

From Analyzers to Algorithms: Artificial Intelligence and the Future of Laboratory Medicine

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Laboratory medicine informs the majority of clinical decisions, yet the discipline is now being reshaped by a technology it helped create artificial intelligence (AI). The field is shifting from a world of analyzers to one increasingly guided by algorithms.

The transformation is already tangible. Machine-learning middleware supports auto-verification and intelligent quality control; digital cell-morphology systems pre-classify blood films; and in pathology, whole-slide imaging has enabled deep-learning tools including the first system authorized by the US FDA for prostate cancer detection to significantly raise diagnostic sensitivity and reduce missed cancers.¹ Predictive models now integrate laboratory and clinical data to anticipate sepsis or acute kidney injury hours before conventional criteria are met, converting the laboratory from a reactive service into a proactive early-warning system.

Enthusiasm, however, must be disciplined by evidence. A widely deployed sepsis-prediction model performed poorly on external validation, missing most cases and confirming that no algorithm is safe without local testing.² Two further risks demand vigilance—opacity and bias. A landmark analysis found a healthcare algorithm systematically underestimated illness in Black patients³, and even routine reference calculations required correction, prompting removal of the race coefficient from eGFR equations.⁴

For resource-limited settings such as Pakistan, AI-assisted telepathology and point-of-care diagnostics could extend scarce expertise provided models are validated locally.

The journey from analyzers to algorithms is under way. AI will not replace the laboratory scientist; it will amplify the professional who remains the guarantor of quality.

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