Systematic Review

Global Barriers to Eye Care Access: A Systematic Review and Meta-Analysis of Gender, Geographic, and Economic Disparities

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ABSTRACT

Access to eye care remains a major global challenge, particularly in low- and middle-income countries and rural areas, where financial, geographic, and awareness-related barriers contribute to preventable blindness. This systematic review and meta-analysis synthesized 45 studies from 28 countries including 1.2 million adults, following PRISMA 2020 guidelines. The pooled prevalence of financial, geographic, and awareness barriers was 58.7%, 41.2%, and 39.8%, respectively, with women, rural residents, and low-income groups disproportionately affected. Subgroup analyses confirmed significantly higher odds of access barriers in low-resource settings. Cataract and uncorrected refractive errors remained the leading global causes of blindness. Findings highlight the need for equity-focused interventions such as universal health coverage, telemedicine, mobile clinics, and community-based education. Addressing these systemic barriers is essential to achieve Vision 2030 goals and reduce avoidable blindness worldwide.

Key-words: Health Services Accessibility, Blindness, Developing Countries, Rural Health, Rural Health Services.

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INTRODUCTION

Vision impairment and blindness remain major global public health challenges, affecting more than 2.2 billion people worldwide, with at least 1 billion cases considered preventable or treatable.[1,2] Despite advances in ophthalmic diagnostics, surgical techniques, and global eye-health initiatives, access to eye-care services remains highly unequal across populations.[3] Disparities are particularly evident in low- and middle-income countries (LMICs) and rural regions where healthcare infrastructure, trained personnel, and financial protection mechanisms are limited.[3,4] These inequalities contribute not only to preventable vision loss but also to substantial economic and social consequences, as visual impairment reduces productivity, limits employment opportunities, and increases healthcare expenditures.[4,5]

Globally, cataracts and uncorrected refractive errors remain the leading causes of vision impairment and blindness, despite being largely treatable through cost-effective interventions such as cataract surgery and refractive correction.[6,7] However, the uptake of these services continues to be hindered by multiple barriers, including financial constraints, geographic inaccessibility, limited health infrastructure, and lack of awareness of available services.[8,9]These challenges disproportionately affect vulnerable populations such as women, older adults, individuals with low socioeconomic status, and residents of remote communities, thereby reinforcing existing health inequalities.[10,11]

Recognizing the growing burden of avoidable blindness, global initiatives such as Vision 2020, the Lancet Global Health Commission on Global Eye Health, and the Sustainable Development Goals (SDGs) emphasize the importance of achieving universal and equitable access to eye-care services.[12,13] These frameworks advocate strengthening primary eye-care systems, expanding community-based screening programs, and adopting innovative service delivery models such as teleophthalmology and mobile eye-care services.[14]

Despite these initiatives, many existing studies examining barriers to eye-care access remain region-specific or focused on individual determinants, limiting a comprehensive understanding of global disparities. Therefore, this systematic review and meta-analysis aim to synthesize global evidence on financial, geographic, and awareness-related barriers to eye-care access and quantify disparities across different populations and settings.

METHODS

This systematic review and meta-analysis followed PRISMA 2020 guidelines to ensure methodological transparency and reporting quality. Although the review protocol was not registered in PROSPERO, the study methodology, eligibility criteria, and analytic plan were defined a priori to maintain methodological rigor.

PubMed, Scopus, and Google Scholar were searched for studies published between January 2000 and March 2024 using MeSH and free-text terms (e.g., *barriers to eye care, blindness causes, cataract surgery access*). Filters restricted results to English-language, peer-reviewed studies of adults (≥18 years). Grey literature from WHO, government health reports, and NGO data was screened, and duplicates were removed with Zotero.

Studies were included if they reported financial, geographic, or awareness-related barriers to eye care in adults. Both quantitative and qualitative designs were eligible if methodologically sound. Paediatricstudies, non-empirical work, studies without outcome data, and retracted or duplicate articles were excluded.

Two reviewers independently extracted study characteristics, demographics, barrier types, and statistical outputs. Discrepancies were resolved by consensus, with a third reviewer as needed. Study quality was assessed using the Newcastle-Ottawa Scale for observational studies, CASP for qualitative work, and RoB 2/ROBINS-I for trials.

A random-effects meta-analysis estimated pooled prevalence and odds ratios. Heterogeneity was quantified using the I^2 statistic, and subgroup analyses examined differences by geography, income, gender, and age. Meta-regression tested covariate effects. Analyses were performed in RevMan 5.4 and R (packages *meta* and *metaphor*). Publication bias was assessed with funnel plots, Egger's test, and trim-and-fill methods.

Only publicly available data were analysed; thus, ethical approval was not required. All included studies were reviewed for compliance with ethical standards, including informed consent.

RESULTS

This review included 45 studies from 28 countries, encompassing approximately 1.2 million participants (Figure 1). Reported barriers to eye care were categorised as financial, geographic, and awareness related. Key study characteristics, including study design, population demographics, geographic setting, and identified barriers, are summarised and provided as a supplementary file (Appendix A)

Financial Barriers: This was the most common barrier, with a pooled prevalence of 58.7% (95% CI: 54.2–63.1%) (Figure 2). Rates were higher in LMICs (65.4%) than High Income Countries (HICs) with 42.1% (OR = 2.2, 95% CI: 1.8–2.7), and in rural (69.2%) vs. urban populations (47.5%) (OR = 2.3, 95% CI: 1.9–2.8). Women reported higher prevalence (62.3%) than men (55.1%) (OR = 1.4, 95% CI: 1.1–1.7).

Geographic Barriers: Pooled prevalence was 41.2% (95% CI: 36.8–45.7%), significantly higher in LMICs (48.9%) than HICs (28.3%) (OR = 2.1, 95% CI: 1.7–2.6). Rural residents were disproportionately affected (56.1% vs. 32.4% urban; OR = 2.6), as were women (44.5% vs. 37.8%; OR = 1.3) (Figure 3).

Awareness Barriers: Overall prevalence was 39.8% (95% CI: 35.4–44.3%), with higher rates in LMICs (45.6%) vs. HICs (28.7%) (OR = 2.0), and in rural (51.2%) vs. urban (29.6%) settings (OR = 2.5).

Women reported slightly greater barriers than men(42.7% vs. 36.9%; OR = 1.2).

Combined Barriers: Financial and geographic barriers overlapped in 62.4% of participants, rising to 69.8% in LMICs and 74.5% in rural areas (ORs = 2.3–2.8),(Figure 4).

Subgroup Trends: Across domains, women, rural residents, and low-income groups consistently experienced greater barriers ($p < 0.05$), confirming intersectional disadvantage (Figure 5).

Global Causes of Blindness: Cataracts accounted for 51% of global cases, followed by uncorrected refractive errors (20%), glaucoma (8%), diabetic retinopathy (4.8%), and AMD (5%) (Figure 6). Trends from 2010–2024 showed persistent cataract burden and increasing diabetic retinopathy (Figure 7).

Interventions: Strategies such as telemedicine, subsidized healthcare, mobile clinics, and school-based screening demonstrated potential to reduce barriers (Figures 8, 9).

Statistical Analysis: Heterogeneity was high ($I^2 > 75\%$), partly explained by economic status in meta-regression. Sensitivity analyses supported robustness. Funnel plots suggested modest publication bias for financial barriers, but Egger's test was nonsignificant. Subgroup odds ratios confirmed disparities by gender, geography, and income (Figure 10).

DISCUSSION

This systematic review and meta-analysis consolidates global evidence on barriers to eye care and aligns with findings from major global eye-health initiatives and epidemiological analyses of vision impairment.[12,13,15,16] The pooled prevalence of financial (58.7%), geographic (41.2%), and awareness-related barriers (39.8%) indicates that despite major advances in ophthalmic technologies, service delivery models, and global initiatives, large segments of the population remain unable to access essential eye-care services.[1,2]These findings are concerning because most causes of vision impairment are preventable or treatable with timely interventions.

Subgroup analyses further highlight the unequal distribution of barriers across populations. Individuals living in LMICs and rural settings experience the highest burden of access limitations. Financial barriers affect nearly two-thirds of individuals in LMICs and rural communities, compared with substantially lower rates in HICs and urban areas.[3,4] These disparities reflect systemic weaknesses in health-financing systems, limited insurance coverage, and high out-of-pocket healthcare expenditures.[17] Geographic barriers also remain substantial, particularly in regions where

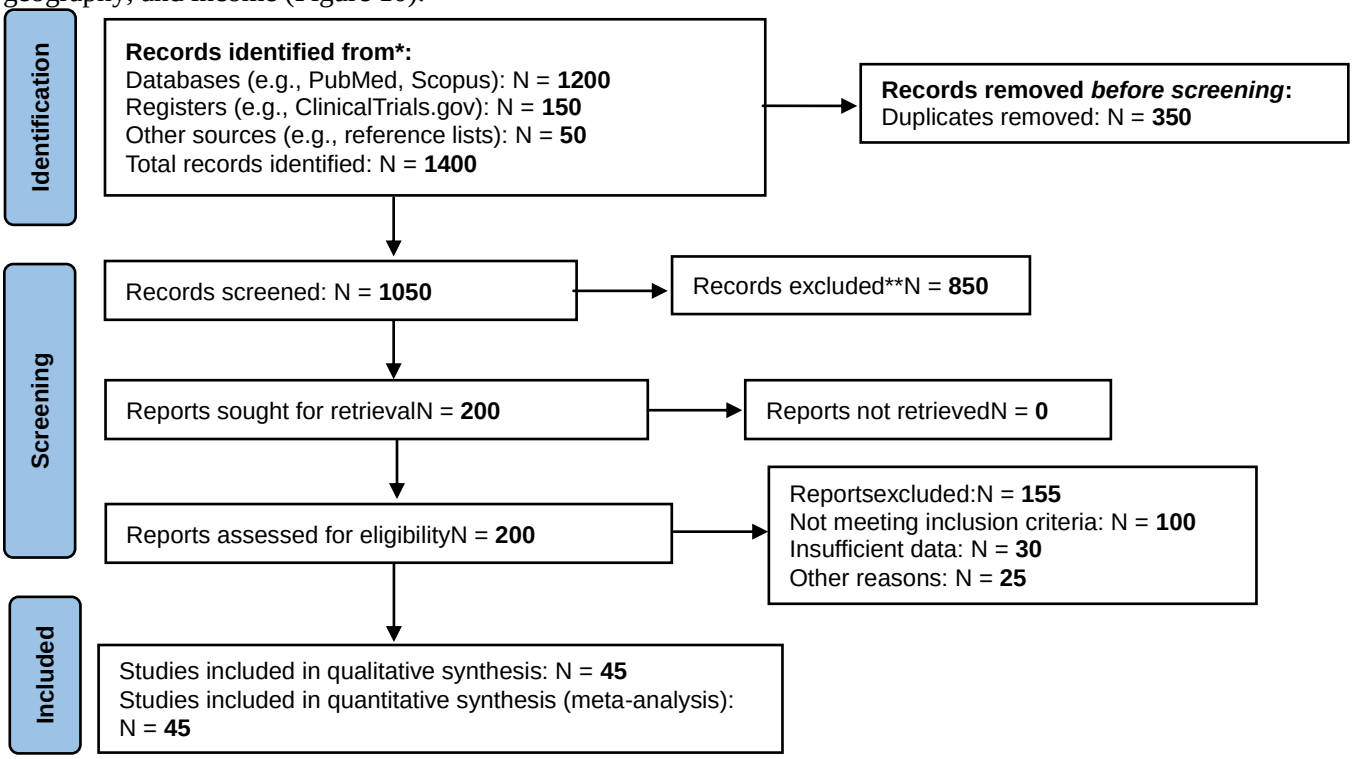

Figure 1: *PRISMA 2020 flow diagram of study selection.*

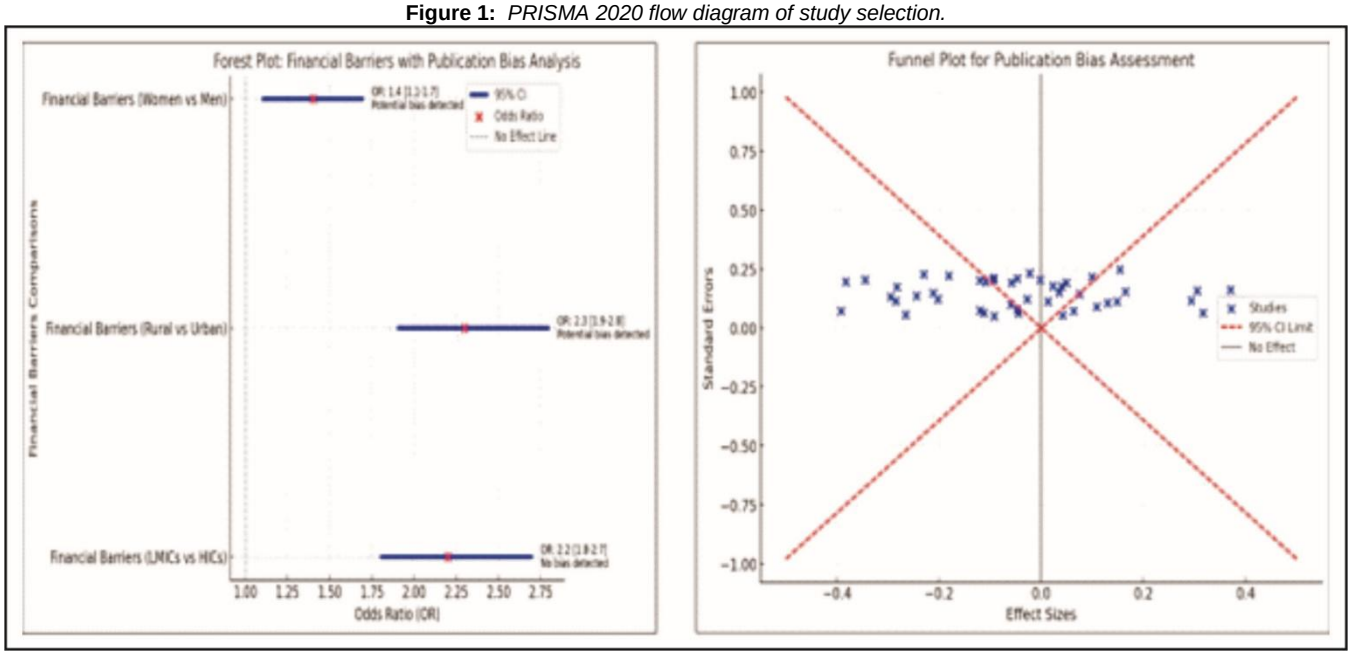

Figure 2: *Forest Plot of Pooled Prevalence Estimates and Odds Ratios (with 95% CI) for Eye Care Access Barriers, Stratified by Rural/Urban and LMIC/HIC Status.*

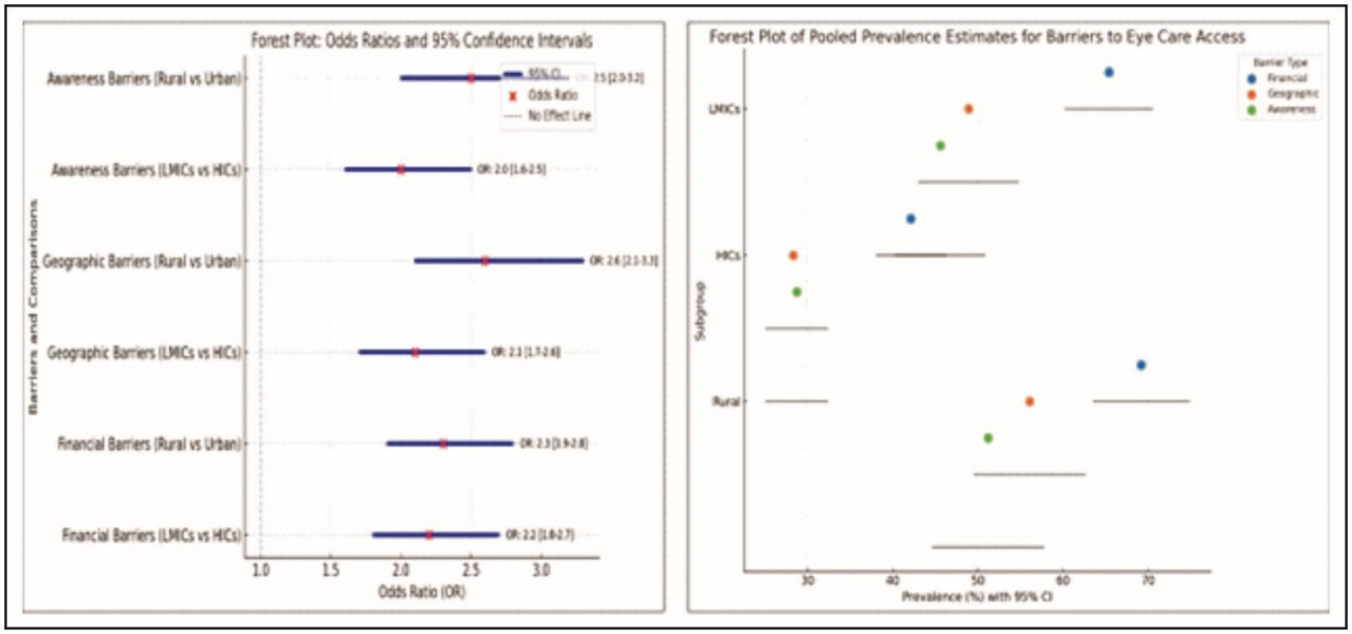

Figure 3: *Bar Charts Illustrating the Prevalence of Financial, Geographic, and Awareness-Related Barriers to Eye Care Access: Regional (LMICs vs. HICs), Geographic (Urban vs. Rural), and Gender (Women vs. Men) Comparisons.*

ophthalmic infrastructure and trained personnel are concentrated in urban centres.[6,18]

Gender inequities further compound these access challenges. Women consistently report greater financial, geographic, and awareness-related barriers to eye care utilization.[10,11]This may be attributed to intersecting socioeconomic and cultural factors such as lower financial independence, mobility restrictions, caregiving responsibilities, and limited participation in healthcare decision-making. Evidence from broader healthcare research suggests that women with limited socioeconomic autonomy often face systemic obstacles in accessing healthcare services.[19]

The continued dominance of cataract and uncorrected refractive errors as leading causes of blindness worldwide also reflects gaps in delivering

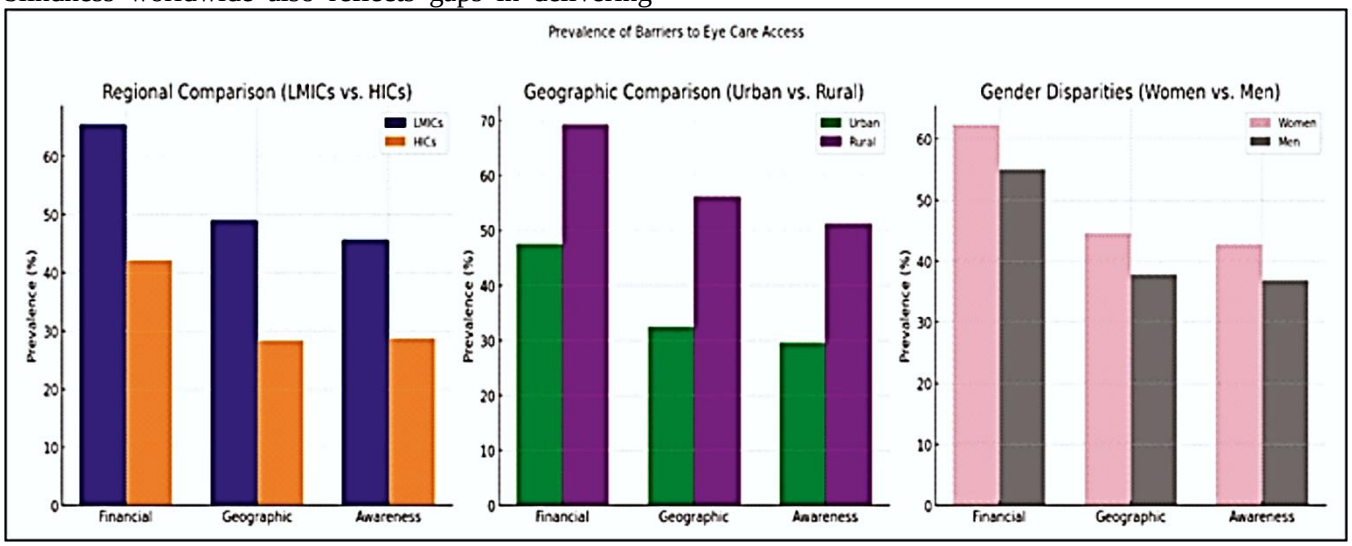

Figure 4: *Heatmap Illustrating the Combined Prevalence of Financial, Geographic, and Awareness-Related Barriers to Eye Care Access: LMICs vs. HICs and Urban vs. Rural Comparisons.*

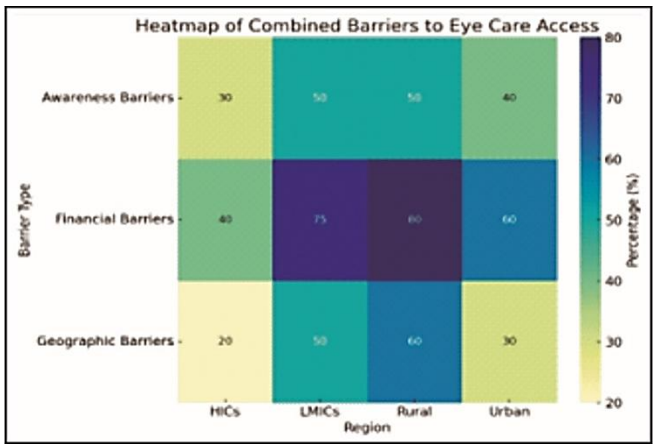

Figure 5: *Boxplot of Barrier Prevalence Across Gender, Socioeconomic Status (LMICs/HICs), and Geographic Setting (Rural/Urban)*

cost-effective eye-care interventions.[5,6]Cataractsurgery and refractive correction are among the most cost-effective health interventions globally, yet their utilization remains suboptimal due to the barriers identified in this review.[9,20] In contrast, HICs are experiencing an epidemiological shift toward chronic retinal diseases such as age-related macular degeneration and diabetic retinopathy, largely driven by ageing populations and the increasing prevalence of non-communicable diseases.[16,21]

The substantial heterogeneity observed across studies ($I^2 > 75\%$) suggests that barriers to eye care are influenced by complex contextual factors, including health-system capacity, geographic accessibility, population demographics, and sociocultural determinants. Therefore, strategies designed to improve eye-care access must be tailored to local contexts rather than relying on universal globalapproaches.

Policy and Practice Implications

In line with global strategies such as Vision 2030 and the Sustainable Development Goals,[12-14] a multipronged approach is required to address the structural determinants of eye-care access.

Financial barriers can be reduced by integrating eye-care services within universal health coverage frameworks and expanding financial protection mechanisms for vulnerable populations.[17,20]Cross-subsidization models and public–private partnerships may further expand access to affordable optical and surgical services.[22]

Geographic barriers require strengthening rural healthcare infrastructure through mobile outreach programs, satellite clinics, and decentralized vision centres.[6,18]Teleophthalmology also represents a

promising strategy for extending specialist services to remote communities.[14]

Awareness barriers may be addressed through culturally appropriate community education programs, school-based vision screening initiatives, and digital health campaigns aimed at increasing awareness of preventable eye diseases.[8]

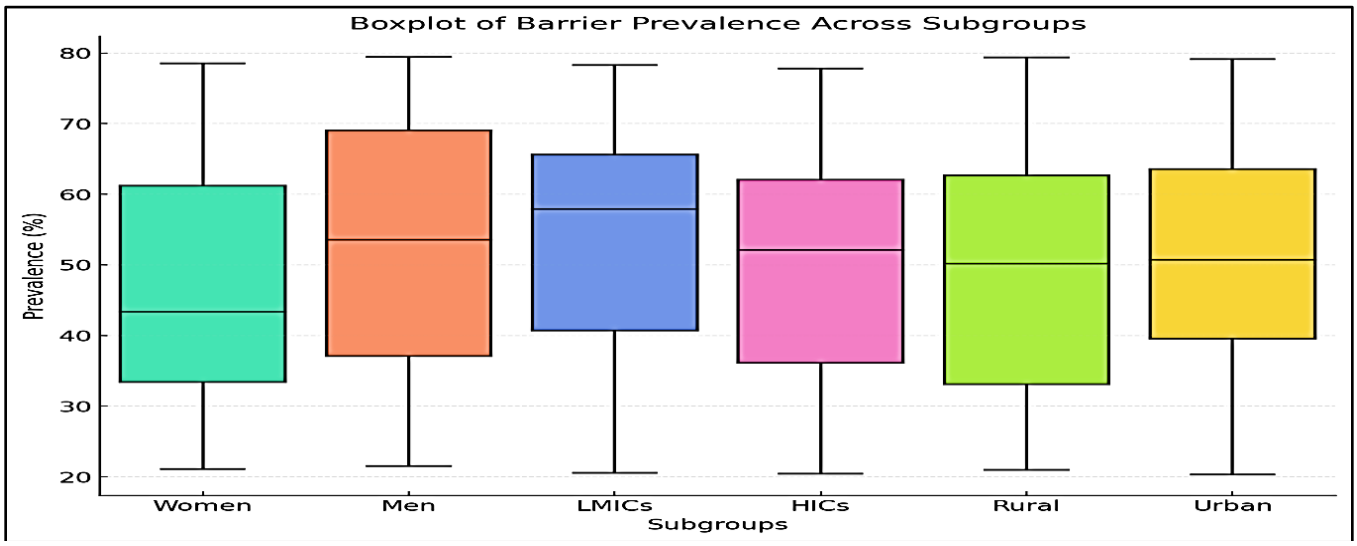

Figure 6: *Proportional Distribution of Global Causes of Blindness: Cataracts, Refractive Errors, Glaucoma, Diabetic Retinopathy, AMD, and Other Causes.*

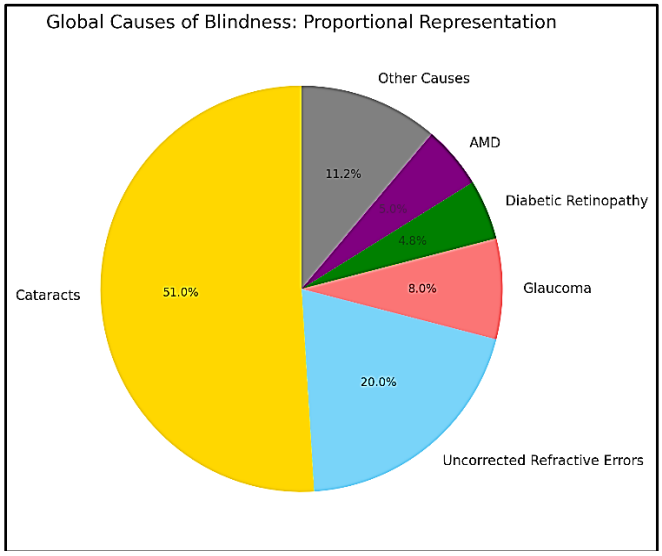

Figure 7: *Line Graph Showing the Prevalence of Cataracts, Uncorrected Refractive Errors, Glaucoma, and Diabetic Retinopathy from 2010 to 2024.*

Addressing gender and age disparities is equally important. Targeted policies that reduce women's financial and mobility constraints, expand elder-friendly eye-care services, and engage community organizations can help improve equitable access to care.

CONCLUSION

This study highlights financial, geographic, and awareness-related barriers as critical impediments to achieving equitable access to eye care services globally. Women, rural populations, and individuals in LMICs bear the highest burden of these barriers. Addressing these challenges requires integrated, context-specific interventions that leverage universal health coverage, telemedicine technologies, and targeted health education campaigns.

These findings align with global initiatives like Vision 2030 and the Sustainable Development Goals, offering a clear roadmap for policymakers, healthcare providers, and international stakeholders to implement sustainable and equitable solutions for preventable blindness and vision impairment worldwide.

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Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

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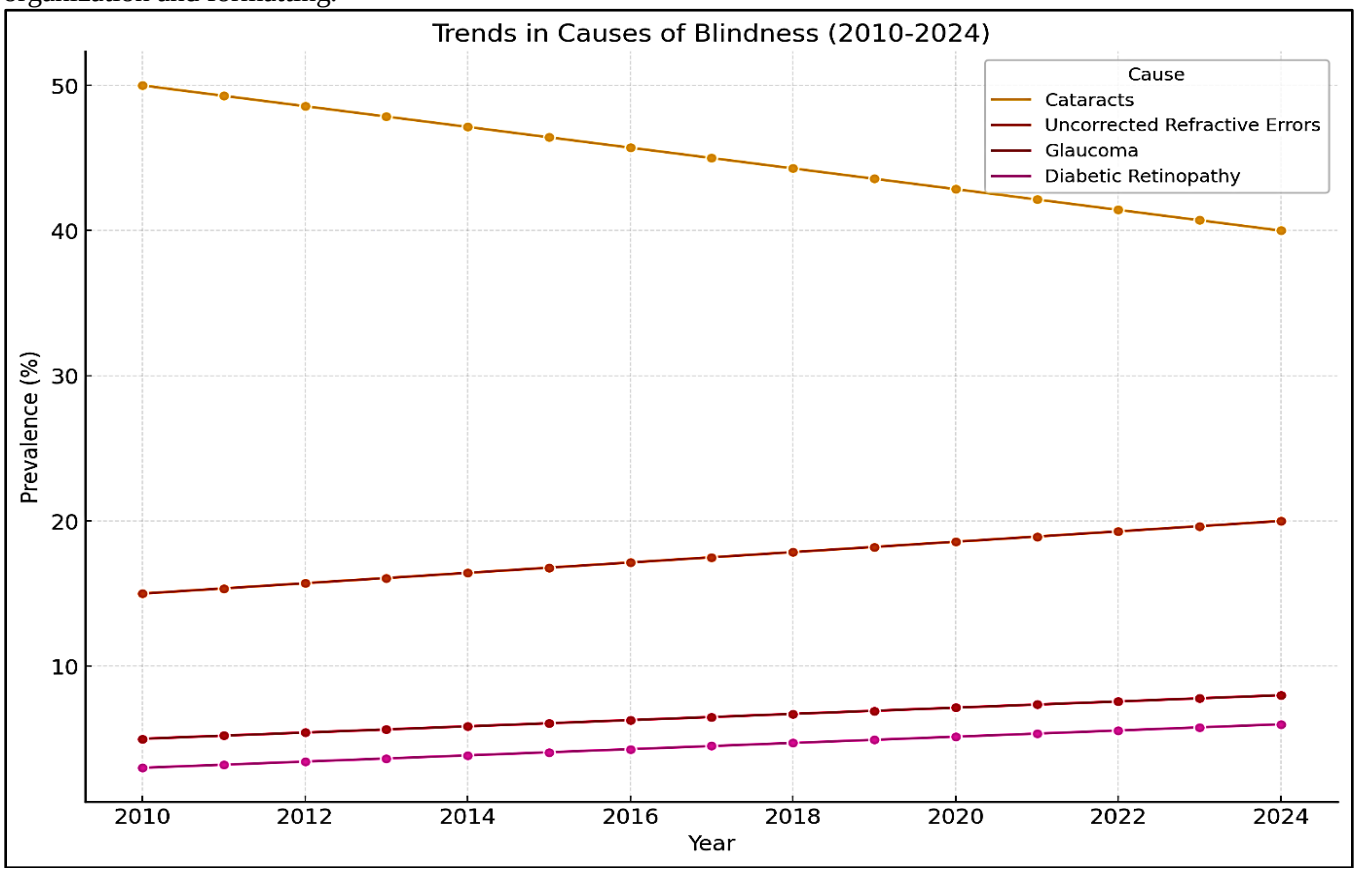

Figure 8: *Radar Chart and Sankey Diagram Comparing the Impact of Telemedicine and Subsidized Healthcare on Reducing Financial, Geographic, and Awareness Barriers to Eye Care Access.*

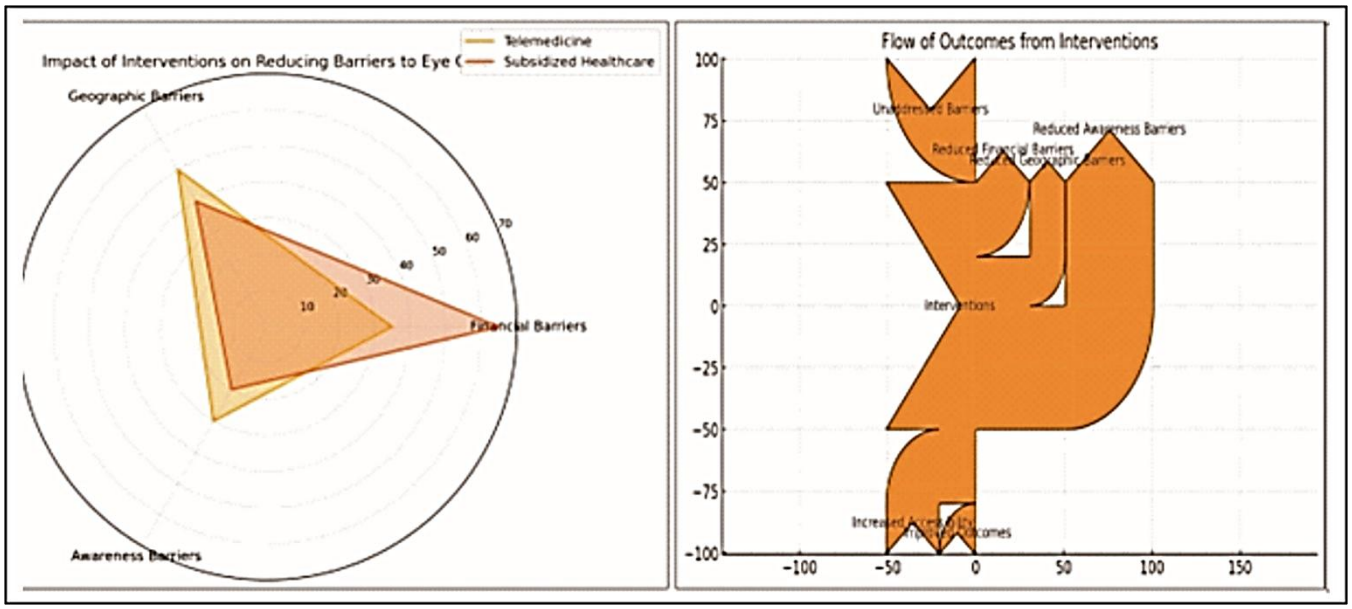

Figure 9: *Color-Coded Comparison of Interventions: Effectiveness and Implementation Challenges in Eye Care Access Programs.*

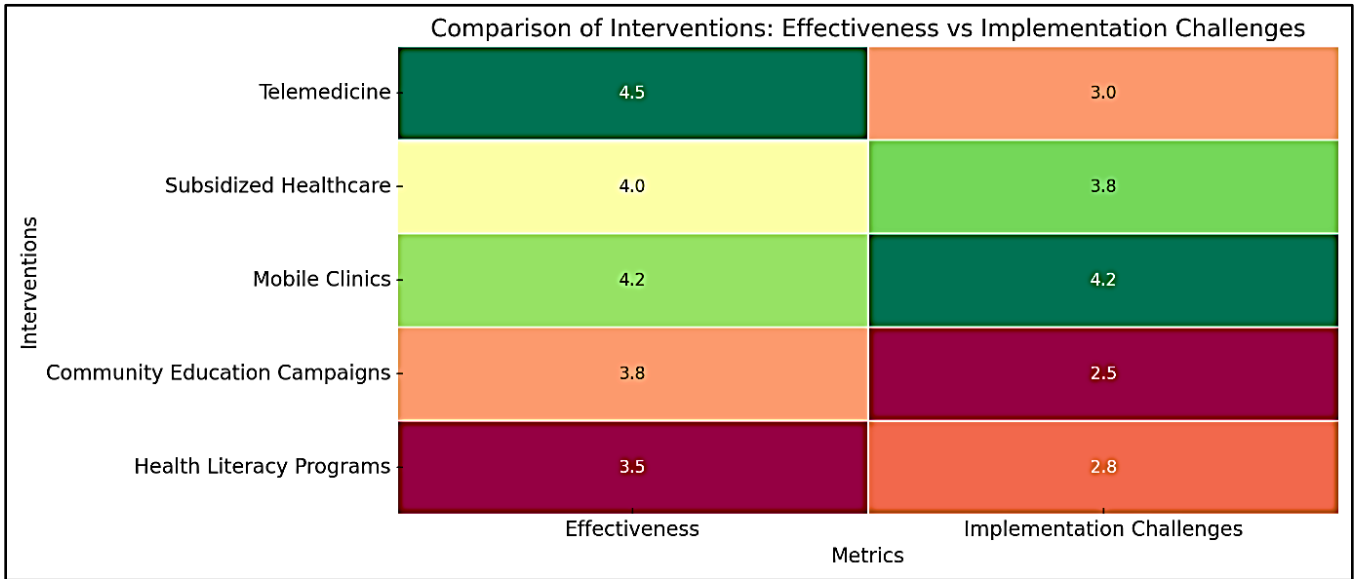

Figure 10: *Forest Plot and Funnel Plot Assessing the Impact of Financial Barriers to Eye Care Access Across Gender, Geographic, and Income Subgroups.*

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Ankit Sanjay Varshney; Associate Professor: *Concepts, Design, Data analysis, Manuscript preparation, Manuscript review.*

Neelam Dhankhar; Professor: *Concepts, Design, Data analysis, Manuscript preparation, Manuscript review.*