countries developed actionable indicators for ICU care in LMICs, emphasizing feasibility, validity and quality impact.[15] Nepal's registry can use such work not as an external checklist, but as a framework to choose indicators that are locally important, clinically meaningful and feasible to collect.

GOVERNANCE, ETHICS AND TRUST

The promise of registries depends on trust. Poor data quality, missing data, unclear ownership and lack of feedback can undermine credibility. Privacy, cybersecurity, consent models where applicable, institutional permissions, authorship rules and publication policies must be transparent. Registry governance must protect data sovereignty, fair authorship, local analytic capacity, capacity building and policy translation.

Equally, registry data should not be used for punitive ranking of hospitals or ICUs without robust risk adjustment, validation and contextual interpretation. A learning registry should promote improvement, not fear. Data collectors and clinicians must understand why each variable matters. Leaders must protect time for data quality. Professional societies can help by defining minimum datasets, standard definitions, governance principles and national reporting norms.

FROM REGISTRY ESTABLISHMENT TO REGISTRY MATURITY: THE NEXT AGENDA FOR NEPAL

Nepal's registry has already moved beyond proof of concept. It has generated local critical care data, supported publications, produced feedback outputs and shown that Nepali ICUs can contribute to regional and international evidence. Its value now lies not only in surveillance, but in its potential to become infrastructure for quality improvement, implementation science, trial readiness and policy translation.

Participation in international research platforms illustrates this next stage. REMAP-CAP, a randomized, embedded, multifactorial adaptive platform trial rapidly adapted for COVID-19, was operationalized in low- and lower-middle-income critical care settings through an existing registry, clinical network and community of practice. Its implementation showed how registry infrastructure can support site recruitment, training, data harmonization, contextual adaptation and integration of trial processes into routine data systems.[16] Similarly, Mega-ROX, a registry-embedded randomized trial comparing conservative and liberal oxygenation targets in mechanically ventilated patients, demonstrates how ICUs can move from observation

to randomization and from local audit to contribution to international causal evidence.[17] For Nepal, these experiences show that registry maturity is not only about producing reports; it is about creating readiness for ethical, rapid and locally led participation in global critical care research.

The maturity agenda for Nepal has four practical dimensions: representativeness, data quality, actionability and policy translation. Representativeness requires expansion to a broader mix of public, private, teaching, regional, provincial and resource-variable ICUs, so that registry findings reflect the true diversity of critical care delivery. Data quality requires a refined dataset, simplified definitions, a stronger data dictionary, visible missing-data review, periodic source-data checks, inter-rater reliability assessment and continued training. Actionability requires dashboards to become the agenda for ICU meetings, morbidity and mortality reviews, nursing discussions, quality committees and hospital leadership decisions. Comparative data should be used to understand variation and support improvement, not to create punitive ranking.

Most importantly, registry findings should lead to practical change. Local teams can use their own data to target delayed ICU admission, sepsis care, antimicrobial stewardship, ventilator safety, renal replacement therapy use, unplanned readmission, discharge delays and nurse-sensitive outcomes. At national level, registry outputs can inform workforce planning, ICU bed allocation, training priorities, organ support capacity, referral systems, disaster preparedness and critical care policy. As governance and data quality mature, Nepal can use the registry for multicenter observational studies, registry-enabled randomized trials, adaptive platform trials, stepped-wedge implementation studies, health economic analysis and responsible benchmarking through initiatives such as LOGIC. The goal is not to collect more data, but to ensure that registry data changes care, informs policy, strengthens trial readiness and keeps Nepal visible in global critical care learning.

Prospects: registry-enabled critical care

The future of Nepal's ICU registry is not simply bigger data. It is useful, trusted, validated and locally owned data that improves decisions. Registry-enabled critical care can support embedded trials, adaptive platform trials, stepped-wedge quality improvement studies, real-time dashboards, national ICU observatories, interoperability with electronic medical records, local risk prediction models, sepsis and antimicrobial resistance surveillance, pandemic preparedness, post-ICU survivorship research, cost-effectiveness analysis, equity monitoring, workforce planning and climate or disaster response.

The registry can also create a national community of practice. ICU nurses, intensivists, pharmacists, physiotherapists, data coordinators and hospital leaders can use shared data to ask shared questions. This is one of the most important cultural shifts that a registry can produce: moving from isolated excellence to networked learning.

CONCLUSION

Nepal does not need to wait for perfect digital systems to begin learning from ICU data; it has already begun. The registry has produced evidence on epidemiology, readmission, antimicrobial use, service capacity, oxygen-support implementation and post-ICU follow-up, and has contributed to larger international trial platforms such as REMAP-CAP and Mega-ROX. The next challenge is to ensure that these outputs change practice, policy and patient outcomes. A well-governed ICU registry can convert daily clinical work into collective intelligence. For LMICs, ICU registries are not administrative luxuries; they are instruments of equity, accountability, quality, research and preparedness. The most important test of a registry is whether its data returns to the bedside and changes care.

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DISCLOSURE

This editorial reflects the author's academic interpretation and perspective on ICU registry development, registry-enabled learning and critical care improvement in Nepal and other low- and middle-income countries. The views expressed are those of the author and do not necessarily represent the official position of any institution, funder, journal, professional society, registry network or collaborating organization unless explicitly stated.

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CONFLICT OF INTEREST

Diptesh Aryal is affiliated with Nepal Intensive Care Research Foundation and has been involved in the development, implementation, analysis and dissemination of work related to the Nepal ICU registry. The author declares no commercial, financial or personal conflicts of interest that could have inappropriately influenced the content of this editorial.

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