**Towards Optimization of AI in Laboratory Medicine**

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**Abstract**

Artificial intelligence (AI) is increasingly redefining laboratory medicine by enhancing diagnostic precision, workflow efficiency, and data-driven decision-making. The growing demand for accuracy and timeliness in diagnostics, alongside financial and ethical considerations, makes the exploration of AI’s role in this field essential. This study was conducted to analyze the benefits, barriers, and optimization strategies for implementing AI within laboratory settings, to provide an evidence-based framework to support the sustainable and responsible integration of AI.

The research employed a quantitative descriptive design, gathering data from 33 laboratory professionals outside the Philippines through purposive and convenience sampling. A structured survey distributed via Google Forms captured insights on three core AI functions: automated data entry, image analysis, and predictive analytics. Data were analyzed using descriptive statistics and regression analysis through SPSS to assess the relationships between AI benefits, barriers, and optimization strategies. Findings showed that AI significantly contributes to diagnostic accuracy, workflow automation, and predictive capabilities. However, challenges such as high implementation costs, data privacy concerns, limited technical expertise, and regulatory compliance issues persist. Respondents emphasized the need for enhanced staff training, ethical oversight, and collaborative partnerships between laboratories and AI developers. Regression results revealed weak predictive relationships between barriers, strategies, and benefits, highlighting AI’s inherent resilience and value in laboratory medicine. In conclusion, AI’s potential can only be fully optimized when technical innovation aligns with strategic implementation and ethical governance. Future adoption requires coordinated efforts across healthcare, academic, and regulatory sectors to ensure equitable and effective utilization.

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