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Short Commentary

Predicting Antimicrobial Resistance in Surgical ICU Patients: A Short Commentary

Prity Rani Deshwal and Pramil Tiwari*

Department of Pharmacy Practice, National Institute of Pharmaceutical Education and Research (NIPER), Mohali, India

***Corresponding author:** Pramil Tiwari, Department of Pharmacy Practice, National Institute of Pharmaceutical Education and Research (NIPER), S.A.S. Nagar, Mohali 160062, India

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Infections are a significant cause of mortality and morbidity worldwide. Antimicrobial resistance (AMR) represents a mounting global health crisis, particularly within high-risk clinical settings such as intensive care units (ICUs), where patients are often immune compromised, frequently exposed to invasive procedures, and heavily reliant on broad-spectrum antibiotics. In the surgical ICUs, patients undergo a variety of surgical interventions and are prone to postoperative complications, which could possibly increase infection risk and antibiotic exposure [1-3].

In the resource constraint settings, antimicrobial stewardship continues to be challenging due to varied clinical practices and infrastructure gaps, the need for early prediction tools for AMR is essentially critical [4].

A very recent study published in the International Journal of Risk & Safety in Medicine [5] has reported the development and comparison of two machine learning-based predictive models—logistic regression (LR) and artificial neural networks (ANN)—to forecast AMR in surgical ICU patients using real-world clinical data from India. The study leverages a robust, real-world dataset drawn from ICU admissions in a private tertiary care hospital in India. Following screening of 8,010 patients, 4,542 surgical ICU patients were included, and over 104 clinical, demographical, microbiological, and pharmacological variables were initially assessed, reflecting that the dataset used is both comprehensive and contextually rich. The comprehensive nature of the data enabled systematic feature selection, resulting in a streamlined model with 38 significant predictors, which balanced performance with interpretability. The inclusion of diverse variables, such as surgical prophylaxis appropriateness, comorbidity burden, device usage, and specific antimicrobial exposures, demonstrates an insightful understanding of the multifactorial nature of AMR in critical care settings.

The results indicated that the ANN model demonstrated superior predictive performance over LR in multiple key metrics, including specificity (91.2% vs. 86%) and area under the receiver operating characteristic curve (94% vs. 93%), underscoring its potential for capturing complex nonlinear interactions often missed by traditional regression methods. The strength of the study lies not only in its large cohort (n=4542) but also in the breadth of clinical, demographic, and microbiological features, which allowed for robust model development. By integrating clinical parameters like device usage, comorbidity burden, surgical prophylaxis timing, and antibiotic history, the models reflect real-world clinical complexity.

Notably, this study represents one of the first applications of ANN to predict broad-spectrum antimicrobial resistance across multiple pathogens in a post-surgical ICU setting. By enabling the early identification of high-risk patients, these models have the potential to support personalized empiric therapy, strengthen antimicrobial stewardship, and mitigate the impact of resistant infections.

The absence of external validation and reliance on data from a single healthcare facility limits the generalizability across other healthcare settings. To optimize the clinical utility, future research should focus on multicentre validation across healthcare systems and incorporation into real-time electronic health record systems. Moreover, evaluating the influence of model outputs on clinical decision-making and patient outcomes following the implementation will be vital to understanding their long-term effectiveness.

In an era demanding precision and prudence in antimicrobial use, this study offers a compelling framework for integrating predictive analytics into ICU care and highlights the promise of machine learning tools in confronting AMR. Predictive tools like ANN can potentially be integrated into electronic health record systems to flag high-risk patients in real time, personalize empiric therapy, and avoid unnecessary antibiotic use. By enabling early risk identification, this approach may curb the emergence of resistant infections and provide timely support to clinicians navigating complex cases in ICU settings.

In conclusion, this study highlights the promising role of ANN in predicting antimicrobial resistance among surgical ICU patients, offering a valuable step toward personalized infection management. The findings support a data-driven shift in antimicrobial stewardship and ICU clinical decision-making. With increased precision and external validation, such models may become integral to the future infection control strategies.

References

1. Schlapbach LJ, Kissoon N, Alhawsawi A, Aljuaid MH, Daniels R, Gorordo-Delsol LA, et al. (2020) World Sepsis Day: a global agenda to target a leading cause of morbidity and mortality. *Am J Physiol-Lung Cell Mol Physiol* 319(3): L518-L522. [crossref]

2. Ferrara F, Castagna T, Pantolini B, Campanardi MC, Roperti M, Grotto A, et al. (2024) The challenge of antimicrobial resistance (AMR): Current status and future prospects. *Naunyn Schmiedebergs Arch Pharmacol* 397(12): 9603-9615. [crossref]

3. Vierra M, Rouhani Ravari M, Soleymani Sardoo F, Shogan BD (2024) Tailored pre-operative antibiotic prophylaxis to prevent post-operative surgical site infections in general surgery. *Antibiotics* 13(1): 99. [crossref]

4. Singh C, Pandey A, Singh L (2024) Health Policy Analysis on the Containment of Antimicrobial Resistance (AMR) in India: A Mixed Methods Study of Antimicrobial Stewardship as a Pivotal Intervention in Tackling AMR. *Anti-Infect Agents* 22(4): 8-22.

5. Deshwal PR, Tiwari P (2025) A comparative analysis of logistic regression (LR) and artificial neural network (ANN) models for predicting antimicrobial resistance in surgical ICU patients: Insights from real-world evidence in India. *Int J Risk Saf Med* 09246479251337933.

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