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Evaluating the Integration of a Machine Learning Algorithm for Diabetic Retinopathy Screening in Dar es Salaam's Primary Care Clinics: A Policy Analysis for the Tanzanian Health System

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Abstract

Diabetic retinopathy is a leading cause of preventable blindness in Tanzania. Screening access is constrained by a critical shortage of ophthalmologists. Primary care clinics in Dar es Salaam are essential for early detection but lack specialist capacity for routine retinal assessment. This policy analysis evaluates the potential integration of a machine learning algorithm for diabetic retinopathy screening in Dar es Salaam’s primary care clinics. It aims to assess the algorithm’s field performance, identify systemic implementation barriers, and analyse the policy implications for the Tanzanian health system. The analysis uses a mixed-methods, multi-stakeholder approach. It reviews technical validation data on the algorithm’s diagnostic accuracy. It also synthesises findings from stakeholder interviews with clinic staff, health ministry officials, and patients, alongside an analysis of health system requirements for digital technology integration. The algorithm demonstrated a sensitivity of 92% for detecting referable diabetic retinopathy in the field setting. Key implementation barriers included unreliable clinic internet connectivity, concerns about healthcare worker training burdens, and unresolved questions regarding long-term cost-effectiveness and maintenance. Stakeholders emphasised the necessity of embedding the technology within a clear referral pathway. Machine learning-assisted screening presents a technically viable opportunity to expand diabetic retinopathy detection in Tanzanian primary care. However, successful integration is contingent upon addressing critical digital infrastructure and health system challenges beyond algorithmic performance. Policy should prioritise pilot programmes in clinics with enhanced connectivity, alongside investment in digital infrastructure. Develop standardised training protocols for healthcare workers and establish clear governance frameworks for data management and patient referral. A phased and costed national rollout strategy is required. diabetic retinopathy, artificial intelligence, screening, primary health care, health policy, Tanzania, digital health, machine learning This analysis provides evidence-informed policy guidance for integrating machine learning-based diabetic retinopathy screening into a resource-constrained primary care system, highlighting critical non-technical barriers that must be addressed for equitable and sustainable implementation.

Keywords: *Health policy analysis, Task shifting, Diabetic retinopathy screening, Sub-Saharan Africa, Primary health care, Technology assessment, Medical algorithms*

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