

Diabetic Eye Care (AID-Eye) Model: A Quasi-experimental Study in Rural China

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Introduction

Diabetic retinopathy (DR) is the leading cause of blindness, disproportionately affecting low- and middle-income countries (LMICs). Shortage in ophthalmic personnel and essential equipment at primary healthcare (PHC) level makes it challenging to offer hierarchical diabetic eye care in rural LMICs. Artificial Intelligence (AI) has the potential to improve resource allocation and address this gap. While previous studies have demonstrated the diagnostic accuracy of AI-based DR screening system in controlled settings, the evidence base for its' deployment in real-world PHC settings with limited resources is lacking.

Objectives

To evaluate the implementation and effectiveness of the deployment of an Artificial Intelligence-Based Hierarchical Diabetic Eye Care (AID-Eye) Model in rural China

Methodology

We implemented the AID-Eye Model (Fig 1) between 2022 and 2024, including: (1) PHC Strengthening: equipping township health centers with portable fundus cameras and training general practitioners (GPs) for fundus image capturing, health education, referral and follow-up management, alongside training ophthalmologists at county hospitals to provide laser treatment; (2) Deployment of AI-based automatic grading algorithm for the detection of DR; (3) Establishing a vertical and horizontal integrated referral system. Implementation outcomes and facilitators/barriers were assessed using the Medical Research Council process evaluation framework. A quasi-experimental design with difference-in-differences approach evaluated the impact on eye health and diabetic eye care utilization. Quantitative and qualitative data were collected from three pilot counties in Anhui Province

Results

The AID-Eye Model has demonstrated a significant impact on diabetic eye care utilization in rural China, averting 27 cases of blindness and facilitating 4,300 additional DR screenings, 753 additional referrals, 829 additional county ophthalmology outpatient visits, and 167 additional DR treatments per 10,000 individuals with diabetes. The process evaluation indicated that the real-world implementation of AID-Eye Model had high fidelity and wide reach, largely supported by both local government and the healthcare system. Despite these achievements, several challenges were identified. These included the need to improve patient compliance with follow-up referrals and subsequent treatments, as well as the provision of appropriate financial and non-financial incentives for GPs. Additionally, there were concerns regarding the adequacy of training for GPs to effectively deliver point-of-screening counseling to patients, as well as broader issues around accountability. Another challenge was the integration of diabetic eye care into existing diabetes management frameworks, which is essential for the sustainability and long-term success of the model.

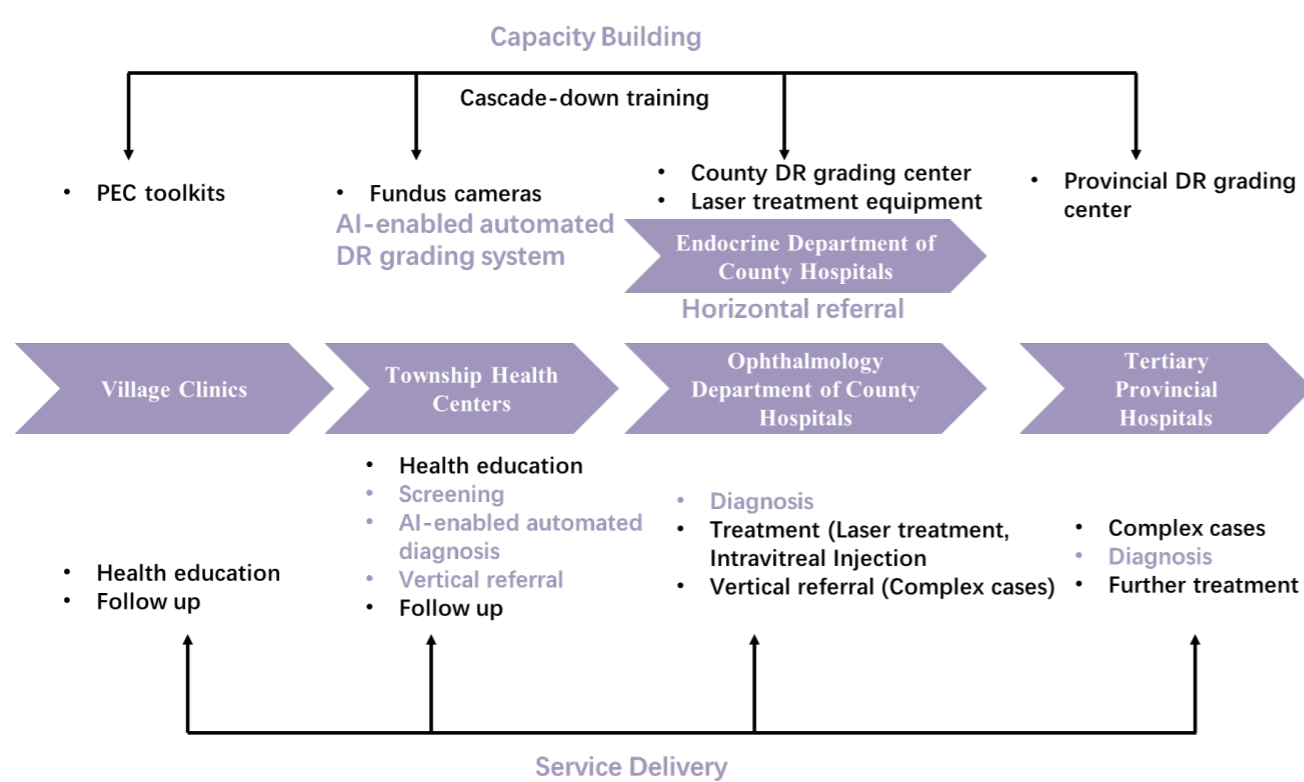


Fig1. The AID-Eye Model

Conclusions

The AID-Eye Model effectively improved diabetic eye care utilization in rural China, highlighting the potential for integrating diabetic eye care into real-world PHC settings with the assistance of AI. In resource-limited settings, technological innovations, when supported by organizational innovations within the healthcare system, play a critical role in the successful implementation and sustainability of complex interventions.

Policy Recommendation

1. The deployment of technological innovations—such as AI—has the potential to improve resource allocation and achieve hierarchical diabetic eye care in resource-limited LMICs when accompanied by organizational innovation, specifically health system strengthening.
2. Seamlessly integrating the AID-Eye Model into existing workflows and establishing authoritative guidelines for AI-based DR screening are crucial for ensuring the model's sustainability and scalability.