## Title: Smart technologies for infection control and antimicrobial stewardship in critical care settings: A narrative review

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**Reviewer A:** **Saika Farook,** **ORCID:** **0000-0003-3761-1705,** **COI:** **None,** **AI disclosure:** **None**

The manuscript entitled "A narrative review of smart technologies for infection control and antimicrobial stewardship in critical care settings" is a nice piece of work done by the authors. Although this is an interesting topic and suitable for the journal, the manuscript needs major revision.

**1. Comment** "several models achieving AUROC values above 0.80" -Accurate, but should clarify heterogeneity across studies and that most models are retrospective.

**Response:** As suggested, we have added achievements from the findings in the Title, and it reads as
"several studies reporting AUROC values exceeding 0.80 despite methodological heterogeneity and predominantly retrospective designs" (Line no. 56-58)

**2. Comment** "Smart technologies show substantial potential to transform ICU infection control"
-Slightly overstated; recommend "have the potential to" to reflect limited real-world validation.

**Response:** As suggested, we have modified our abstract having conclusion section (Line no. 67-68)

**3. Comment** "The issue is temporary, as evidenced by the sharp increase in stress…"
-Scientifically unclear and contradictory. AMR and ICU strain are not temporary issues. Rephrase or remove "temporary."

**Response:** As suggested, we have modified the a line Introduction, and it reads as:
"collateral damage to essential, healthy commensal microbial flora" (Line no. 67-68)

**4. Comment** "collateral to essential and healthy microbial flora damage"
Grammatically incorrect and unclear. Should be "collateral damage to normal/commensal flora."

**Response:** As suggested, we have modified the Introduction and removed the Grammatically incorrect in the Introduction.
"The issue reflects a sustained and escalating burden, as evidenced by the sharp increase in stress, rather than a short period of time" (Line no. 97-100)

**5. Comment** Methods section: It should be modified and elaborated

**Response:** As suggested, we have modified the Methods which is modified and elaborated (Line no. 132-175)

**6. Comment** In the Result section:

- "These models are quite effective… AUC is 0.94"
- This is overgeneralisation. Not all models achieve this performance. Specify which condition, model, and study context.

**Response:** As suggested, we have modified the Result part.
In a specific ICU setting, supervised machine-learning models such as gradient-boosted trees have demonstrated high predictive performance for early sepsis detection, achieving an AUC of up to 0.94 in single-centre retrospective validation studies, although such performance is not uniform across models or clinical contexts (Line no. 251-255)

**7. Comment** The Table 1 caption section is not well written in "AI/ML systems could accurately predict a variety of infection-related occurrences". This line also appears vague. Recommend specifying which outcomes and under what conditions.

**Response:** Thank you very much, sir, for your responses. We have modified our manuscript Table 1 caption part as per your suggestions. AI/ML models have demonstrated accurate prediction of specific infection-related outcomes—particularly ICU-acquired sepsis, VAP, CLABSI, SSIs, and UTIs—under defined clinical settings, achieving AUROC values ranging from ~0.80 to 0.94 and enabling early detection up to 4–12 hours before clinical onset in validated ICU and hospital cohorts. (Line no. 261-265 )

**8. Comment** The Table 2 caption section is not well written in
"Therefore, most acute care facilities will soon be able to benefit…"

**Response:** As suggested, we have modified the Table 2 caption part.
Therefore, acute care facilities may benefit in the future from adapting approaches derived from traditional remote patient

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**9. Comment** The Table 2 caption section is not well written in

"new data architectures (like mobile computing)"
-Scientifically imprecise. Likely meant "edge computing," not mobile computing.

**Response:** As suggested, we have modified the Table 2 caption part.

"new data architectures (such as edge computing) (Line no. 312-313)"

**10. Comment** The Table 3 caption section is not well written in

"conflicting data on a direct and long-lasting impact on mortality"
-Good critical insight, but this point should be emphasised earlier to balance optimistic claims.

**Response:** As suggested, we have modified the Table 3 caption part.

"conflicting data on a direct and long-lasting impact on mortality"
-Good critical insight, but this point should be emphasised earlier to balance optimistic claims. (Line no. 355-358)

**11. Comment** The Discussion section is not well written in

"XAI platforms provide concise explanations"
-Oversimplified. XAI improves interpretability but does not always produce clinically intuitive explanations. Should be qualified.

**Response:** As suggested, we have modified the Discussion section.

XAI platforms can enhance model interpretability by providing concise explanations, but these explanations are not always clinically intuitive and may require expert contextualisation (Line no. 388-391)

**12. Comment** The Discussion section is not well written in

"structured communication protocols, like SBAR"
-SBAR discussion feels weakly connected to smart technologies; consider tighter integration or removal.

**Response:** As suggested, we have modified the Discussion section.

In this context, embedding structured communication protocols such as SBAR within smart digital health technologies enhances real-time information exchange, thereby strengthening patient safety and interdisciplinary coordination (Line no. 415-418)

**13. Comment** The Conclusion section is not well written in

"too smart technologies like AI, IoT, and telemedicine"
-Typographical/grammatical error ("too smart"). Should be "smart technologies."

**Response:** As suggested, we have modified the Conclusion.

This scoping study suggests that the integration of advanced technologies such as artificial intelligence, the Internet of Things, and telemedicine has the potential to fundamentally transform critical care management. (Line no. 493-495)

**14. Comment** The Conclusion section is not well written in

"lays the groundwork for critical care medicine to have a high-performance, infection-resistant future"
-Aspirational language; recommend more cautious, evidence-based phrasing.

**Response:** As suggested, we have modified the Conclusion.

This combination has the potential to support advancements in critical care medicine by strengthening infection control practices, contributing to improved clinical outcomes, and promoting more judicious and sustainable antibiotic use (Line no. 510-512)

**15. Comment** Table 1: Row 2, Column 4, "accuracy of up to 4 hours before start". Unclear phrasing: "4 hours before start" likely refers to prediction 4 hours before clinical manifestation—needs rewording for clarity. ± values are given, but the source of variation (CI, SD?) should be clarified.

**Response:** As suggested, we have modified the Table 1.

Some sepsis prediction models can predict sepsis up to 4 hours before clinical onset, achieving an AUROC of approximately 0.847 (± 0.050 SD) in internal validation and 0.761 (± 0.052 SD) in external validation. (Line no. 670-671)

**16. Comment** Table 1: row 4, column 4, "ML is the most common AI type used; predictive modelling is the most common advantage" Vague and non-quantitative; could be rephrased to describe concrete outcomes or key findings.

**Response:** As suggested, we have modified the Table 1 part. Machine learning is the most frequently applied AI type, with predictive modeling being its primary advantage in generating actionable insights. (Line no. 670-671)

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**17. Comment** Table 1: row 6, column 2, "Concept" AI-driven examples. The label "Concept" is ambiguous; clarify whether these are pilot studies, theoretical models, or proof-of-concept research.

**Response:** As suggested, we have modified the Table 1. Pilot studies of AI-driven diagnostic and therapeutic applications (Line no. 670-671)

**18. Comment** Table 2: row 3, column 3, "Vital signs…physical activity and emotional state"
"Emotional state" is vague—how is it measured, and how does it relate to infection or AMS? Needs clarification.

**Response:** As suggested, we have modified the Table 2. Vital signs (heart rate, $SpO_2$), physical activity level, and emotional state assessed using a validated mood/anxiety scale to examine its association with infection status and antimicrobial stewardship (AMS) practices (Line no. 684-685)

**19. Comment** Table 2: row 4, column 4, "Optimising antibiotic use in older adults" Over specific population may not match the general ICU focus; consider noting applicability to broader ICU populations.

**Response:** As suggested, we have modified the Table 2. Optimising antibiotic use in adult ICU populations, including older patients. (Line no. 684-685)

**20. Comment** Table 2: row 5, column 5, "Digital tools empower patients and can improve surveillance sensitivity, but resource distribution and interdisciplinary integration" Incomplete sentence—should be rewritten for clarity.

**Response:** As suggested, we have modified the Table 2.
Digital tools empower patients and enhance surveillance sensitivity; however, challenges persist in equitable resource distribution and effective interdisciplinary integration. (Line no. 684-685)

**21. Comment** Table 3: row 2, column 3, "Comparing AMS strategies before and during the COVID-19 pandemic"
The primary function column describes a comparison rather than the tool itself. It would be clearer to explicitly describe the digital tools or functionalities (e.g., AMS dashboards, virtual consultation platforms).

**Response:** As suggested, we have modified the Table 3.
Digital AMS tools and functionalities (e.g., AMS dashboards, electronic prescribing surveillance, and virtual infectious disease consultation platforms) implemented before versus during the COVID-19 pandemic (Line no. 699-700)

**22. Comment** Table 3: row 3, column 5, "Digital interventions reduce antimicrobial use and improve appropriateness, but their impact on clinical outcomes is inconsistent". The phrase "inconsistent impact" is vague; if possible, specify which outcomes were assessed and why results varied.

**Response:** As suggested, we have modified the Table 3. Digital interventions reduce antimicrobial use and improve prescribing appropriateness; however, effects on clinical outcomes such as infection resolution, length of hospital stay, and mortality vary across studies due to differences in settings, intervention design, and patient populations (Line no. 699-700)

**Reviewer E: Kazi Mahzabin Arin, ORCID: 0009-0004-0064-3847, COI: None, AI disclosure: None**

**23. Comment** The manuscript's hypothesis is highly appreciated but the manuscript needs more formatting

**Response:** Thank you very much for your appreciation. It was very encouraging

We have now revised the manuscript in light of your comments. We believe that the paper has been further improved in content and presentation. The point-wise response to the comments is provided in this table

**24. Comment** The Methods section is very brief, needs to be detailed, otherwise it cannot be reproducible.
The authors' analyses need to be addressed.

**Response:** As suggested, we have modified the Methods which is modified and elaborated (Line no. 132-175)

**25. Comment** please replace "must be" with May be', it will be more appropriate wording.

**Response:** As suggested, the in conclusion section "must be" with May be' has replace. (Line no. 505)

**26. Comment** Too long statement, hampers readability. please break it into three lines. The statement here refers to Figure 1, but the manuscript focuses on critically ill patients admitted to the ICU, which is irrelevant.

**Response:** Even though broad-spectrum empirical therapy is often required to save lives in critically ill patients, excessive reliance on such treatment can cause collateral damage to essential commensal microbial flora and lead to unnecessary drug exposure. This practice increases the risk of treatment failure when the infecting pathogen is resistant to the prescribed agents. Moreover, indiscriminate use of broad-spectrum antimicrobials directly intensifies selection pressure, thereby accelerating the development of antimicrobial resistance, as illustrated in Figure 1 (1). (Line no. 91-97)

**27. Comment** Is not relevant to the previous. It is not understandable what the authors want to say here.

**Response:** The issue reflects a sustained and escalating burden, as evidenced by the sharp increase in stress, rather than a short period of time and complexity of healthcare systems in recent years (1). (Line no. 97-99)

**28. Comment** The word 'shortcomings' is repeated here; it would be better to use a similar word.

**Response:** Used "gaps" word. (Line no. 100)



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**Responsible editor:** Tahniyah Haq, **ORCID:** 0000-0002-0863-0619, **COI:** None

**29. Comment** The manuscript's hypothesis is highly appreciated but the manuscript needs more formatting

**Response:** Thank you very much for your appreciation. It was very encouraging. We have now revised the manuscript in light of your comments. We believe that the paper has been further improved in content and presentation. The point-wise response to the comments is provided in this table.

**30. Comment** Please shorten the abstract to under 300 words

**Response:** As suggested, we have modified the Abstract words limit within 300 words which is modified. (Line no. 40-73)

**31. Comment** Include more details, such as databases searched and keywords, in the methods instead of the results

**Response:** As suggested, we have modified the Methods which is modified and elaborated (Line no. 132-175)

**32. Comment** Headings such as result may be omitted.

**Response:** Headings such as result is omitted. (Line no. 176)

**33. Comment** Headings such as discussion may be omitted.

**Response:** Discussion such as result is omitted. (Line no. 363)

**34. Comment** Include abbreviations in the footnote of all the table 1

**Response:** Abbreviations included in the footnote of all the table 1 (Line no. 671-676)

**35. Comment** Include abbreviations in the footnote of all the table 2

**Response:** Abbreviations included in the footnote of all the table 2 (Line no. 685-689)

**36. Comment** Include abbreviations in the footnote of all the table 3

**Response:** Abbreviations included in the footnote of all the table 3 (Line no. 700-705)

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