

The Impact of Multiplex PCR of Diagnostic Efficacy and Clinical Outcomes in Patients with Severe Pneumonia in the Intensive Care Unit: A Systematic Review and Meta-Analysis

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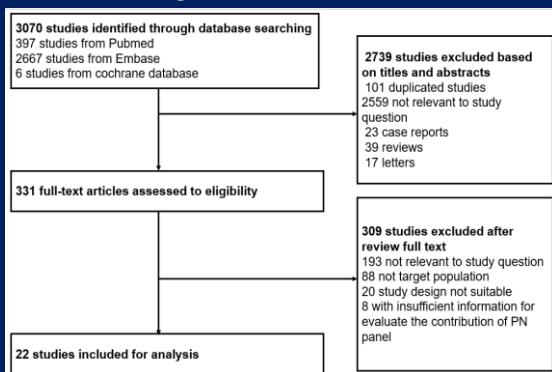
Background

The accurate identification of the pathogen and the implementation of timely, appropriate treatment are vital in pneumonia patients with intensive care unit (ICU) admission. Multiplex polymerase chain reaction (PCR) facilitates the rapid discernment of pathogens, thereby potentially enabling targeted treatment and minimizing antimicrobial exposure. The objective of this study is to assess the efficacy of multiplex PCR in accurately detecting pathogens and in optimizing antibiotic usage.

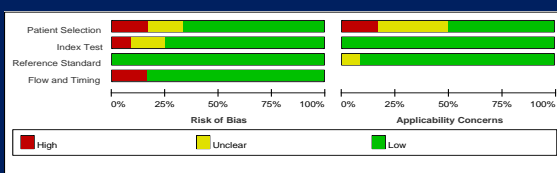
Materials and Methods

A comprehensive search was undertaken across PubMed, Embase, and the Cochrane database from January 2018 to Dec 2022 to identify cohort, randomized controlled trial and cross-sectional studies utilizing multiplex PCR for the diagnosis of pneumonia in patients admitted to ICUs. Random-effects meta-analyses conducted to evaluate the diagnostic precision for bacteria and the influence of multiplex PCR on antibiotic utilization.

PRISMA flow diagram.



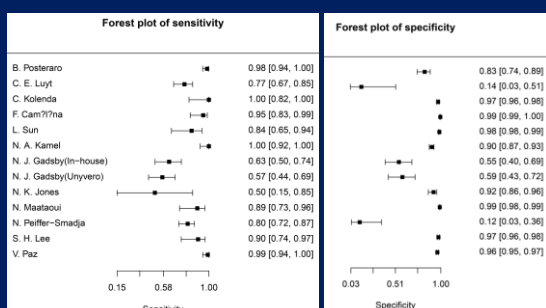
QUADAS-2 for included studies.



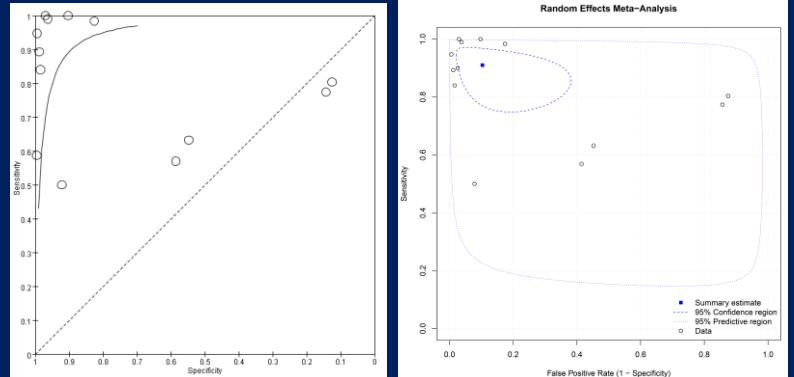
Results

Out of the 3070 studies retrieved, 22 were deemed suitable for inclusion, incorporating a total of 1264 patients. The sensitivity and specificity in the pathogen detection of multiplex PCR were 91.0% (95% CI 81.2% to 96.0%) and 89.7% (95% CI 73.0% to 96.5%) respectively.

Forest plot of the estimated sensitivity and specificity.

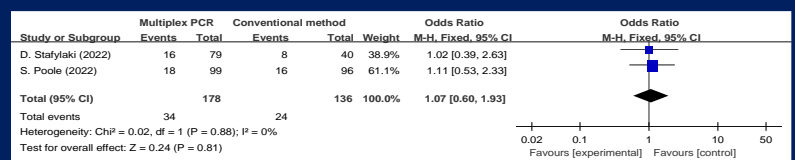
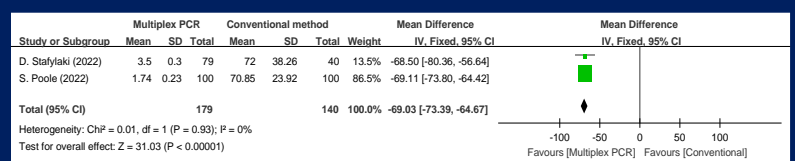
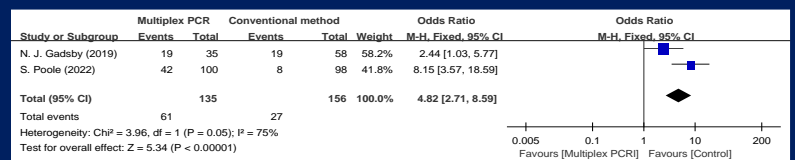


Summary receiver operating curve (ROC) analysis.



Multiplex PCR testing was associated with a reduction of 69.03 hours (95% CI -73.39 to -64.67) in the time to obtain results, and a more antibiotics de-escalation rate (OR 4.82, 95% CI 2.71 to 8.59). There was no significant difference in mortality between the two groups.

Forest plot of antibiotics de-escalation rate, time to results reduction (in hours), and mortality with rapid multiplex PCR versus routine testing.



Conclusions

Multiplex PCR has high sensitivity and specificity of pathogen identification in patients with severe pneumonia. A decrease in the time to obtain microbiology results and an increase in antibiotics de-escalation rate suggest that multiplex PCR may facilitate improvements in appropriate antimicrobial usage amongst pneumonia patients admitted to the ICU.

References

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