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The utility of Artificial Intelligence in the detection of Interstitial Lung Disease on chest radiography

L. Fourie (Stellenridge, South Africa), J. Hoffman (Stellenbosch, South Africa), M. Moolla (Stellenbosch, South Africa), Z. Nxumalo (Stellenbosch, South Africa), C. Koegelenberg (Stellenbosch, South Africa)

Background: High-resolution computed tomography (HRCT) is integral to the diagnosis of interstitial lung disease (ILD) but is costly and often unavailable in low- and middle-income countries (LMICs). Although ILD features may be present on chest x-rays (CXR), early disease can be difficult to detect. This study evaluated the diagnostic performance of a deep-learning algorithm for detecting ILD on CXR.

Methods: We conducted a retrospective diagnostic accuracy study including 295 adult CXRs (156 ILD-confirmed cases and 139 controls). All images were analysed using an AI model. Discriminatory performance was assessed using the area under the receiver operating characteristic curve (AUROC). Internal validation was performed using 200-iteration bootstrap resampling, comparing AUROCs for the full dataset and a hold-out test set. Diagnostic performance was evaluated at four thresholds with calculation of sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). Model calibration was assessed using logistic regression, Hosmer–Lemeshow testing, and Brier score.

Results: The model achieved an overall AUROC of 0.926. AUROC was 0.933 in the training set and 0.907 in the hold-out set. At the optimal threshold, sensitivity was 92.3%, specificity 82.0%, PPV 85.2%, NPV 90.5%, and accuracy 87.5%. Interstitial opacity was the strongest predictor of ILD (adjusted odds ratio 494.8). Calibration analysis showed a slope of 0.866, intercept -0.138 , Hosmer–Lemeshow $\chi^2 = 13.53$, and Brier score 0.0996.

Conclusion: The AI model demonstrated strong diagnostic accuracy and, at the optimal threshold, functioned effectively as a screening tool with high rule-out capability. Implementation may support workflow optimisation and improved triaging for further investigation.
