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CLINICAL VALIDATION AND STATISTICAL PERFORMANCE ANALYSIS OF QUANTUM MEDICAL EMERGENCY AI SYSTEM

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Relevance. Emergency medicine faces critical challenges – crowded departments, limited patient data, and multiple life-threatening conditions with overlapping presentations, while diagnostic delays seriously harm patients. Existing tools address only single conditions (qSOFA for sepsis, NIHSS for stroke), creating diagnostic blind spots. This study investigates how a comprehensive AI system providing real-time risk assessment for multiple acute emergencies simultaneously can address these implementation gaps.

Aim: to create and validate a software program across 15 supported conditions by assessing diagnostic accuracy, sensitivity, specificity in real emergency department settings; performing statistical validation using large-scale simulated encounters; evaluating clinical utility including early detection and time savings; and documenting regulatory compliance.

Materials and methods. The system uses Bayesian inference, Monte Carlo simulations, and quantum-inspired algorithms to assess 15 life-threatening conditions. Phase 1 tested 158 real patients across three emergency departments. Phase 2 involved 150,000 simulated encounters (10,000 per condition) with data drawn from published trials, EHR patterns, and expert-generated edge cases. Outcomes included accuracy, sensitivity, specificity, and AUC-ROC with 95% confidence intervals. Reliability was assessed using Cohen's Kappa, with significance set at $p<0.05$.

Results and their discussion. In real-world testing, the system achieved 94.3% accuracy, 91.7% sensitivity, and 96.1% specificity. It identified critical conditions 4.2 hours earlier than standard care, saved 23 minutes per complex case, and reduced missed diagnoses from 12.4% to 3.8%. Resource utilization improved with 94.1% correct ICU triage, unnecessary lab tests reduced by 22.7%, and hospital stays shortened by 1.2 days. In Phase 2, statistical validation confirmed these findings with 98.7% accuracy (95% CI: 98.5-98.9%), sensitivity 94.4% (95% CI: 93.8-95.0%), specificity 99.0% (95% CI: 98.8-99.2%), and AUC-ROC of 0.984. The platform's architecture provided seamless access to hospital medical records for data transfer. Reliability checks showed excellent agreement with Cohen's Kappa of 0.89.

Conclusions. The Quantum Medical Emergency AI System demonstrated robust diagnostic performance across both validation phases, achieving 98.7% accuracy across 15 life-threatening conditions. By providing simultaneous risk assessment for multiple emergencies, it addresses the fundamental challenge of undifferentiated patients in emergency settings. The early detection advantage averaging 4.9 hours – with acute kidney injury detected 8.1 hours earlier and sepsis 4.8 hours earlier – provides a critical window for preventive interventions. With full regulatory clearances and comprehensive security compliance, the platform represents a clinically validated, secure, and immediately implementable tool that helps clinicians work faster, more consistently, and with fewer errors across a broader spectrum of life-threatening conditions.