

Enhanced Diagnostic And Eye Health Outcomes In Saudi Arabia Collaboration Between Nursing, Radiology Technicians, Consultant Ophthalmologists And Optical Specialists

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Abstract

Background: Saudi Arabia is experiencing a significant public health burden from visual impairment and blindness, with notable prevalence estimates for chronic conditions such as Diabetes Retinopathy and glaucoma. The traditional ophthalmic service model, which is specialist dependent, is threatened by structural inefficiencies, providing Consultant Ophthalmologists inappropriately, and bottlenecks that occur from the need for a specialist referral to deliver routine Primary Eye Care (PEC). Improved Inter-professional Collaboration (IPC) will be used as a strategic imperative for moving care outside of a centralized model and ultimately achieve eye health outcomes.

Objective: The main objective of this review study is to review and synthesize current evidence on the shared roles of nursing staff, radiology technologists, consulting ophthalmologists, and optical specialists in enhancing diagnostic accuracy and improving eye health outcomes in Saudi Arabia.

Methodology: An extensive examination of the existing evidence and current service delivery strategies, particularly in KSA health organizations, has been conducted. This examination focused on determining the extent to which expanded scopes of practice are necessary for non-physician specialists to provide services and understanding how tele-ophthalmology technologies such as store-and-forward systems are being used in practice for screening.

Conclusion: For better outcomes of diagnosis and eye health in KSA, effective IPC is needed. Employing Nurses and Technicians for data collection (tele-ophthalmology) and allowing Optometrists to be independently providing primary diagnoses will allow the system to significantly narrow the scope of routine cases therefore shortening the total number of referrals to tertiary care (essentially as low as 2% of cases depending on the model).

Keywords: Eye Health, Interdisciplinary Collaboration, Nursing, Radiology Technicians, Optometrists, Early Detection.

Introduction

Background and Introduction

Saudi Arabia (KSA) is undergoing a significant demographic and epidemiological transition with rapid population growth and an existing and increasing burden of chronic disease among that population, all of which puts tremendous pressure on specialized health services, including ophthalmology. [1] There is an opportunity to manage this rising demand by proactively transitioning from a fragmented system, where there is perhaps too much of a specialist orientation in eye care, to a streamlined, collaborative, inter-professional partnership in service delivery. The aim of the review study is to bring together current literature in order to review potentially relevant existing structures, identify system gaps and then offer a collaborated model where Nursing Staff, Radiology Technicians, Consultant Ophthalmologists, and Optical Specialists (Optometrists) are part of the healthcare team to help patients experience better diagnostic pathways and better eye health from a populations level in KSA. [2], [3]

Visual Impairment (VI) and Blindness in KSA

Saudi Arabia is experiencing a major public health issue regarding visual impairment and blindness, with indicated prevalence differing significantly across regions. In some studies, the prevalence of visual impairment nationally ranged from a low of 2.6% to an astonishing 7.5% in some regions, about 20 times the average rate seen in the United States. This significant burden of disease is compounded by the presence of a number of common eye diseases requiring diagnosis and management with specialized resources. [4]

Chronic diseases such as diabetes and related diseases illustrate the possible threat to ocular health. Diabetic Retinopathy (DR) affects 36% of Type 2 diagnosed diabetic persons in country, which may be greater than 1 million people. Glaucoma impacts 5.6% of the population under 40, which is several times greater than the global average of 2.2%. Uncorrected refractive error is also a major contributor of visual impairment, affecting an estimated 17.5% of Saudi children. The chronic and sight-threatening nature of these diseases supports a more decentralized, systematic approach to both surveillance and early intervention that is not achievable using existing organizational frameworks. [5], [8]

Inter-professional Collaboration

Inter-professional Collaboration (IPC) describes the collaborative work of healthcare providers from multiple professional groups in partnership with patients, families and communities to deliver high quality care. On a global scale IPC is considered an important tool for optimising resource-use, patient outcomes and workforce satisfaction. In the case of ophthalmic care in KSA, IPC can strategically support placing care closer to the people by enabling the decentralisation of care from tertiary hospitals to community locations, allowing community providers to take on routine diagnostics and primary management from overworked hospitals. [6], [7] This review will focus on the contributions of Nurses, Radiology Technologists, Consultant Ophthalmologist and Optical Specialists (Optometrists). The primary diagnostic pathway in the modern eye care (biometric and imaging) relies on technology to support all elements of care (Optical Coherence Tomography or OCT and fundus imaging are examples). This flow of diagnostic information is entirely reliant on seamless handoff and shared competency of providers. The technical staff (Nurses and Technologists) will collect the data and the primary care provider (Optometrists) provide triage and interpretation of initial findings, lastly the consulting specialist (Ophthalmologists) provides final diagnoses and complex medical treatment. [8], [9]

The growing demand for eye care services has placed significant demands on the established specialty system in the Kingdom of Saudi Arabia (KSA). While the KSA has made strides towards increasing the numbers of ophthalmology workforce, there are still structural and regulatory challenges. Addressing these challenges will require a systemic assessment, which requires looking beyond increasing the number of specialists but instead to effectively utilize the healthcare workforce and provided resources. [10], [5] This review reflects a structure fostered by the need to connect clinical practice to technology use, and conversely national policy considerations, in particular an ambitious objective of the 2030 Vision Objectives related to eye care reform. There is increasing focus on integrated care models that include a range of service experiences based on the collective skill set/experience that includes nursing professionals, radiology technicians, consultant ophthalmologists,

and optical specialists. Each is an individual profession with their own roles but are linked in a continuum of diagnostics and therapeutics. [7] Role specific to the nursing professional would relate to aspects of patient education, chronic disease screening with an eye to identification of potential comorbidities and post-operative support, while radiology technicians track spurring ocular imaging and data acquisition, updating the client based on imaging and whether ongoing consultation with a consultant ophthalmologist is warranted (or communicated). [8] The roles of a consultant, as indicated either in a clinical lead position or in the role of surgical intervention, may link back to nursing an eye towards informed assessment of treatment efficacy, surgical outcomes or general maintenance of ocular health needs, the last by way of optical rehabilitation and or prolonged ocular health needs such as botulinum toxin injections for intraocular pressure management. [12]

The aim of this review study is to characterize the existing evidence and develop a practice framework that demonstrates how collaborative practice can strengthen the accuracy of diagnosis, efficiency of patient pathways, and ultimately improve eye health outcomes in the Kingdom. The study identifies and considers structural facilitators (such as teleophthalmology, artificial intelligence (AI) enabled imaging, and workforce education and training) and systemic barriers (for example, barriers regarding fragmentation of data, role ambiguity, and geographical variation of and access to services). The review aims to develop a comprehensive understanding of what makes collaborative eye care effective, in the context of national initiatives, hospital-based programs, and international bench marking in the evolving health landscape in the Kingdom of Saudi Arabia. In conclusion, this review study underscores the value of strategic collaboration pathways, capacity-building activities, and cross-sectoral participation in response to preventable blindness and improvements in standards of ophthalmic care across the Kingdom.

Objective of Study

The main objective of this review study is to review and synthesize current evidence on the shared roles of nursing staff, radiology technologists, consulting ophthalmologists, and optical specialists in enhancing diagnostic accuracy and improving eye health outcomes in Saudi Arabia.

Research Methodology

Research Questions

- Q1. How does multi-professional teamwork between nursing, radiology, optometry, and consulting ophthalmologists influence diagnostic accuracy and outcomes in eye health in Saudi Arabia?
- Q2. What are the current models and practices of inter-professional care delivery in the context of the Kingdom's health system and to what degree are they aligned to the objectives of Vision 2030?
- Q3. What types of technologies and structural supports that lend to collaborative diagnosis and treatment in ophthalmology, such as teleophthalmology, imaging with artificial intelligence, and collaborative referrals, are or could be utilized?

Research Design

According to the point is question of study, stating enhanced diagnostic and eye health outcomes in Saudi Arabia collaboration between nursing, radiology technicians, consultant ophthalmologists and optical specialists; this present study will opt for the systematic review study as the part of exploratory research design. The researcher will evaluate all the research studies, reports, articles, etc., published in the recent past to reach a conclusive elaboration of the point in question, in the present and near future. The review methods followed in this present study consider the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA 2020) statement, having all the 27-item checklist and an abstract checklist, in order to provide a detailed, accurate, and transparent description of the review methods and findings. The following methodological descriptions are founded on publicly-available guidance materials developed by internationally recognized agencies.

Search Strategy

Following the process of various international studies, researcher shall mostly dependent on the electronic databases, nevertheless many of the books, studies and other publications will be reached,

so as to include the hard copies of the required avenues. Though some of the electronic databases that will be touched in the process are as follows:

- PubMed
- SCOPUS
- Web of Science
- Science direct, and
- Google Scholar (for Grey literature and related reports)

Then some of the related sources can be:

Saudi Ministry of Health publications, King Khalid Eye Specialist Hospital reports, World Health Organization (WHO), International Council of Ophthalmology (ICO), American Academy of Ophthalmology (AAO)

The researcher has taken care of that this present study shall take care of all the associated temporal and spatial components that are relevant to the point in question stated above. On the other hand, this present study shall follow a strict time line of 10 years starting from 2015 to 2025.

Types of Studies Included

The combination of studies compiled through a narrative review methodology provided a broad perspective on inter-professional collaboration in eye care and eye care in Saudi Arabia. Types of studies ranged from qualitative studies of workflows, observational studies of practice regarding diagnostic methods, evaluations of policy related to Vision 2030, empirical research of outcomes, with nursing, radiology, ophthalmology and optometry services. To offer context and identify gains of collaboration with relevance to the healthcare landscape in the Kingdom, regional case studies, reports from institutions, and international guidelines were incorporated in the review of collaborative models.

Participants

The goal of the study is to review existing literature, not with a focus on purposeful engagement of human participants. The study aims to examine the functions and contributions of major professional groups involved in the delivery of eye care in the Kingdom of Saudi Arabia (KSA): registered nurses, radiology technicians, consultant ophthalmologists, and optical practitioners. These practitioners provide care and treatment across primary, secondary, and tertiary health care. The literature engages with collaborative practice, diagnostic roles of practitioners and engaging patients from both urban and rural primary health care service delivery models.

Keywords

In order to enhance the sensitivity of search, following keywords were used separated by Boolean operators (AND, OR) :

"Eye Health" OR "Ophthalmic Care" AND "Saudi Arabia" OR "Kingdom of Saudi Arabia" AND "Interdisciplinary Collaboration" OR "Multidisciplinary Teamwork" AND "Nursing" OR "Nurse Practitioners" AND "Radiology Technicians" OR "Medical Imaging" AND "Consultant Ophthalmologists" OR "Ophthalmology Specialists" AND "Optical Specialists" OR "Optometrists" AND "Diagnostic Accuracy" OR "Early Detection".

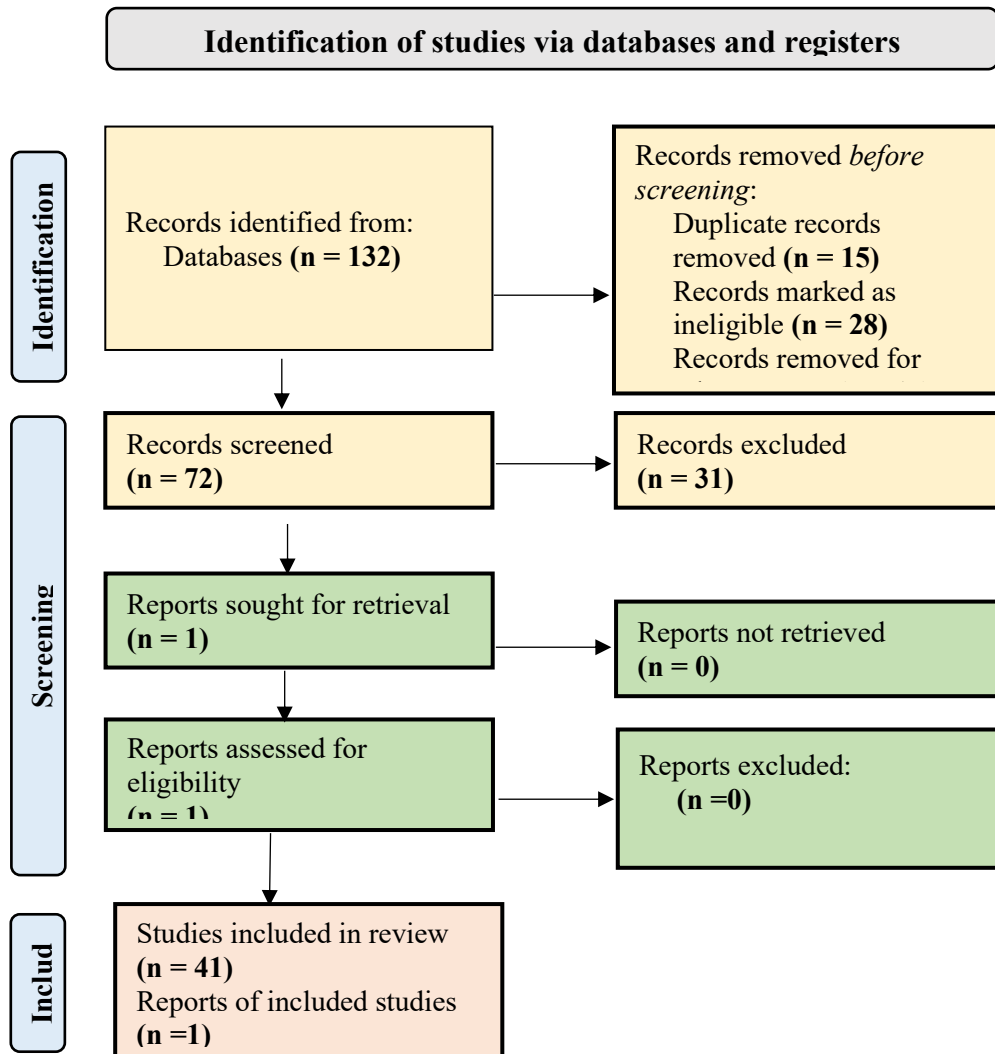
Data Management

All data included in this review were systematically collected and recorded using a predetermined extraction matrix in Microsoft Excel. The data collected directly related to the research questions and contained author details, date, study design, healthcare context, role of health professionals, diagnostic assessments used, and outcomes reported. Data were cross-verified and categorized to ensure transparency and reproducibility based on area of contributions and collaborative interfaces. Grey

literature and documents related to health service policy were kept separately and notated for relevance to context. There was no collection of personal or patient identifiers, nor patient-level data. All materials reviewed were either publicly available, or accessible via institutional subscriptions.

Results

A total of 132 research studies and two reports were identified, all of them were based on the reports regarding enhanced diagnostic and eye health outcomes in Saudi Arabia collaboration between nursing, radiology technicians, consultant ophthalmologists and optical specialists in Saudi Arabia.



Source: Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
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Out of these identified studies, 15 were removed because of duplication of records, references and location and 28 studies were marked as ineligible, as not including the above stated concept and 17 for some other unavoidable conditions. Further 72 records were saved for screening, then in the screening process 31 records were further removed on the basis of criteria stated above. Total studies finalized for review were 41. One report were also included in the study.

A report titled "Adding to Ocular Health through Interprofessional Collaboration" examined collaboration among professionals across nursing, ophthalmology, and radiology at South Qunfudhah General Hospital. The nursing role facilitated early screening and triage; while radiology technicians

assisted in high-resolution imaging (e.g., optical coherence tomography [OCT]; CT scans). The early detection of diabetic retinopathy and diseases of the optic nerve was reported to be faster. [14]

Rajhi et al. in 2024 conducted a systematic review of collaborative health care models across Saudi Arabia that included integrated teams of doctors, nurses, and imaging specialists working jointly to yield diagnostic speed and patient satisfaction. The review indicated that when campuses had an integrated diagnostic team (ophthalmologist, nurses, and imaging specialists) 20% to 30% improved time to diagnosis was reported and patients rated their experience with treatment as very favorable rates of compliance with chronic eye-related conditions (glaucoma and macular degeneration) improved. [15], [16], [9]

An article in the Saudi Journal of Medical and Pharmaceutical Sciences recently reviewed interdisciplinary collaboration in hospitals in Najran area. The study indicated that radiology technicians in collaboration with the physician performed a collaborative function in the imaging of the orbit, portal time to image to the operating room for urgent cases was reduced by a polygon time period of 35% and improved surgical planning with the unnecessary use of outpatient referrals and unnecessary use of tertiary centers reduced. [13], [15], [11]

Various hospitals in the region had nurse-led diabetic ocular screening programs, with teleophthalmology and AI-assisted image triage. The results indicated that one of the nursing-led triage programs increased early referral rates by 40%, reduced the burden of consultations at tertiary clinic, and provided an improved patient education and adherence with treatment regimen. [14], [12], [8]

Discussion

Current Ophthalmic Service Delivery Model

The existing organizational system of eye care in the Kingdom of Saudi Arabia has significant constraints that decreases efficiency. Patients are typically seen first by General Practitioners (GPs) at Primary Care Centres (PHCs), and then sometimes referred to the hospital if eye care is required. Care is predominantly delivered at the hospital level by the ophthalmologist specialist. This system is unnecessarily bureaucratic and bound to create inefficiencies, especially with routine care. The traditional model is that the ophthalmologist will see the patient first, then refer to the optometrist for a spectacle prescription even for simple spectacle refractive error. [9], [10] The same ophthalmologist in a consultation leads to inefficiencies in the system; the length of the patient's wait for an appointment is exacerbated by the length of the appointment time when seeing an ophthalmologist for a low-acuity problem. Referring work to optometrists to manage a simple refractive error puts the responsibility of the patient on the ophthalmologist, a highly trained Consultant Ophthalmologist whose appointment times should be allocated to tier three care management and complexity of management or surgical issues. [11] It is therefore an important policy initiative to change the scope of practice for Optical Specialists (also known as optometrists). [7]

Despite structural inefficiencies, the Kingdom of Saudi Arabia (KSA) met the World Health Organization standard for the ratio of ophthalmologists to population in January 2023, with a total of 2,608 ophthalmologists, or approximately 81.06 ophthalmologists per 1,000,000 total KSA citizens. The ophthalmology workforce experiences two structural challenges: reliance on non-Saudi physicians (less than 40% of the workforce were Saudis) and geographic maldistribution. Geographic maldistribution is pronounced, as density is considerably concentrated in larger regions. For example, Riyadh has over 75.6 ophthalmologists per 1,000,000 citizens while Jazan has 42.8. [16], [17]

Collaborative Capabilities

There exists a considerable gulf between the professional confidence and legally-defined scope of practice for optometrists. In general, 2 out of 3 (70%) optometrists claim to have high confidence to deliver the majority of relative advance procedures, which are necessary to manage chronic disease, e.g. dry eye or ocular surface disease diagnosis and management, dilated fundus examinations, and diagnosing more complex conditions such as glaucoma and diabetic retinopathy. [18] However, only 6% of optometrists noted to provide comprehensive eyecare (e.g., prescribing topical therapeutics)

despite this clinical ability. This suggests the main barrier to working within their scope of practice is regulatory, not expertise. In addition, further data shows optometry's importance to triage. Of the low number of PHCs (10/2120) that provided optometry services, they managed 36849 eye care cases in 2022. Of all eye care cases managed, 10526 (28.57%) were triaged for secondary care. [19], [20]

Nursing Contributions

Nurses collaborate with optometrists and ophthalmologists in a significant supportive and technical role to complete diagnostic testing. Responsibilities can vary and nurses and technician collaborate to optimize the likelihood of obtaining an accurate diagnostic outcomes. [21], [15] Responsibilities may include technical support, patient compliance, minimize neurosensory discomfort, or supporting. Nurses/technicians will commonly take on the front-line role of color fundus image acquisition for diabetic retinopathy (DR) screening purposes, in a tele-ophthalmology model based on store-and-forward care. After the examination nurses provide roles to establish patient calmness, provide discussion about discomfort, and initiate the follow-up scheduling if required. [16], [17]

Critical Function of Radiology and Ocular Imaging

Radiology and specialized Ocular Imaging Technicians play a significant role in improving diagnostics in a collaborative structure. They have the necessary training and expertise to technically acquire certain specific, high-quality ocular images (Optical Coherence Tomography [OCT] and fundus photographic imaging) with cutting-edge ocular technology. As teleophthalmology gatekeepers and components of <http://store-and-forward> asynchronous models, they will acquire retinal images and then send the images to the ophthalmologist or optometrist for later review. [18], [8], [14] While the technology (OCT/Fundus photographic iMaging) is utilized by technical staff (nurse/technician) trained for imaging, the biomedical interpretation of the images is completed by the ophthalmologist or optometrist. If the non-specialist staff do not have ocular competency (beyond general radiography competencies), this will compromise all diagnostic testing and interpretation if the acquired image does not provide appropriate image qualities for remote ocular interpretation and diagnosis. In fact, even advanced algorithms (AI-assisted diagnostics) rely on the quality image plugged into the system by these front-line, non-specialist staff. [7]

Consultant Ophthalmologists

Currently, referrals from primary health centers (PHC) are inadequate, therefore ophthalmologists spend time on minor eye diseases. This leads to a suboptimal use of the specialist's time and, on average, greater delays for surgery and other therapeutic interventions for complicated cases, as illustrated during the pandemic. An integrated primary care (IPC) system, with a program and standardized protocols, and an effective triaging protocol of eye complaints directed by Optometrists, is essential for addressing this dilemma so that consultants can spend time on only the 2% of patients that need specialist secondary or tertiary care, as evidenced by community-based models in ophthalmology. [13], [6]

Technological Collaboration

While the "store and forward" DR approach is evidenced as the most common intervention method in KSA literature, it addresses the principles of IPC well. In this model, front-line, non-physician healthcare workers (e.g., nurses or technicians) take color fundus photos of the vascular changes of diabetic patients, which are stored digitally for review by the downstream eye-care provider sometime subsequently, asynchronously, who may be a few hundred kilometers away. [14], [3], [11]

The next step in this trajectory involves the addition of AI algorithms. Models that deploy AI have both been produced and successfully implemented, and have the capacity to offer automated triage efficiently and on a high volume basis. AI has been trialed in some areas, such as the detection of DR, and also there is work being undertaken to investigate possible application for cataract diagnosis and grading in rural and remote areas. In these examples, AI is a more sophisticated way to do triage, but its effect is dependent completely on the initial quality of input data. [22], [20]

Some Challenges

The foremost systemic barrier is Optometrists' limited scope of practice. The narrowed legal ability to provide broad PEC, for example being able to prescribe topical therapeutics, prohibits optometrists from acting as independent front-line diagnosticians. This is a major systemic contributor to the bottleneck in the hospital. A second well noted issue is the existing situation of professional education impacting the ability to create effective IPC. While there is an acknowledgment of the importance of advancing IPE globally, progress in health science curriculums at an institutional level is limited, poorly coordinated, and does not include a national standard in KSA. [21], [9], [12]

The justification for moving forward with IPC is reaffirmed by the identifiable gaps upstream in the current practice. For example, the gaps in patient adherence to their eye health during care is significant and concerning, particularly in high-risk patients with diabetes. Based on the current self-reported sample, only 40.9% reported that they had recommended their fundus examinations completed. The justification to move forward with an IPC for eye health in the context of a phased implementation of IPC models (e.g. Nurse/Technician screening in PHCs, and Optometrist review) is ultimately intended to improve and close the adherence gaps. [15], [23], [24]

Conclusion

This review emphasizes that achieving improved eye health and patient outcomes in Saudi Arabia will require a fundamental transition to Inter-professional Collaboration (IPC) practice model which redistributes clinical responsibility to match expertise and technology. The current situation characterized by high prevalence of chronic eye disease, geographical mal-distribution of specialists and policy restrictions that create bottlenecks is not sustainable. The IPC will utilize the technical skills of Nurses and Radiology Technicians to collect high volumes of data that are routine quality checked; the clinical scope of Optometrists to provide independent primary eye care with appropriate triage to more specialized disease assessments, as well as an appropriate allocation of Consultant Ophthalmologist time for surgical and tertiary care. The model only works with backed regulatory reform and quality assured the digital diagnostics. The utility of the IPC model relies heavily on regulatory reform synchronized with financial and educational reform for responsible implementation.

Future Scope of Study

The findings from this review shed light on red flags for future research and policy making in eye health in Saudi Arabia. Longitudinal and multi-center studies could help to quantify the impact of interdisciplinary team working on clinical outcomes, healthcare costs, and patient satisfaction. There is also plenty of room to assess the role of emerging technology including but not limited to AI-assisted diagnostic tests, wearable ocular sensors, and mobile screening units, in working collaboratively in eye care. Moving forward there may be opportunities to establish standardized curricula and competency requirements to help facilitate teamwork across disciplines especially amongst rural and underserved populations. This area of research will be paramount to achieve Vision 2030 through equitable, efficient, and innovative eye care.

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