Delivery Models of Diabetic Retinopathy Services in Low- and Middle-Income Countries: A Scoping Review

Protocol

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Background

Diabetic retinopathy (DR) is a leading cause of preventable blindness globally

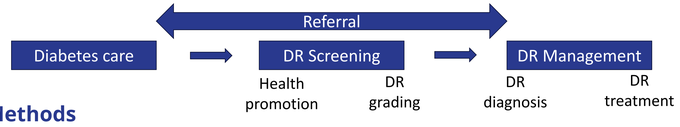
80% of people with diabetes live in LMICs; DR burden projected to increase >55% by 2045

Systematic screening and timely treatment is cost-effective in HICs but rarely implemented in LMICs due to workforce shortages, infrastructure gaps, weak referral systems

Objectives

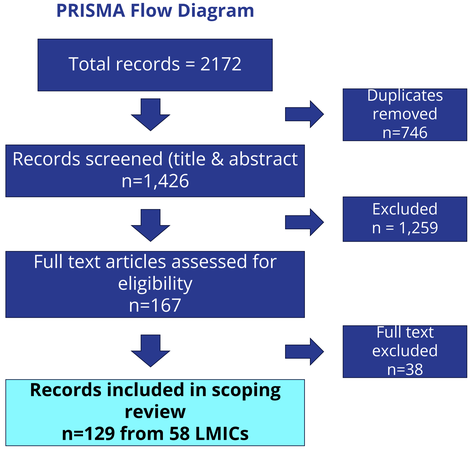
1. To describe existing DR service delivery models used in LMICs
2. To describe the nature and scope of evidence on their effectiveness

Figure 1: DR Continuum of Care Framework used for results synthesis



Methods

Figure 2: Study selection process (PRISMA – ScR)



Results

Figure 3: Distribution of reports by World Bank Income Level, n = 129

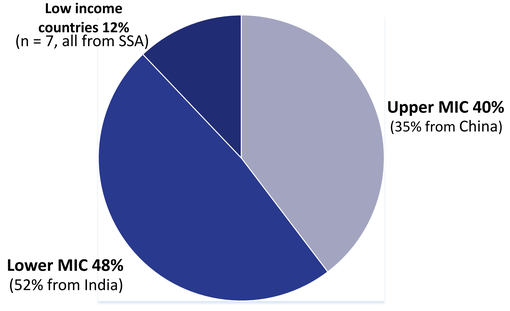


Table 1: Reports describing DR Screening service delivery characteristics

Screening Facilities (n=109)	Screening Personnel (n=112)	Screening Technologies (n=106)	Grading Approaches (n=105)
Diabetes/NCD Clinic 33%	Eye professionals only 47%	**Fundus photography 76% → 62% non-mydriatic → 20% portable**	Point-of-care human grading **50%**
Primary/Community HC 20%	**Task-sharing (eye + non-eye) 28%**	Direct ophthalmoscope 5%	**Telemedicine remote-grading 42% →78% human-guided →22% AI-guided**
Mobile/Outreach Camp 17%	**Task-shifting (non-eye cadres) 17%**	Slit lamp/BIO 4%	Combined approaches 8%
Eye Clinic only 17 %	AI-based systems (adjunct) 10%	Combined approaches 18%	
Diabetes + Eye Clinic 15%			

Overall: 81.9% of DR screening was reported along with Diabetes/NCD services and was opportunistic in 85% of reports

Referral Pathway: screening to treatment (n=88)
- **Primary → Tertiary level 41%**
- Primary + secondary → tertiary 22%
- Community-based → tertiary 21%
- Other combinations 12.3%

Treatment for DR
Exclusively provided by **Ophthalmologists**
- **Exclusively tertiary: 73.9%**
- Secondary + tertiary: 23.9%
- Primary or secondary level was rare

Economic Evaluation Reports of DR Screening + Treatment
Only limited studies (n=3) available, all reporting "screening + treatment" as cost-effective VS "No screening + No treatment" (More Cost effective with: Higher screening adherence, telemedicine and systematic screening)
- **Malawi (Low-income country)**: US$400/QALY (Vetrini 2018)
- **India (Lower MIC)**: US$248/QALY (Wittenberg 2024)
- **China (Upper MIC)**: US$1,141–4,179/QALY (Zhang 2022)

Table 2: Evidence Across the DR Care Continuum (n =129 reports)

DR Care Continuum Component (N=129)	Studies describing component n (%)	Studies reporting effectiveness outcomes n (%)	Types of outcomes reported
Health promotion strategies	46 (36%)	13 (10%)	Screening coverage, screening uptake, referral completion
Screening setting & integration (level of care, facility type, linkage to diabetes services)	108 (84%)	0 (0%)	Not reported
Screening personnel / workforce configuration	106 (82%)	0 (0%)	Not reported
Screening technology & grading approach	106 (82%)	29 (23%)	Diagnostic accuracy (sensitivity, specificity, kappa)
Screening strategy (systematic vs opportunistic; frequency)	74 (57%)	0 (0%)	Not reported
Referral mechanisms	99 (77%)	11 (9%)	Referral adherence, treatment uptake
Treatment service delivery (location, modality, provider)	78 (61%)	9 (7%)	BCVA change, central retinal thickness (CRT)
Cost of screening and/or treatment	21 (16%)	21 (16%)	Unit cost per person screened/treated
Cost-effectiveness analyses (For screening + Treatment: n= 3, 2%)	18 (14%)	18 (14%)	ICER per QALY, cost per QALY gained, cost per sight-year saved

Conclusions

1. DR service delivery in LMICs is heterogeneous but shows increasing integration into diabetes care
2. Increased adoption of digital imaging, telemedicine, and AI is enabling task-sharing and task-shifting
3. Treatment is centralised at tertiary level.
4. Evidence on referral adherence, treatment uptake, and long-term visual outcomes is limited.
5. Organised screening linked to treatment is cost-effective, especially with technology.

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