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INVITED REVIEW

# Gaps in Glaucoma Diagnosis and Management in Low-Resource Settings: Evidence, Challenges, and Practical Solutions for West Africa

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## Abstract

Glaucoma remains a leading cause of irreversible blindness in West Africa, where prevalence among adults aged ≥40 years far exceed global norms. Despite the availability of effective medical and surgical interventions, late presentation and advanced disease at diagnosis persist, driven by systemic, socioeconomic, and cultural barriers. This review synthesizes evidence on epidemiological burden, risk factors, diagnostic capacity, and care pathway challenges in low-resource settings. Key findings include aggressive disease phenotypes, thin corneal profiles, and high familial risk, compounded by deficits in diagnostic infrastructure, particularly gonioscopy, and workforce shortages. Barriers span awareness, access, adherence, and follow-up, with cost and health literacy as dominant constraints. Practical solutions emphasize community-based screening, task-shifting to optometrists, integration of glaucoma care into primary health systems, cost-containment strategies for medications, and telemedicine for remote monitoring. Implementation science approaches and policy reforms, including insurance coverage and workforce upskilling, are critical to reducing glaucoma-related blindness. Addressing these gaps through coordinated, context-specific interventions offers a pathway to preserve vision and improve quality of life across West Africa.

Keywords: Glaucoma, West Africa, Low-resource settings, Diagnostic capacity, Gonioscopy, Task-shifting.

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## Introduction

Glaucoma represents one of the most consequential yet least adequately addressed public health crises in West Africa [1,2]. The disease affects millions of people across the region, with population-based prevalence estimates of approximately 4.4% to 7.3% among adults aged 40 years and older, rates substantially exceeding those documented in European and many Asian populations [1,2]. More sobering still is the observation that at the time of first clinical presentation, at least one in five patients with glaucoma are already blind, and over half meet visual field criteria for advanced disease [3,4]. This pattern of late presentation is not happenstance but rather the product of a convergence of biological, behavioral, health system, and structural factors that remains unresolved among these West African populations most at risk of this sight-threatening disease [5].

The problem has not been that treatments do not exist since medical and surgical therapies can effectively control intraocular pressure (IOP) and prevent or slow visual loss [6,7]. Rather, the structure, financing, workforce, and information systems of West African health care are fundamentally misaligned with the characteristics of glaucoma as a disease: chronic, asymptomatic, progressive, irreversible, requiring lifelong surveillance and medication adherence, and affecting populations with limited financial resources and minimal health literacy about the disease condition [8]. Closing these gaps will require simultaneous action across awareness, diagnosis, access, adherence, and long-term monitoring, supported by regional guideline development, task-shifted workforce models, and health

system financing reforms [9,10].

## Search Strategy and Selection Criteria

This mini-review synthesizes evidence from population-based surveys, clinical studies, and health system assessments conducted in West Africa between 2014 and 2025. Literature was identified through searches of electronic databases (PubMed, Scopus and Google Scholar) using keywords including "Glaucoma," "West Africa," "Prevalence," "Diagnostic Capacity," and "Barriers to Care."

## Epidemiological Burden of Glaucoma in West Africa

West Africa carries a disproportionate share of the global glaucoma burden relative to its population size [2]. The scale of glaucoma in West Africa demands urgent recognition as both a clinical and systemic failure of health infrastructure. Population-based surveys consistently document Primary Open-Angle Glaucoma (POAG) prevalence rates far exceeding global norms, with recent pooled estimates suggesting 5.8% across African studies, while West African cohorts specifically demonstrate rates between 4.4% and 7.3% [2].

This burden manifests aggressively, characterized by rapid progression, presentation at younger ages (often under 50 years), and advanced visual field loss at diagnosis [11]. Unlike population-based data, clinic-based data reveals that most patients arrive in tertiary clinics with moderate-to-severe disease, rendering preservation of vision exceedingly challenging [12]. These epidemiological realities underscore a vicious cycle wherein late presentation intersects with aggressive pathophysiology, perpetuating high rates of irreversible visual impairment across communities already strained by poverty and competing health priorities.

## Risk Factors and Phenotype of Glaucoma in West African Populations

Understanding the risk profile of West African glaucoma is essential for designing effective screening and prevention strategies. The major risk factors for POAG established through prospective cohort studies and clinical trials include elevated IOP, increased age, male sex, lower central corneal thickness (CCT), positive family history, African or African-Caribbean ancestry, and myopia [13,14].

The Nigeria National Blindness Survey provided granular insight into these variables within the local context. Univariable analyses demonstrated a linear relationship between intraocular pressure and disease risk, where each 1 mmHg increase in IOP was associated with a 1.26-fold increased risk of POAG [15]. Furthermore, central corneal thickness (CCT) emerged as a potent independent predictor. Individuals with a CCT of less than 555 micrometers faced a 4.2-fold increased risk compared to those with thicker corneas [15]. This finding is particularly salient given that the mean CCT in the surveyed population was approximately 540 micrometers, substantially thinner than the global average of 555 micrometers. This suggests that thin corneas, a known risk factor for faster disease progression, may be relatively common in Nigerian populations, rendering standard IOP adjustments critical [15,16].

Family history plays a pivotal but often neglected role in the risk profile [14]. A positive family history of glaucoma or blindness was elicited from approximately 6–8% of respondents in the Nigeria survey and was associated with a more than two-fold increased risk of prevalent POAG [17]. The implication is that in settings where awareness is low and screening is passive, familial cases go undetected and secondary cases in relatives accumulate without intervention [17,18].

Risk factors specific to African-descent populations merit further emphasis. A 2024 global systematic review and meta-analysis found that African and Caribbean populations had an annual cumulative incidence of POAG of approximately 23.46 per 10,000 person-years, substantially higher than European and Asian populations [14]. Moreover, the relationship between IOP and the risk of conversion from ocular hypertension to glaucoma was found to be steeper in African-descent individuals, suggesting a lower threshold for damage [19].

## Disease Progression and Natural History

Understanding the trajectory of untreated glaucomatous disease clarifies the stakes of delayed diagnosis. In patients with untreated POAG, the rate of visual field deterioration averages approximately 0.8 decibels (dB) per year in global cohorts [20]. However, for West Africa, where treatment initiation is often delayed until advanced disease is present, progression rates in the time preceding diagnosis are likely substantial [21].

Modeling studies suggest that an individual with undetected POAG at age 50 with a mild visual field defect (mean deviation -5 to -10 dB) could progress to blindness (mean deviation < -20 dB) by age 65–70 if untreated [20,22]. This represents approximately 15–20 years of preventable visual loss [20]. The Ocular Hypertension Treatment Study (OHTS) and subsequent analyses demonstrate that early intervention is effective: topical IOP-lowering therapy reduced the 5-year incidence of conversion to glaucoma from approximately 9.5% in untreated groups to 4.4% in treated groups [23].

## Diagnostic Capacity and Current Practice

### Optometry and Diagnostic Infrastructure in Ghana and Nigeria

The 2023 cross-sectional study by Ocansey and colleagues serves as the most granular assessment of glaucoma diagnostic practice in West Africa 24. While the data in West Africa leans heavily on Ghana and Nigeria due to the sparseness of literature in the domain from the subregion,

Table 1: Diagnostic Capacity and Practice Patterns Among Optometrists in Ghana and Nigeria

| Diagnostic Parameter | Ghana (n=238) | Nigeria (n=255) | Interpretation |
|---|---|---|---|
| Basic Assessment | | | |
| IOP (Tonometry) | 98.0% | 95.3% | High coverage of basic screening. |
| Optic Nerve Head Exam | 98.7% | 93.7% | High coverage of basic screening. |
| Slit-lamp Biomicroscopy | 96.9% | 74.9% | Significant gap in Nigeria for detailed anterior segment exam. |
| Advanced Diagnostics | | | |
| Visual Field Testing (Any) | ~87% | ~81% | Availability exists, but specific utilization often lags. |
| OCT Availability | 87.6% | 71.9% | Surprisingly high equipment presence, but likely underutilized. |
| Gonioscopy (Essential) | 5.5% | 11.2% | Critical Gap: The definitive test for angle closure is rarely done. |
| Level of Care Achieved* | | | |
| Level 3 (Optimal Care) | 75.5% | 29.7% | Ghana shows higher adherence to optimal protocols. |
| *Level 3 Care defined in study as: Basic assessment + Visual Fields + OCT + Gonioscopy [24]. | | | |

A significant disconnect exists between the availability of high-cost tools and the utilization of essential, low-cost diagnostics. While OCT is available in many urban centers, its utilization is limited by cost ($15,000–50,000 per unit) and training requirements. In contrast, gonioscopy lenses cost less than $1,000 yet are used by only 5–11% of practitioners. This skill deficit has critical clinical implications: without gonioscopy, distinguishing open-angle from angle-closure disease is impossible, leading to potential mismanagement and missed opportunities for prophylactic laser peripheral iridotomy. Consequently, adherence to global standards, such as those established by the American Academy of Ophthalmology (AAO) [26,27] and European Glaucoma Society (EGS) [28] regarding target IOP and disease staging, remains low, as the necessary diagnostic data is simply unavailable in routine practice. Therefore, rather than prioritizing expensive imaging, health systems should focus on a "minimum viable diagnostic package" for primary and secondary care, consisting of reliable tonometry and gonioscopy.

### Practice Patterns and Workforce Variables

Beyond equipment, individual characteristics powerfully predict diagnostic practice. Optometrists with more than 10 years of experience were over seven times more likely to diagnose glaucoma compared to junior practitioners [24]. Furthermore, private practice optometrists were 3.33 times more likely to diagnose glaucoma than those in public facilities [24]. This suggests a system where experienced, motivated practitioners concentrate in urban, fee-for-service settings, systematically disadvantaging lower-income populations who rely on public, often rural, facilities staffed by less experienced personnel.

### The Broader Eye Care Workforce

The shortage of ophthalmologists in sub-Saharan Africa remains a major constraint, with an average density of approximately 1.2 ophthalmologists per million population, far below the WHO recommendation of 8–15 per million [25,29]. In Nigeria, earlier assessments identified fewer than five glaucoma-trained sub-specialists in the entire country [30].

Primary health care (PHC) facilities, the foundation of the health system, are largely unprepared. An assessment of 233 PHCs in Nigeria found that while 95% had a room for eye exams, only 12% had a tonometer, and fewer than 5% of staff had received any formal training in eye disease screening [31]. Consequently, patients with early, asymptomatic glaucoma passing through PHCs may go undetected until visual loss prompts a referral.

### The Care Pathway: Barriers from Awareness to Management

Conceptualizing glaucoma care as a pathway reveals systematic failures at every stage. Table 2 summarizes barriers to Glaucoma care along the patient pathway.

## Physiological and Structural Aspects of Diagnosis

### Intraocular Pressure and Optic Nerve Assessment

Standard Goldmann applanation tonometry is the gold standard but requires expensive slit lamps and expertise. While rebound tonometry (e.g., iCare) offers a portable alternative, the unit cost ($2,000–3,000) remains a barrier for PHCs. Furthermore, the reliance on Cup-to-Disc Ratio (CDR) assessment via direct ophthalmoscopy is prone to error. While OCT is available in many urban centers, its utilization is limited by cost ($15,000–50,000 per unit) and training requirements [34]. Recent data from Ghana suggests that local populations may have specific OCT normative values that differ from global databases, necessitating population-specific calibration [35].

### Visual Field Testing and Gonioscopy

Automated perimetry is largely restricted to tertiary centers [36]. Frequency-doubling technology (FDT) has been used in screening but is not ubiquitous [36]. Emerging tablet-based perimetry (e.g., Eyecatcher) shows promise for low-resource settings but requires validation [36]. The most critical, low-cost technical gap remains gonioscopy [37]. Despite requiring equipment costing less than $1,000, it is performed by only 5–11% of optometrists, leading to significant underdiagnosis of angle-closure glaucoma and missed opportunities for prophylactic laser peripheral iridotomy [37].

Table 2: Barriers to Glaucoma Care Along the Patient Pathway

| Pathway Stage | Key Barriers Identified | Impact |
|---|---|---|
| Awareness | Low Health Literacy: Only ~39% awareness in rural Ghana.<br>Asymptomatic Nature: "No pain, no problem" mindset.<br>Cultural Beliefs: Attribution of blindness to spiritual causes or aging. | Patients do not seek care until vision is irreversibly lost. |
| Access | Distance: 20–50 km travel often required.<br>Cost: Transport costs often exceed consultation fees.<br>Workforce: Shortage of specialists in rural areas. | High rates of non-attendance even after referral. |
| Diagnosis | Equipment: Lack of perimetry/OCT in secondary centers.<br>Cost: Diagnostic tests require out-of-pocket payment.<br>Skill: Low gonioscopy rates lead to misclassification. | Delayed diagnosis or misdiagnosis of glaucoma type. |
| Treatment Acceptance | Surgery Fear: Fear of iatrogenic blindness (30–40% refusal rates).<br>Preference: Reliance on traditional healers/prayer.<br>Cost: Surgery requires large upfront lump-sum payment. | Patients refuse the most effective long-term interventions. |
| Adherence | Cost: Monthly drops cost $10–35 USD (significant % of income).<br>Side Effects: Redness/stinging without perceived benefit.<br>Understanding: Lack of insight into chronic nature of disease. | Medication stops when money runs out or symptoms are absent. |
| Follow-up | Loss to Follow-up: 30–50% default within 1–3 years.<br>System: Poor appointment systems and long wait times. | Disease progression goes monitoring; surgical failure undetected. |

Source: [32,33]

## Evidence-Based Interventions and Practical Solutions

Addressing the crisis requires a multi-pronged approach tailored to the West African context.

### Community Outreach and Case-Finding

Community-based screening effectively reaches the undiagnosed. It has been demonstrated a 6.38% yield of glaucoma cases in Nigerian outreach programs, targeting older, poorer, and less educated populations than those found in clinics [33]. However, the study also revealed a critical drop-off: only 32.5% of referred patients actually attended the hospital for follow-up examination [33].

To bridge the gap between identification and clinical attendance, outreach must be multifaceted and must go beyond case-finding to trust-building. First, on-site health education is indispensable; it must explicitly address the asymptomatic nature of early glaucoma and dismantle the common misconception that lack of pain equates to lack of disease. Ideally, this education is delivered in local languages using culturally appropriate metaphors. Second, the logistical barriers of distance and cost must be actively dismantled through transportation support, such as vouchers or arranged minibus transport from community sites to referral clinics. Finally, the integration of community leadership, including religious organizations and town unions, is essential for trust. In Ilorin, Nigeria, such collaborative models were shown to improve both screening participation and referral adherence [38]. These leaders can help dismantle misconceptions about the "spiritual" nature of blindness and reinforce the medical necessity of treatment. Furthermore, logistical barriers must be addressed through transportation support (vouchers or arranged transport) to referral clinics.

### Task-Shifting and Workforce Development

West Africa is uniquely positioned to leverage its Doctor of Optometry (OD) workforce. With structured Continuing Professional Development (CPD), optometrists can manage early glaucoma. To close the diagnostic gap, training programs should mandate clinical simulation labs specifically for gonioscopy, ensuring practitioners can identify angle-closure disease. This aligns with the "Balanced Eye Team" model, successful in Malawi,

utilizes ophthalmologists for surgery, optometrists for management, and nurses for screening [39]. Establishing clinical simulation labs for trabeculectomy training (as per the GLASS trial) can also rapidly upskill ophthalmology residents [40]. Crucially, this training must extend beyond the operating room to postoperative care. Task-shifting protocols must explicitly include nurse-led monitoring of trabeculectomy blebs for signs of scarring or infection, ensuring long-term surgical survival in rural settings where ophthalmologist follow-up is inconsistent.

### Integration into Primary Health Care (PHC)

Glaucoma screening should be integrated into existing Non-Communicable Disease (NCD) clinics. Patients attending for hypertension or diabetes should receive simultaneous IOP and optic disc screening. This reduces patient travel burden and leverages existing chronic disease infrastructure.

### Medication Access and Cost Containment

Cost remains the primary barrier to treatment initiation and adherence. Policy-level interventions are required to address this. While Selective Laser Trabeculoplasty (SLT) is increasingly advocated by the AAO and EGS [26-28] as a cost-effective first-line intervention, its widespread adoption in West Africa is currently constrained by high initial equipment costs and maintenance requirements similar to those of OCT. Therefore, optimizing medical therapy costs remains the most immediate priority. The optimization of Essential Medicines Lists (EML) and procurement policies constitutes a primary lever; ensuring that generic prostaglandin analogues and beta-blockers are not only listed but procured through regional pooled mechanisms can significantly reduce unit costs. Concurrently, the inclusion of glaucoma medications and surgical procedures within national health insurance schemes, such as those in Ghana and Nigeria, is vital to prevent catastrophic health expenditures for enrollees [41]. Furthermore, clinical workflows can be adapted to reduce patient burden; shifting to 3 or 6-month prescriptions for stable patients reduces the frequency of clinic visits and the associated indirect costs of transportation and lost wages.

### Adherence Support and Telemedicine

Given the chronic nature of the disease, adherence support is as critical as the initial diagnosis. Technological solutions offer scalable methods to support adherence [9]. Automated reminder systems, particularly Short Message Service (SMS) interventions, have demonstrated efficacy in improving self-reported adherence in Nigerian pilot studies [42]. Beyond adherence, telemedicine models such as "store-and-forward" teleophthalmology offer a mechanism to democratize access. In these models, rural nurses or optometrists capture clinical data and images to transmit to urban specialists for review, effectively extending the reach of sub-specialty care to underserved areas [43].

### Implementation Science and Health System Factors

Success depends on organizational readiness. Applying the Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework clarifies the scalability of interventions [44]. Reach is extended to rural populations through task-shifting models, such as the Malawi Balanced Eye Team [45]. Effectiveness is evidenced by Nigerian pilot studies where SMS reminders increased medication compliance by approximately 20% [46]. Adoption is facilitated by integrating glaucoma screening into existing NCD clinics to leverage established patient flows. Implementation is operationalized through clinical simulation labs to build workforce capacity, while Maintenance is secured through sustainable financing mechanisms like national health insurance coverage. Programs must assess facility capacity (electricity, supply chains, staff motivation) prior to launch. Sustainability requires moving from donor funding to integration within government health budgets and insurance schemes. Robust monitoring and evaluation systems are non-negotiable to track referral uptake, treatment adherence, and visual outcomes.

## Conclusion

Glaucoma in West Africa is a massive, largely preventable cause of blindness. Closing the gap requires systematic application of known interventions tailored to the region's specific socio-economic landscape. For national governments, the priority must be the formal declaration of glaucoma as a public health priority, accompanied by the mandate that national health insurance schemes provide comprehensive coverage for both medication and surgery. For health system leaders and hospital administrators, the focus must pivot toward equipping primary and secondary facilities with basic diagnostic tools and formalizing referral pathways, potentially through the implementation of "Balanced Eye Teams." The clinical workforce must commit to upskilling, particularly in gonioscopy, while simultaneously engaging in community education to improve health literacy. Finally, civil society and patient advocacy groups play a vital role in destigmatizing the disease and holding systems accountable. With sustained commitment across these sectors, West African health systems can significantly reduce glaucoma-related blindness, preserving the sight and quality of life of millions.

### Disclosure statement

None to declare.

## References


1. Sarfo J, Mordi P, Aggrey E, Quaicoe ASP, Attafuah P. Glaucoma prevalence and treatment in sub-Saharan Africa's elderly population: a scoping review. BMC Geriatrics. 2025-04-17 2025;25doi:10.1186/s12877-025-05901-0
2. Asiamah R, Kyei S, Owusu G, Agyiri PE. Prevalence of glaucoma in Africa: A systematic review and Bayesian meta-analysis. PLOS One. 2025-08-14 2025;20doi:10.1371/journal.pone.0330567

3. Adekoya BJ, Shah SP, Onakoya AO, Ayanniyi AA. Glaucoma in southwest Nigeria: clinical presentation, family history and perceptions. International ophthalmology. 2014;34:1027-1036.
4. Enock ME, Omoti AE, Momoh RO. Glaucoma in a suburban tertiary care hospital in Nigeria. Journal of ophthalmic & vision research. 2010;5(2):87.
5. Onyia O, Achigbu E, Ejiakor I, et al. Risk factors for late presentation among glaucoma patients attending three referral hospitals in South-East Nigeria: case–control study. Cogent Public Health. 2022;9(1):2125533.
6. Lee SS-Y, Mackey DA. Glaucoma–risk factors and current challenges in the diagnosis of a leading cause of visual impairment. Maturitas. 2022;163:15-22.
7. Cohen LP, Pasquale LR. Clinical characteristics and current treatment of glaucoma. Cold Spring Harbor perspectives in medicine. 2014;4(6):a017236.
8. Delgado M, Abdelrahman A, Terahi M, et al. Management Of Glaucoma In Developing Countries: Challenges And Opportunities For Improvement. ClinicoEconomics and Outcomes Research: CEOR. 2019-09-01 2019;11:591-604. doi:10.2147/ceor.s218277
9. Kyei S, Kwao E, Mashige PK, Abu SL, Racette L. Adherence to ocular hypotensive medication in patients with primary open angle glaucoma in Ghana. Journal of Glaucoma. 2023;32(9):777-782.
10. Ocansey S, Kyei S, Diafo A, Darfor KN, Boadi-Kusi SB, Aglobitse PB. Cost of the medical management and prescription pattern for primary open angle glaucoma (POAG) in Ghana–a retrospective cross-sectional study from three referral facilities. BMC health services research. 2016;16(1):282.
11. Olawoye O, Kizor-Akaraiwe N, Pons J, et al. Clinical Characteristics and Stage at Presentation of Glaucoma Patients in Sub-Saharan Africa. Journal of Glaucoma. 2022-06-27 2022;31:717-723. doi:10.1097/ijg.0000000000002068
12. Thapa S, Paudyal I, Joshi P, Singh K, Parajuli A. Glaucoma in Developing Countries. Nepalese journal of ophthalmology : a biannual peer-reviewed academic journal of the Nepal Ophthalmic Society : NEPJOPH. 2021-01-01 2021;13 25:112-121. doi:10.3126/nepjoph.v13i1.35606
13. Tham Y-C, Li X, Wong TY, Quigley HA, Aung T, Cheng C-Y. Global prevalence of glaucoma and projections of glaucoma burden through 2040: a systematic review and meta-analysis. Ophthalmology. 2014/11 2014;121(11):2081-2090. doi:10.1016/j.ophtha.2014.05.013
14. Shan S, Wu J, Cao J, et al. Global incidence and risk factors for glaucoma: A systematic review and meta-analysis of prospective studies. Journal of global health. 2024;14:04252.
15. Cook C. Glaucoma in Africa: size of the problem and possible solutions. Journal of glaucoma. 2009;18(2):124-128.
16. Ezinne NN, Kyei S, Obinwanne CJ, et al. Normative corneal biometric parameters in sub-Saharan African populations: A systematic review and meta-analysis. Contact Lens and Anterior Eye. 2025:102412.
17. Kyari F, Gilbert C, Peto T, Nigeria Nat Visual I. Risk Factors for Primary Open-Angle Glaucoma in Nigeria: Results of the Nigeria National Survey of Blindness and Visual Impairment. Meeting. IOVS. 2014 2014;55(13):4299-4299.
18. Bhargava S, Mason L, Okeke C. The Significance of Screening Family Members in Glaucoma: Opportunities and Challenges. Journal of Glaucoma. 2024;33:S40-S44.
19. Khachatryan N, Medeiros FA, Sharpsten L, et al. The African Descent and Glaucoma Evaluation Study (ADAGES): predictors of visual field damage in glaucoma suspects. American journal of ophthalmology. 2015;159(4):777-787. e1.
20. Heijl A, Bengtsson B, Hyman L, Leske MC, Group EMGT. Natural history of open-angle glaucoma. Ophthalmology. 2009;116(12):2271-2276.
21. Kyari F, Wormald R, Murthy GV, Evans JR, Gilbert CE. Ethnicity and deprivation are associated with blindness among adults with primary glaucoma in Nigeria: results from the Nigeria national blindness and visual impairment survey. Journal of glaucoma. 2016;25(10):e861-e872.
22. Mwanza J-C, Tulenko SE, Budenz DL, et al. Incidence of glaucoma progression and rate of visual field deterioration in a cohort of urban Ghanaians. Journal of Glaucoma. 2022;31(7):503-510.
23. Kass MA, Heuer DK, Higginbotham EJ, et al. The Ocular Hypertension Treatment Study: a randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open-angle glaucoma. Archives of ophthalmology. 2002;120(6):701-713.
24. Ocansey S, Ekure E, Osuagwu U, et al. Profiling and factors associated with glaucoma diagnostic practice in sub-Saharan Africa-a cross sectional study of Nigerian and Ghanaian optometrists. BMC Ophthalmology. 2023-08-08 2023;23doi:10.1186/s12886-023-03083-0
25. Palmer JJ, Chinanayi F, Gilbert A, et al. Mapping human resources for eye health in 21 countries of sub-Saharan Africa: current progress towards VISION 2020. Human resources for health. 2014;12(1):44.
26. Prum BE, Jr., Herndon LW, Jr., Moroi SE, et al. Primary Angle Closure Preferred Practice Pattern Guidelines. Ophthalmology. 2016;123(1):P1-P40. doi:10.1016/j.ophtha.2015.10.049
27. Gedde SJ, Vinod K, Wright MM, et al. Primary Open-Angle Glaucoma Preferred Practice Pattern. Ophthalmology. 2021;128(1):P71-P150. doi:10.1016/j.ophtha.2020.10.022
28. Spaeth GL. European glaucoma society terminology

and guidelines for glaucoma. British journal of ophthalmology. 2021;105(Suppl 1):1-169.

29. Dean WH, Buchan JC, Gichuhi S, et al. Ophthalmology training in sub-Saharan Africa: a scoping review. Eye. 2021;35(4):1066-1083.
30. Musa KO, Idowu OO, Aribaba OT, Salami MO, Onakoya AO, Akinsola FB. Sub-specialization among Nigerian ophthalmologists: status, disposition and barriers. International Ophthalmology. 2022;42(10):3005-3015.
31. Aghaji A, Burchett HE, Oguego N, Hameed S, Gilbert C. Primary health care facility readiness to implement primary eye care in Nigeria: equipment, infrastructure, service delivery and health management information systems. BMC health services research. 2021;21(1):1360.
32. Obasuyi O, Yeye-Agba O, Ofuadarho O. Factors limiting glaucoma care among glaucoma patients in Nigeria: A scoping review. PLOS Global Public Health. 2024-01-26 2024;4doi:10.1371/journal.pgph.0002488
33. Olawoye O, Washaya J, Gessesse G, et al. Glaucoma Treatment Patterns in Sub-Saharan Africa. Journal of Glaucoma. 2023-07-21 2023;32:815-819. doi:10.1097/ijg.0000000000002273
34. Okonkwo O, Hassan A, Bogunjoko T, Akinye A, Akanbi T, Agweye C. Low rates of optical coherence tomography utilization in the diagnosis and management of retinovascular diseases in a lower middle income economy. Nigerian Journal of Clinical Practice. 2023;26(7):1011-1016.
35. Nelson-Ayifah D, Mashige KP, Munsamy AJ. Normative values for retinal parameters in a Ghanaian clinical population at risk for glaucoma. African Vision and Eye Health. 2024;83(1):1-9.
36. Jones PR, Smith ND, Bi W, Crabb DP. Portable perimetry using eye-tracking on a tablet computer—a feasibility assessment. Translational vision science & technology. 2019;8(1):17-17.
37. Amoah-Smith O, Eghaghara J, Ryan B, Robinson DG. Glaucoma case finding and management among optometrists in Ghana and Nigeria. Optometry and Vision Science. 2025-07-28 2025;102:529-535. doi:10.1097/opx.0000000000002283
38. Adepoju FG, Olokoba BL, Olatunji VA, Obajolowo TS, Bolarinwa T, Yusuf IA. Community eye care outreaches through collaborations with community-based organisations in resource-poor settings in Ilorin, Nigeria. Journal of West African College of Surgeons. 2022;12(3):79-83.
39. Kalua K, Lindfield R, Mtupanyama M, Mtumodzi D, Msiska V. Findings from a Rapid Assessment of Avoidable Blindness (RAAB) in Southern Malawi. Article. PLoS One. 2011 2011;6(4):e19226-Article No.: e19226. doi:10.1371/journal.pone.0019226
40. Annoh R, Buchan J, Gichuhi S, et al. The impact of simulation-based trabeculectomy training on resident core surgical skill competency. Journal of glaucoma. 2023;32(1):57-64.
41. Koffuor G, Ababio-Danso B, Gyanfosu L, Amoateng P. The efficacy of NHIS-listed anti-glaucoma drugs in the management of primary open-angle glaucoma. Journal of Medical and Biomedical Sciences. 2012;1(2)
42. Osahon PT, Mote LA, Ntaji VI. Assessment of the impact of medPlan®, a medication reminder mobile application, in glaucoma patients in Benin City, Nigeria. Tropical Journal of Pharmaceutical Research. 2020;19(12):2677-2682.
43. Choudhari NS, Chandran P, Rao HL, et al. LVPEI Glaucoma Epidemiology and Molecular Genetic Study: teleophthalmology screening for angle-closure disease in an underserved region. Eye. 2020;34(8):1399-1405.
44. Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. American journal of public health. 1999;89(9):1322-1327.
45. Kalua K. How to create a balanced eye team: an example from Malawi. Community eye health. 2018;31(102):46.
46. Aigbonoga D, Adewale B, Igwilo J, et al. Efficacy of short message service (SMS) intervention on medication adherence and knowledge of stroke prevention among clinic attendees at risk of stroke: a randomized controlled trial. BMC Public Health. 2025;25(1):1-9.

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