2023-02-01

# Topical Review: Optometry in Nepal—Clinical Practice, Research Advances, and Challenges

Safal Khanal

Nabin Paudel

Rabindra Adhikary

Mahesh Raj Joshi *School of Health Professions*

# Topical Review: Optometry in Nepal—Clinical Practice, Research Advances, and Challenges

Safal Khanal, OD, PhD, FAAO,[1]* Nabin Paudel, PhD,[2] Rabindra Adhikary, MOptom,[3] and Mahesh Raj Joshi, PhD, FAAO[4]



**SIGNIFICANCE:** This article reviews educational standard, clinical practice, research advances, and challenges associated with optometry in Nepal and provides critical considerations for contemporary and new optometry programs in countries with similar socioeconomic status and health care systems.

Optometry education started in Nepal in 1998 with the primary objective of addressing the unmet needs of eye health and vision care in the country. Over the last two decades, this program has made significant contributions to facilitating and improving the delivery of quality eye care and establishing the nation's eye health system as an exemplary model in South Asia. Despite the positive impact in a short time, optometry education and the profession continue to face several challenges, including a shortage of training resources and facilities, poor quality control and regulation of practice standards, lack of professional recognition, limited pathways for entry to governmental jobs via the national public service commission, and limited clinical and academic opportunities in existing eye care programs. This article reviews current education and clinical practice standards, highlights research advances, and discusses present and future challenges in sustaining and improving the quality of education and advancing the scope of practice of optometry in Nepal. Given the limited access to primary eye care services in Nepal, appropriate professional recognition and integration into the national health system, and initiatives targeted at improving the delivery of optometry education in alignment with successful international models may provide a long-sought solution to making eye care services accessible to all and lowering the burden of visual impairment in the country.

*Optom Vis Sci 2023;100:134–142. doi:10.1097/OPX.0000000000001980*



**Author Affiliations:**
[1]School of Optometry, University of Alabama at Birmingham, Birmingham, Alabama
[2]Center for Eye Research Ireland, Technological University Dublin, Dublin, Ireland
[3]Reiyukai Eiko Masunaga Eye Hospital, Banepa, Nepal
[4]School of Health Professions, University of Plymouth, Plymouth, United Kingdom
*skhanal@uab.edu

Optometry education was introduced in Nepal in 1998 in collaboration with the University of Auckland in New Zealand. The primary focus of the program was to meet eye care needs in Nepal and establish human resources able to provide comprehensive eye care, covering optical and medical management services including refraction and dispensing, diagnosis and management of eye diseases, and surgical referrals.[1] As an initiative directed at improving primary eye care, the program has unequivocally fulfilled its objectives of addressing the unmet needs of eye health care and providing accessible and quality eye care to the Nepalese population over the last two decades. For example, the program has aided in bridging to some extent the massive gap in human resources that to date continues to limit the delivery of eye care services to the public in Nepal. The program has also advanced public eye health care, notably in vision and eye health assessments and care of schoolchildren, the elderly population, and underrepresented or marginalized communities.[2–10] In addition, the program continues to make significant contributions to the advancement of eye and vision research within the country and beyond, with many graduates of the program now completing their doctorate degrees and taking up academic and research positions at leading universities around the globe. The purpose of this review article is to provide an overview of the current education and clinical practice scenario, highlight research advances, and discuss present and future challenges in sustaining and improving the quality of education and advancing the professional scope of practice of optometry in Nepal.

## THE CURRENT OPTOMETRY EDUCATION SYSTEM AND CLINICAL PRACTICE SCENARIO

For nearly two decades, optometry training in Nepal was available only at the BP Koirala Lions Centre for Ophthalmic Studies (BPKLCOS), Institute of Medicine, Kathmandu. From the beginning, this program has implemented a merit-based enrollment system in which students are selected based on their rankings after a nationwide entrance examination and offered a scholarship by the Government of Nepal. The annual intake was 6 students until 2016 when the number of enrolled students was increased to 10, with the additional 4 students admitted under the self-pay scheme. Given the relatively few seats available, many students traveled to the neighboring country India to obtain optometry training in private institutions. More recent establishments of the Bachelor of Optometry and Vision Science program at the National Academy of Medical Sciences enrolling 40 students (30 free and 10 reserved

quotas, 2018) and the Bachelor of Optometry (2018) and Master of Optometry (2019) programs at Pokhara University enrolling 17 (2 scholarship seats) and 12 students, respectively, have substantially increased the current intake of optometry students to nearly 70 per year. Another university, Purvanchal University, is also on the verge of introducing a bachelor of optometry program with the curriculum development process already completed. To date, 125 students have graduated from the optometry program at the Institute of Medicine. Other schools have yet to produce their first batch of graduates. More than 1200 optometrists have been registered in the Nepal Health Professional Council (NHPC) as of 2021 (personal oral communication with an NHPC member, September 28, 2022). In the last 5 years, there has also been a large influx in the number of Nepalese optometry graduates from India to Nepal. Of the NHPC-registered optometrists, nearly 1100 are graduates from India.

To map out the profile of Nepalese optometrists, the authors distributed a short five-question Google Form survey via professional social media groups. The survey was made available from May 15 to June 15, 2022. Out of 175 optometrists who participated in the survey (~15% sample), 122 (69.7%) were male, and 53 (30.3%) were female. Most respondents were aged 25 to 34 years (102[58.6%]) and younger than 25 years (48[27.6%]), whereas the frequency of respondents was 22 (12.6%) in the 35- to 44-year range and 2 (1.1%) in the 45-year and older age range. Nearly three-quarters of the respondents were graduates of optometry schools in India (129[73.7%]). This figure approximates the profile of optometrists registered in the NHPC (~85% graduates from Indian schools, personal oral communication with an NHPC Executive Board Member representing optometry, September 28, 2022). Table 1 illustrates the distribution of current location and practice areas of the survey respondents.

**TABLE 1.** Distribution of Nepalese optometrists based on an online survey (n = 175)

| Country | Number (%)* |
|---|---|
| Nepal | 114 (65.5) |
| India | 31 (17.8) |
| Australia | 8 (4.6) |
| United States | 4 (2.3) |
| Maldives | 2 (1.2) |
| Others | 15 (8.7) |
| **Area of practice** | **Number (%)†** |
| Private optometry practice | 87 (50.6) |
| Optometry-ophthalmology practice | 60 (34.9) |
| Academia | 28 (16.3) |
| Public health | 13 (7.6) |
| Administration | 8 (4.7) |
| Research | 7 (4.1) |
| Others | 14 (8.1) |

*Total of 174 responses. †Total of 172 responses. Twenty-seven respondents were involved in more than one area of practice.

## Program Structure

All three optometry schools in Nepal currently run a 4-year program at the undergraduate (bachelor's) level. Among them, one school (Pokhara University) also offers a 2-year master of optometry course at the post-graduate level. The Medical Education Commission conducts common entrance examinations for the bachelor's and master's degrees separately and allocates the students to different schools according to the matched merit of the students. To be eligible for admission to the bachelor of optometry program, candidates need to complete higher secondary level (10 + 2/A level science streams) with a biology major or diploma in health sciences (ophthalmology) or certificate in health science (ophthalmology) and should pass with at least 50% marks on the entrance examination conducted by the respective schools.

The requirements for entry into optometry programs vary around the world. In Canada and the United States, optometry training is delivered through a professional doctorate program, doctor of optometry (OD), for which prospective candidates complete a bachelor's degree with prerequisite courses followed by the Optometry Admission Test examination.[11,12] A similar system to pursue a post-graduate OD degree is in place in Australia (The University of Western Australia[13] and The University of Melbourne[14]). Schools in Australia also offer a combined bachelor of vision science/master of optometry degree for optometry practice through programs delivered over either 3.5 years[15] or 5 years: Flinders University,[16] University of New South Wales,[17] University of Canberra,[18] and Queensland University of Technology,[19] whereas the only optometry school in New Zealand at the University of Auckland offers an honors degree for 5 years.[20,21] The admission system in Nepal is similar to that in the United Kingdom where the entry requirement for the undergraduate optometry course is A level with grades from BBB to AAB in science subjects.[22] However, entry to optometry programs in Nepal requires an additional entrance examination with ranks based on these grades determining selection in preferred optometry schools. To be eligible for admission to the master of optometry program, candidates need to have a bachelor of optometry or OD or equivalent degree (bachelor of optometry and vision science, bachelor of science in optometry) from a recognized university/institution and an active NHPC registration as an optometrist and should pass with at least 50% marks in the entrance examination conducted by the Medical Education Commission.

The initial 3-year curriculum of the optometry course at Tribhuvan University mirrored that of the optometry school in Auckland at the fundamental level. However, the revised 4-year curriculum in 2002 incorporated several components that are relevant to meet the national eye care needs of the country. Recently established courses have followed the same curriculum as that of Tribhuvan University with minor modifications.[23,24] The first year of the undergraduate optometry program comprises basic science courses that include an introduction to the human body systems and an in-depth study of the visual system (e.g., anatomy, pathology, biochemistry, physiology, and pharmacology). The following 2 intermediate years, also regarded as the pre-clinical years, involve core optometry courses, including vision science, ocular diseases, ophthalmic dispensing, contact lenses, binocular vision, pediatric and geriatric optometry, and low vision. The final year is mostly devoted to clinical placement whereby students obtain clinical training under the supervision of qualified optometrists and ophthalmologists within their host institute and outside. In addition, final-year students are required to complete an honors-level research project

and a community research project, which typically involves knowledge, attitude, and practice studies. The inclusion of two independent research projects requiring the submission of two project reports/dissertations in the final year is a unique aspect of the Nepalese optometry program. Clinical training begins as early as the second year in which students are placed to observe clinical examinations. Training continues into the third and fourth year with rotations in different optometry (preliminary examination, refraction, orthoptics, contact lens, low vision, pediatric optometry, geriatric optometry) and ophthalmology clinics (cornea, uvea, glaucoma, retina, neuro-ophthalmology). The undergraduate program also includes community health and community optometry components in years 1 and 3 in collaboration with the Department of Public Health, with an emphasis on delivering community eye care. In the final year, students are also provided with opportunities to be involved in school screenings and community eye camps. The new post-graduate optometry programs, which are primarily teaching focused, include advanced ocular diagnostics and management courses, community eye health, clinical rotations, and a clinical dissertation.

In contrast to the programs in Western countries,[25–28] the undergraduate and post-graduate optometry programs in Nepal lack evaluation of clinical skills in a structured competency-based model. Instead, clinical competency of students is tested at the end-of-year examinations in the form of unstructured short and long cases. This traditional approach of clinical competency assessment has limitations associated with examination consistency and reliability, and objective evaluation of students.[29,30] Competency-based models where students are evaluated against set criteria for specific clinical skills and objective clinical examinations with structured rubrics[30] are in practice in many countries around the world for professional standards in optometry practice.[25,27,28] It is high time that Nepalese optometry programs introduced the clinical competency–based assessments in the university examinations and subsequent licensure tests for required for professional practice.

A significant distinction with the programs in Australia, New Zealand, and the United Kingdom is that optometry students in Nepal are trained in systems that manage high-volume patients in relatively low-resource settings. This training system has allowed students to receive comprehensive training in diagnosis and management of a wide spectrum of ocular diseases and pre-surgical and post-surgical management, in addition to the training in core optometry-related areas, including refraction, dispensing, contact lens practice, low-vision rehabilitation, geriatric and pediatric examination and management, orthoptics and vision therapy, and ocular electrophysiology and imaging. Moreover, the coexisting training approach has, to some degree, enhanced the interprofessional concord and encouraged comanagement of ocular conditions.

The optometry program at BPKLCOS has been recognized for its high academic and clinical standards. Every year, approximately 50% of graduates engage in clinical practice within the country, whereas the remaining goes overseas to pursue their post-graduate studies.[1,31] Countries that Nepalese optometrists have pursued or are currently pursuing post-graduate degrees include the United States, South Korea, the United Kingdom, Australia, and New Zealand. To date, three Nepalese optometrists (including authors N.P. and S.K.) have earned their PhDs from the University of Auckland (two from the School of Optometry and one from the Department of Ophthalmology), six from optometry schools in Australia, three from the United Kingdom, one from Portugal, and eight from schools in the United States. Several alumni of the optometry program at BPKLCOS now hold professorships, lectureships, and post-doctoral research positions in leading optometry institutions around the world.

## Optometry Legislation and Scope of Practice

In Nepal, the delivery of eye care occurs through several cadres of human resources, including ophthalmologists, optometrists, ophthalmic assistants, ophthalmic nurses, and orthoptists.[32] Along with ophthalmologists, optometrists are considered autonomous, regulated, and licensed healthcare professionals.[31] The World Council of Optometry defines optometry as "a healthcare profession that is autonomous, educated, and regulated (licensed/registered), and optometrists are the primary healthcare practitioners of the eye and visual system who provide comprehensive eye and vision care, which includes refraction and dispensing, detection/diagnosis and management of disease in the eye, and the rehabilitation of conditions of the visual system."[33] With the established requirements of a formal university course at the undergraduate and post-graduate levels, ophthalmologists and optometrists comprise two cadres of independent eye-care practitioners in Nepal. However, unlike other health professions such as medicine, nursing, and pharmacy, optometry does not have a separate governing council, primarily because of the low number of practicing optometrists in the country and lack of meaningful lobbying with the policymakers. Rather, optometrists (graduates from Nepal and abroad with optometry qualifications) are registered in the NHPC where they need to maintain an active registration for practice. Since 2021, NHPC has introduced a licensure examination before registration and practice to standardize the professional quality of graduates from optometry schools within the country and abroad. Contrary to countries such as Canada and the United States have strict licensure requirements with various stages including theory and clinical examinations,[34] optometry licensure in Nepal is limited to theory examination. In view of the large influx of optometry graduates from abroad especially from India and the prospect of emerging new optometry colleges inside the country, it is critical that the licensure examination incorporates clinical competencies to regulate the standards of clinical practice.

With both diagnostic and therapeutic prescription rights, the scope of practice of optometry in Nepal appears relatively broad compared with other Asian countries such as India, Pakistan, Bangladesh, Sri Lanka, Jordan, Saudi Arabia, and the Philippines.[35–37] Independent therapeutic prescribing is an emerging aspect of optometry practice and is integral to the establishment of optometrists as primary and specialty eye care providers. Similar to the developed countries, such as New Zealand, Australia, and the United Kingdom,[20,38,39] Nepalese optometrists are allowed to diagnose and treat primary eye care disorders, prescribe diagnostic and therapeutic drugs (topical and oral), and practice in specialty areas such as refraction, low vision, contact lenses, and binocular vision. They are also allowed to comanage more severe ocular pathologies (e.g., anterior and posterior segment diseases and laser refractive procedures), perform diagnostic and investigative procedures, and offer optical or medical management in collaboration with ophthalmologists who offer medical or surgical management.

In 2013, the NHPC published a code of ethics for optometry as a legally binding document.[40] As per the code of ethics, optometrists have the right to practice independently or in collaboration with other health care providers to manage eye diseases and provide spectacle lens therapy, contact lens therapy, low-vision therapy, binocular vision therapy, occupational vision care, and visual rehabilitation. In health care delivery, their responsibilities include

prevention, health education, promotion, and maintenance, diagnosis, treatment and rehabilitation, counseling, and consultation. The code of ethics also recognizes the rights of optometrists to conduct descriptive or analytical research in both community and hospital settings and to provide ocular health certificates to patients regarding their vision and eye health. As per the code of ethics, optometrists in Nepal can prescribe pharmaceutical (therapeutic) agents, which include topical and oral antibiotics, topical and oral antivirals, topical and oral antifungals, hyperosmotic agents, topical and oral analgesics, antipyretics, nonsteroidal anti-inflammatory, topical and oral antiallergics, topical ocular decongestants, topical corticosteroids and corticosteroid-antibiotic combination, topical glaucoma drugs, ocular lubricants, vitamins, multivitamins, and antioxidant preparations. To practice in this scope, optometrists lean on their education of ocular pharmacology obtained during clinical rotations in the final 2 years of their undergraduate optometry programs where they learn to prescribe topical and oral medications under supervision. Nepalese optometrists do not have surgical privileges but can perform punctal dilation, insertion of punctal plugs, cornea and conjunctival foreign body removal, syringing and probing (nasolacrimal duct), corneal and conjunctival swab collection, and minor lid and conjunctival surgeries.

Since its establishment in 2001, the Nepalese Association of Optometrists has been persistently advocating for the rights and benefits of optometrists in Nepal. However, it has yet to be conscientiously thoughtful in publishing clinical practice guidelines and in helping practitioners continue professional development through regular calendars. Other organizations such as Mero Eye Foundation and ForOptom that hold conferences and symposia are emerging, but they lack regularity. Optometry-related conferences are sometimes conducted by eye hospitals, but the frequency is rather low in comparison to ophthalmology meetings.

## RESEARCH ADVANCES

Since the commencement of the optometry program at the Institute of Medicine in 1998, research has remained an integral part of the undergraduate optometry degree in Nepal. The research project module incorporates theoretical teaching of research methodology and the completion of a research project and dissertation in the final year of the undergraduate degree. Most graduates get exposure to the field of scientific publication and research in optometry via the submission of their undergraduate research work in international journals. The scope of undergraduate research projects by optometry students has considerably evolved over the years. The initial studies were primarily hospital-based prospective studies such as investigations of refractive status in cataract surgery and assessment of causes of low vision in hospitals, to name a few.[41,42] However, more recent undergraduate projects have involved diverse areas such as community-based research[5,8,43] and studies on medication toxicity[44,45] and visual functions in individuals with special needs[6,7,9] and neurological disorders.[46,47] The quality of the undergraduate projects is reflected by their publication in leading optometry/ophthalmology journals such as *Documenta Ophthalmologica*, *Clinical and Experimental Optometry*, *Journal of Optometry*, and *Optometry and Vision Science*. The scope of research in optometry has significantly increased with the rise in the number of Nepalese optometrists with post-graduate research degrees. In 2019, approximately 50% of optometrists trained from BPKLCOS had completed or were pursuing master's degree or PhD at universities overseas including the United Kingdom, United States, Australia, and New Zealand.[48] A substantial proportion of optometrists with research degrees when compared with other eye care professionals places optometry in a unique position to contribute to eye and vision research in Nepal.

Nepalese research scholars have made significant contributions to various fields of optometry and ophthalmology research. Research on vision-related quality of life has resulted in the development and assessment of the quality-of-life questionnaires for ocular conditions, such as keratoconus[49] and refractive error.[50] Other studies have evaluated the quality of life in patients with low vision[51] and older adults living in nursing homes.[52] These works have provided important insights into the quality of life of patients with ocular disorders.

Pediatric vision is another major area of research for Nepalese optometrists. A study in more than 6000 schoolchildren in Kathmandu valley reported myopia as the main cause of visual impairment.[2] Further studies have evaluated causes of pediatric low vision in hospital settings[42,43] and integrated schools for the visually impaired.[9,53] Studies have also been published on ocular morbidities in vulnerable groups of children[5,9] and those with multisensory impairment.[3] There have also been significant contributions to understanding visual processing in pediatric systemic conditions, such as Down syndrome,[6] albinism,[54] cerebral palsy,[7] and pre-term birth.[46,55] Other studies have evaluated higher-order visual functions, such as motion and shape perception in normal development[56] and clinical conditions, including amblyopia[57] and neonatal hypoglycemia.[58]

Eye health in schoolchildren and visual impairment have been other major themes of research for Nepalese scholars. Several studies have evaluated the effectiveness of school screenings and health promotional programs in the early detection of refractive errors and ocular diseases and in improving the eye health of schoolchildren.[59,60] Nepalese optometrists have also investigated the causes of low vision and the efficacy of low-vision devices in the schools for the visually impaired and in hospitals providing low-vision services in Nepal.[42,43] Similar works have been carried out by Nepalese researchers in several regions outside Nepal.[61–64]

Research on post-illumination pupil response,[65] the sustained pupillary constriction after light offset, has explored the use of the technique to assess intrinsically photosensitive retinal ganglion cells in normal aging[66] and to develop diagnostic measures in clinical conditions, such as glaucoma[67] and refractive errors.[66] Nepalese optometrists have published studies on the anterior eye, including investigations of tear film lipids and dynamics,[68–70] pathophysiology and diagnosis of the dry eye,[71,72] and limbal stem cells.[73] Other studies have focused on different aspects of contact lens wear, such as compliance and complications.[74,75] Myopia has emerged as the major area of vision research in recent times. Nepalese optometrists have contributed to this field with several studies on mechanisms and interventions of myopia.[76–79]

The high research output of Nepalese optometrists in the last two decades reflects an increasing interest and enthusiasm for eye and vision research. Of 150 students that have received optometry degree from the Institute of Medicine up until 2022, 57 graduates have been research active (minimum of one PubMed-indexed publication within a 3-year period). The average number of scientific publications from these optometrists is on the rise every year. We calculated the research outputs (journal articles and published abstracts) of these research-active optometrists from Google Scholar, ResearchGate, and Pubmed databases from 2005 to September

2022. As shown in Fig. 1A, the number of research outputs has been steadily increasing, rising from one per research-active person in 2008 to nearly three in 2021. Similarly, the impact of these research works has also seen significant growth with 70 citations per research-active person in 2021 (Fig. 1B).

## PRESENT AND FUTURE CHALLENGES

### Clinical and Regulatory Challenges

The prevalence of uncorrected refractive error as the leading cause of visual impairment and the second most common cause of blindness globally calls for a crucial role of optometrists in addressing this burden.[80] The Vision 2020 Global Initiative for the Elimination of Avoidable Blindness: Action Plan 2006 to 2011 recommended each nation develop a national Vision 2020 plan incorporating measures to address visual impairment due to uncorrected refractive errors.[81] To achieve this, the report suggested a target of one trained functional refractionist per 50,000 population by 2020.[81] Although Nepal has already met this target, a major challenge is the recognition of optometrists as eye health practitioners among the public and fellow eye care practitioners and integration into the national health care system and public hospitals. Despite the increasing contributions to eye care delivery, the

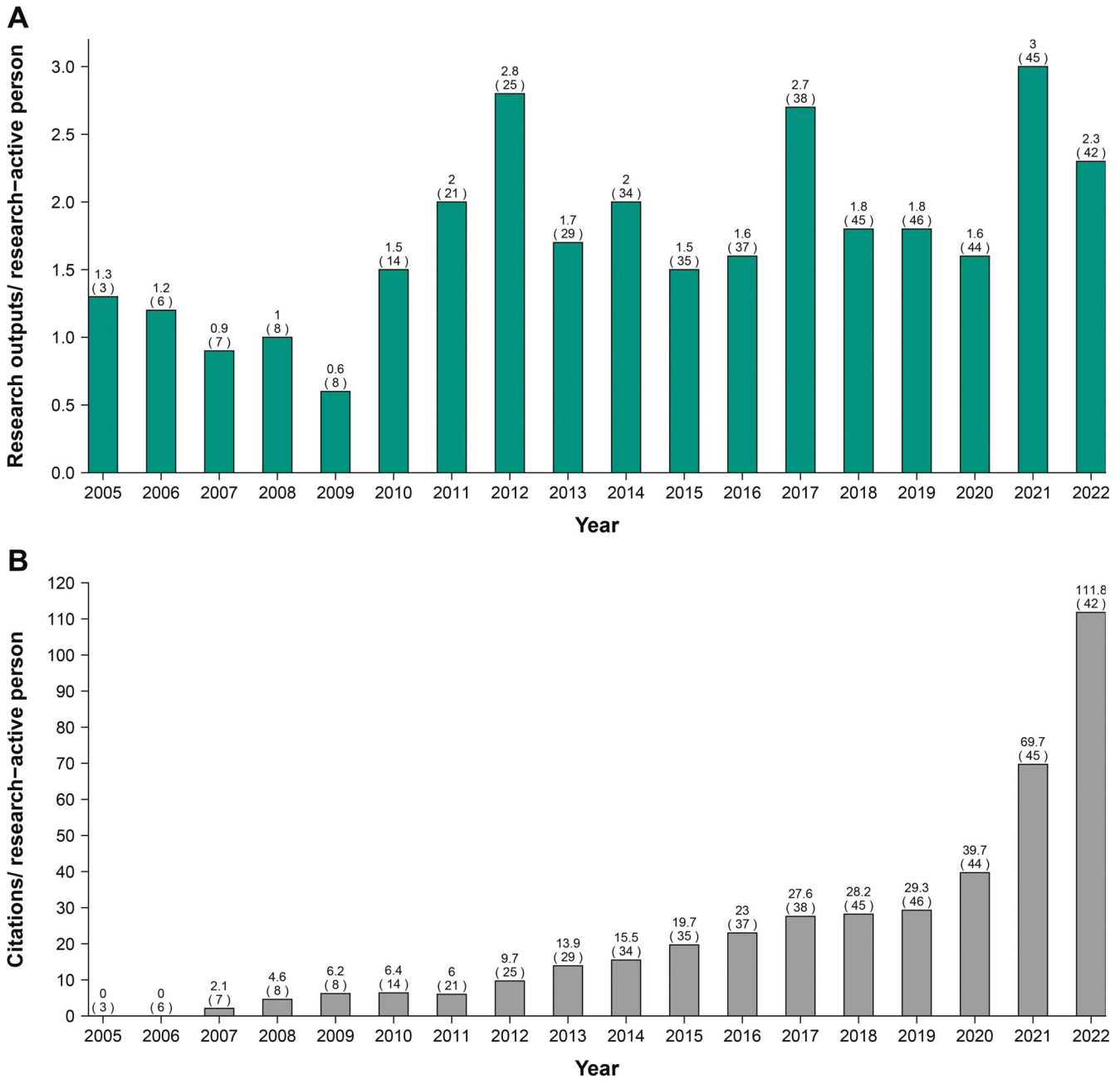


**FIGURE 1.** (A) Research outputs and (B) citations of research outputs per research-active person of Nepalese optometrists from January 2005 to September 2022. The number inside parenthesis indicates the number of research-active person.

role of optometrists continues to get overlooked in commentaries about eye care in the country.[82,83] There is still no provision for recruitment of optometrists in permanent roles at government level except in the Nepal Army. Although optometrists in Nepal are registered with the NHPC as independent healthcare practitioners, the lack of clear governmental legislation regarding the overlapping scope of practice among ophthalmologists, optometrists, orthoptists, ophthalmic assistants, and ophthalmic nurses has led to continual conflicts among these different cadres of eye care professionals.

The eye care system in Nepal is dominated by nongovernmental organizations where most hospitals and eye care centers are affiliated.[83] Although these organizations have contributed significantly to eye care delivery in the country, lack of awareness about the scope of practice of optometrists and a narrow focus on medical and surgical management within these organizations have resulted in structural imbalance, with considerations primarily given to ophthalmologists as tertiary eye care providers, and ophthalmic assistants and ophthalmic nurses as providers of primary eye care and associated investigative procedures. Moreover, optometrists face a glass ceiling in their career ladder even after long years of service in eye hospitals because ophthalmologists tend to occupy leadership positions in these organizations, and considerations for optometrists are almost nonexistent. This system has not only significantly limited opportunities for optometrists and deprived the public of more affordable and easily accessible care but also prevented ophthalmology resources to be devoted to significant unmet surgical care needs of the country. Admittedly, the public recognition and clinical scope of optometrists inside Nepal have yet to be broadened as have been in the developed countries. Whereas evidence regarding public perception of optometric eye care in Nepal is lacking, findings from other countries provide support for public trust in eye care services provided by optometrists.[84,85]

Although significant progress has been made in integrating optometrists within the ophthalmic patient management ecosystem in public and private hospitals with an increasing number of hospitals advertising vacancies for optometry positions, the number of optometrists employed seems inadequate to address the optometric needs of patients attending these hospitals for eye care services. A possible reason for the low hire of optometrists is the administrative preference for eye care delivery models involving ophthalmic assistants for the provision of screening, history taking, refraction, and investigative procedures and ophthalmologists for the provision of medical and surgical care. This model, although economically advantageous for the targeted large volume of patient care, has the potential to significantly compromise patient care, and contrasts with the successful eye care delivery models around the world that have demonstrated the efficient role of optometrists in areas such as pre-operative and post-operative care for cataracts, glaucoma management, review of patients with diabetes, and pediatric eye care.[86–88] In countries such as Australia and the United Kingdom, optometry practice extends into the comanagement of cataracts, glaucoma, and diabetic retinopathy.[89–91] Nepalese optometrists currently provide some aspects of these enhanced eye care services (e.g., pre-surgical and post-surgical care, glaucoma monitoring, and emergency triage) in both hospital and private practice settings, but no established model or pathway that formally streamlines such collaborative care approach is in practice.

## Academic Challenges

Over the two decades, Optometry education in Nepal has faced some significant challenges in terms of scope of practice and governmental recognition but demonstrated great success as evident by the number of optometry graduates being accepted at international universities.[1,31] However, with the recent establishment of the two new schools of optometry, concerns about the quality of the education delivery are increasing.[48] These concerns mainly relate to the establishment of the program without appropriate planning, insufficient optometry faculty-to-student ratio, noninvolvement of optometry stakeholders in the conceptualization and establishment of the program, lack of resources including well-equipped laboratories, and nonuniformity of training across different institutes.[48] Although the establishment of additional optometry programs will substantially increase human resources to enhance optometry practice in the country, these programs seem to be brought about by hospital needs rather than strategically addressing the unmet needs of eye care delivery in the country. Moreover, questions remain about the availability of the academic workforce necessary to effectively implement these programs. There are a limited number of optometrists with post-graduate degrees in the country, and those involved in the delivery of optometry programs have a relatively greater workload with both teaching and clinical responsibilities, which include didactic and clinical teaching, pre-clinical and clinical student supervision, and administering specialty clinics such as contact lens, binocular vision, and low vision. A survey among Nepalese optometrists registered in Nepalese Association of Optometrists reported that the vast majority (93%) had concerns about the lack of involvement of optometrists in the planning of the program, and more than half (57.5%) of the respondents opined that a new program required major curriculum revision and provision of resources, including well-equipped laboratories and full-time optometry faculties, for the delivery of standard quality optometry education.[48] It is imperative that these critical issues be addressed to ensure a continued growth of optometry education in the country.

## Research Challenges

Despite the growing number of Nepalese optometrists involved in research and their publication outputs, eye and vision research in Nepal is still in its nascent stage. The primary focus of developing countries such as Nepal is on health service delivery to the public, and as a result, research and innovation usually fall behind the top priorities. Unsurprisingly, Nepal hence lacks infrastructure and resources necessary for high-quality research. One limiting factor has been the lack of qualified research-oriented human resources in the country. The recent establishment of post-graduate programs should facilitate this shortage and contribute to the conduct of high-impact research. The lack of research funding in Nepal is another limiting factor. To this end, Nepal-trained optometrists residing overseas could play a critical role in terms of knowledge transfer and research collaborations. There have already been collaborative projects between optometrists residing in Nepal and those abroad.[9,46,55,92] In the future, knowledge and skill exchange between local and overseas optometrists and collaboration across various eye care sectors would be important to further develop eye and vision research in Nepal. This would aid Nepalese optometrists and vision scientists in establishing dedicated research institutes for continued and high-quality research outputs in a collaborative or freelancing model.

To qualitatively evaluate some of these challenges, the authors solicited opinions from optometrists currently involved in academia and clinical practice in Nepal. A lecturer involved in the delivery of both undergraduate and post-graduate optometry programs

remarked that "optometrists in educational institutions are constrained to work with a low remuneration compared with other medical professionals. There is a lack of understanding among fellow professionals, administrative staff, and university officers about the practice scope and capabilities of optometrists. The leadership is undermining the profession in terms of providing appropriate hierarchical ranks and benefits." Another lecturer commented, "I have faced challenges in every step of research, from planning to publication. The involvement of eye hospitals and academic institutions in research and innovation is severely limited. In addition, research grants and funds are scarce. A research department has yet to be set up in my institution despite it running academic programs in eye care for nearly two decades." An optometrist in private practice stated that "private optometry practice in Nepal faces a significant challenge due to the lack of a clear referral mechanism." Another practitioner opined that "the lack of awareness about the scope of optometry among not only the general public but also the management team and hospital staff thwart the practice of optometry to its full scope." Another experienced clinical optometrist mentioned "less priority is given to optometrists in terms of benefits and promotions resulting in slow career growth and development. There is no scope of professional development even after working in the institution for over a decade."

## RECOMMENDATIONS

Nepal faces an immediate need for the introduction of an optical act to curb the unethical and unprofessional market practice in refraction and optical dispensing industries that will, in turn, enhance job security of eye health professionals including optometrists. The provision of jobs at the governmental level will allow Nepalese optometrists to practice to their full scope and contribute toward further advancing eye care in the nation. The establishment of licensing examinations that include both theory and clinical competencies is critical to ensure adequate professional standards for all practicing optometrists, including those receiving optometry education at foreign institutions. Awareness campaigns at the local and national levels seem imperative to invoke a change in perception among the public that the scope of optometry in Nepal is not limited to refraction services as often perceived but extends to much more comprehensive areas, such as diagnosis and treatment of eye diseases, surgical referrals, management of binocular vision problems, common and specialty contact lens, vision training, low vision, pre-operative and post-operative management, pediatric and geriatric eye health, and public health eye care.[31] The nongovernmental eye care organizations and policymakers should integrate optometrists into the current public eye care delivery system in alignment with the established and successful international collaborative models whereby optometrists act as primary eye care providers at every level as the first point of contact with patients and refer them to ophthalmologists for medical and surgical management as appropriate. The establishment of such referral pathways and comanagement models will significantly lessen the burden on the existing eye health system while also providing affordable, accessible, and quality care to patients in both urban and rural communities. Legislation to mandate the strict comanagement pathway that distinctly delineates the boundaries of professional practice among different cadres of eye health care providers may ultimately be required to provide efficient and high-quality care. Finally, all academic optometry institutions should emphasize the provision of the state-of-the-art training resources and facilities including well-equipped laboratories; incorporate qualified optometrists as key stakeholders in the planning, establishment, and delivery of optometry programs; and ensure standardization of academic training across institutions to continually produce highly competent optometrists in Nepal.

### ARTICLE INFORMATION

**Submitted:** January 30, 2022

**Accepted:** November 11, 2022

**Funding/Support:** None of the authors have reported funding/support.

**Conflict of Interest Disclosure:** None of the authors have reported a financial conflict of interest.

**Author Contributions and Acknowledgments:** Conceptualization: SK; Data Curation: MRJ; Formal Analysis: SK, MRJ; Visualization: SK; Writing – Original Draft: SK, NP, MRJ; Writing – Review & Editing: SK, NP, RA, MRJ.

The authors would like to thank Mr. Bob Kinnear for his long-standing support for the development of optometry education in Nepal.

### REFERENCES

**1.** Khanal S, Paudel N, Joshi MR. Optometry in Nepal: A Historical Perspective. Clin Exp Optom 2022;105:80–3.

**2.** Shrestha RK, Joshi MR, Ghising R, et al. Ocular Morbidity among Children Attending Government and Private Schools of Kathmandu Valley. JNMA J Nepal Med Assoc 2011;51:182–8.

**3.** Bist J, Adhikari P, Sharma AK. Ocular Morbidity in Hearing Impaired Schoolchildren. Child Care Health Dev 2011;37:394–7.

**4.** Gnyawali S, Shrestha GS, Khanal S, et al. Ocular Morbidity among Porters at High Altitudes. Nepal J Ophthalmol 2017;9:30–6.

**5.** Pant M, Shrestha GS, Joshi ND. Ocular Morbidity among Street Children in Kathmandu Valley. Ophthalmic Epidemiol 2014;21:356–61.

**6.** Paudel N, Leat SJ, Adhikari P, et al. Visual Defects in Nepalese Children with Down Syndrome. Clin Exp Optom 2010;93:83–90.

**7.** Marasini S, Paudel N, Adhikari P, et al. Ocular Manifestations in Children with Cerebral Palsy. Optom Vision Devel 2011;42:178.

**8.** Dev MK, Shrestha GS, Paudel N, et al. Visual Status and Ocular Morbidity in Older Adults Living in Residential Care. Graefes Arch Clin Exp Ophthalmol 2012;250:1387–93.

**9.** Puri S, Bhattarai D, Adhikari P, et al. Burden of Ocular and Visual Disorders among Pupils in Special Schools in Nepal. Arch Dis Child 2015;100:834–7.

**10.** Shrestha GS, Manandhar S, Joshi ND, et al. Ocular Morbidity among the Children of Squatter Settlements in Kathmandu. Optom Vis Sci 2013;90:1012–8.

**11.** Kramer GA, Johnston J. Validity of the Optometry Admission Test in Predicting Performance in Schools and Colleges of Optometry. Optometric Educ 1997;22:53–9.

**12.** Buckingham RS, Bush SR. Predictors of Academic Success for Students at the Michigan College of Optometry. Optometric Educ 2013;38:92–9.

**13.** The University of Western Australia. Postgraduate: Doctor of Optometry. Available at: https://www.uwa.edu.au/study/courses/doctor-of-optometry. Accessed December 20, 2022.

**14.** The University of Melbourne. Doctor of Optometry. Available at: https://study.unimelb.edu.au/find/courses/graduate/doctor-of-optometry/. Accessed December 20, 2022.

**15.** Deakin University. Bachelor of Vision Science/Master of Optometry. Available at: https://www.deakin.edu.au/course/bachelor-vision-science-master-optometry. Accessed December 20, 2022.

**16.** Flinders University. Bachelor of Medical Science (Vision Science)/Master of Optometry. Available at: https://www.flinders.edu.au/study/courses/bachelor-medical-

science-vision-science-master-optometry. Accessed December 20, 2022.

**17.** University of New South Wales. Bachelor of Vision Science/Master of Clinical Optometry. Available at: https://www.unsw.edu.au/study/undergraduate/bachelor-of-vision-science-clinical-optometry?studentType=Domestic. Accessed December 20, 2022.

**18.** University of Canberra. Vision Science and Optometry. Available at: https://www.canberra.edu.au/about-uc/faculties/health/study/vision-science-and-optometry. Accessed December 20, 2022.

**19.** Queensland University of Technology. Master of Optometry. Available at: https://www.qut.edu.au/courses/master-of-optometry. Accessed December 20, 2022.

**20.** Black JM, Jacobs RJ, Phillips JR, et al. The Changing Scope of Optometry in New Zealand: Historical Perspectives, Current Practice and Research Advances. J R Soc N Z 2019;49:188–204.

**21.** Turnbull PR, Craig JP. Oral Medication Prescribing by Optometrists in New Zealand. Clin Exp Optom 2021; 104:425–7.

**22.** University and Colleges Admissions Service. Optometry. Available at: https://www.ucas.com/explore/subjects/optometry. Accessed December 20, 2022.

**23.** Eye Health Nepal. Curriculum for Bachelor of Optometry and Vision Science—NAMS; 2021. Available at: https://www.eyehealthnepal.com/nams-optometry-curriculum/. Accessed December 20, 2022.

**24.** Eye Health Nepal. Pokhara University Master of Optometry (M. Optom) Curriculum; 2021. Available at: https://www.eyehealthnepal.com/pokhara-university-master-of-optometry-m-optom-curriculum/. Accessed December 20, 2022.

**25.** Kiely PM, Slater J. Optometry Australia Entry-level Competency Standards for Optometry 2014. Clin Exp Optom 2015;98:65–89.

**26.** Backhouse S, Chiavaroli NG, Schmid KL, et al. Assessing Professional Competence in Optometry—A Review of the Development and Validity of the Written Component of the Competency in Optometry Examination (COE). BMC Med Educ 2021;21:11.

**27.** Cane D, Penny M, Marini A, et al. Updating the Competency Profile and Examination Blueprint for Entry-level Optometry in Canada. Can J Optom 2018;80: 25–34.

**28.** Myint J, Edgar DF, Murdoch IE, et al. The Impact of Postgraduate Training on UK Optometrists' Clinical Decision-making in Glaucoma. Ophthalmic Physiol Opt 2014;34:376–84.

**29.** Newble D. Techniques for Measuring Clinical Competence: Objective Structured Clinical Examinations. Med Educ 2004;38:199–203.

**30.** Harden RM, Gleeson FA. Assessment of Clinical Competence Using an Objective Structured Clinical Examination (OSCE). Med Educ 1979;13:41–54.

**31.** Kaphle D, Kandel H, Paudel P. Optometry in Nepalese Context: The Profession beyond Providing Refraction Services. JNMA J Nepal Med Assoc 2019;57:59–63.

**32.** Gyawali R, Adhikary R, Kandel H. Allied Eye Health Professionals in Eye Care Services in Nepal. Community Eye Health 2020;33:S9–10.

**33.** Smith DP. The 75th Anniversary of the World Council of Optometry. Clin Exp Optom 2002;85:210–3.

**34.** Hobbs BN, Bryant J. Examination Innovation: Transforming the National Board of Examiners in Optometry's Clinical Skills Examination. Optom Vis Sci 2019;96:896–7.

**35.** Naidoo K, Arvind A, Abesamos-Dichoso C, et al. Optometry in South-East Asia. In: Das T, Nayar PD, eds. South-East Asia Eye Health: Systems, Practices, and Challenges. Singapore: Springer Singapore; 2021:303–11.

**36.** Okasheh-Otoom A, Gammoh Y, Otoum M, et al. The Scope of Optometry Practice in Jordan. Optom Vis Sci 2022;99:35–44.

**37.** Aldebasi YH, Ahmed MI, Monaco WA. Are Optometrists Necessary in Primary Health Care Centres in Saudi Arabia? Afr Vis Eye Health 2018;77.

**38.** Ng RJ, Martis RM. Medical Optometry: A New Term to Describe the Therapeutic Scope in Australia and New Zealand. Clin Exp Optom 2021;104:532–4.

**39.** Harper R, Creer R, Jackson J, et al. Scope of Practice of Optometrists Working in the UK Hospital Eye Service: A National Survey. Ophthalmic Physiol Opt 2016; 36:197–206.

**40.** Mero Eye; Nepalese Ophthalmic Magazine. Code of Ethics for Optometrist [sic] by Nepal Health Professional Council. Available at: https://meroeye.com/news/code-of-ethics-for-optometrist-by-nhpc/. Accessed December 20, 2022.

**41.** Joshi MR, Shakya S. Change in Refractive Status of the Patients Undergoing Phacoemulsification Surgery. Nepal Med Coll J 2009;11:19–22.

**42.** Khanal S, Lama P. Profile of Low Vision Population Attending Low Vision Clinic in a Peripheral Eye Hospital in Nepal. Optom Vis Perf 2013;1:208–12.

**43.** Uprety S, Khanal S, Morjaria P, et al. Profile of Paediatric Low Vision Population: A Retrospective Study from Nepal. Clin Exp Optom 2016;99:61–5.

**44.** Kandel H, Adhikari P, Shrestha GS, et al. Visual Function in Patients on Ethambutol Therapy for Tuberculosis. J Ocul Pharmacol Ther 2012;28:174–8.

**45.** Sharma R, Marasini S, Sharma AK, et al. Methanol Poisoning: Ocular and Neurological Manifestations. Optom Vis Sci 2012;89:178–82.

**46.** Kharal A, Khanal S, Shrestha JB, et al. Flash VEP in Clinically Stable Pre-term and Full-term Infants. Doc Ophthalmol 2020;141:259–67.

**47.** Khanal S, Davey PG, Racette L, et al. Comparison of Retinal Nerve Fiber Layer and Macular Thickness for Discriminating Primary Open-angle Glaucoma and Normal-tension Glaucoma Using Optical Coherence Tomography. Clin Exp Optom 2016;99:373–81.

**48.** Kaphle D, Kandel H, Paudel P, et al. Profile of Nepalese Optometrists and Their Perspectives about a New Optometry School. Afr Vis Eye Health 2019;78.

**49.** Khadka J, Schoneveld PG, Pesudovs K. Development of a Keratoconus-specific Questionnaire Using Rasch Analysis. Optom Vis Sci 2017;94:395–403.

**50.** Kandel H, Khadka J, Fenwick EK, et al. Constructing Item Banks for Measuring Quality of Life in Refractive Error. Optom Vis Sci 2018;95:575–87.

**51.** Gyawali R, Paudel N, Adhikari P. Quality of Life in Nepalese Patients with Low Vision and the Impact of Low Vision Services. J Optom 2012;5:188–95.

**52.** Dev MK, Paudel N, Joshi ND, et al. Impact of Visual Impairment on Vision-specific Quality of Life among Older Adults Living in Nursing Home. Curr Eye Res 2014;39:232–8.

**53.** Shrestha JB, Gnyawali S, Upadhyay MP. Causes of Blindness and Visual Impairment among Students in Integrated Schools for the Blind in Nepal. Ophthalmic Epidemiol 2012;19:401–6.

**54.** Khanal S, Pokharel A, Kandel H. Visual Deficits in Nepalese Patients with Oculocutaneous Albinism. J Optom 2016;9:102–9.

**55.** Uprety S, Morjaria P, Shrestha JB, et al. Refractive Status in Nepalese Pre-term and Full-term Infants Early in Life. Optom Vis Sci 2017;94:957–64.

**56.** Joshi MR, Falkenberg HK. Development of Radial Optic Flow Pattern Sensitivity at Different Speeds. Vision Res 2015;110:68–75.

**57.** Joshi MR, Simmers AJ, Jeon ST. Implied Motion from Form Shows Motion Aids the Perception of Global Form in Amblyopia. Invest Ophthalmol Vis Sci 2020; 61:58.

**58.** McKinlay CJ, Alsweiler JM, Ansell JM, et al. Neonatal Glycemia and Neurodevelopmental Outcomes at 2 Years. N Engl J Med 2015;373:1507–18.

**59.** Bhattarai D, Gnyawali S, Silwal A, et al. Student-led Screening of School Children for Refractive Error Correction. Ophthalmic Epidemiol 2018;25:133–9.

**60.** Paudel P, Yen PT, Kovai V, et al. Effect of School Eye Health Promotion on Children's Eye Health Literacy in Vietnam. Health Promot Int 2019;34:113–22.

**61.** Gyawali R, Bhayal BK, Adhikary R, et al. Retrospective Data on Causes of Childhood Vision Impairment in Eritrea. BMC Ophthalmol 2017;17:209.

**62.** Paudel P, Ramson P, Naduvilath T, et al. Prevalence of Vision Impairment and Refractive Error in School Children in Ba Ria—Vung Tau Province, Vietnam. Clin Experiment Ophthalmol 2014;42:217–26.

**63.** Joshi MR, Persad V, Farnon N. A Retrospective Study of Causes of Visual Impairment and Use of Low Vision Devices in the Low Vision Clinic in Trinidad and Tobago. J Optom 2021;14:335–41.

**64.** Kaphle D, Marasini S, Kalua K, et al. Visual Profile of Students in Integrated Schools in Malawi. Clin Exp Optom 2015;98:370–4.

**65.** Adhikari P, Zele AJ, Feigl B. The Post-illumination Pupil Response (PIPR). Invest Ophthalmol Vis Sci 2015;56:3838–49.

**66.** Adhikari P, Pearson CA, Anderson AM, et al. Effect of Age and Refractive Error on the Melanopsin Mediated Post-illumination Pupil Response (PIPR). Sci Rep 2015; 5:17610.

**67.** Adhikari P, Zele AJ, Thomas R, et al. Quadrant Field Pupillometry Detects Melanopsin Dysfunction in Glaucoma Suspects and Early Glaucoma. Sci Rep 2016;6: 33373.

**68.** Tomlinson A, Khanal S. Assessment of Tear Film Dynamics: Quantification Approach. Ocul Surf 2005;3: 81–95.

**69.** Khanal S, Bai Y, Ngo W, et al. Human Meibum and Tear Film Derived Cholesteryl and Wax Esters in Meibomian Gland Dysfunction and Tear Film Structure. Ocul Surf 2022;23:12–23.

**70.** Khanal S, Bai Y, Ngo W, et al. Human Meibum and Tear Film Derived (O-acyl)-omega-hydroxy Fatty Acids as Biomarkers of Tear Film Dynamics in Meibomian Gland Dysfunction and Dry Eye Disease. Invest Ophthalmol Vis Sci 2021;62:13.

**71.** Khanal S, Tomlinson A, McFadyen A, et al. Dry Eye Diagnosis. Invest Ophthalmol Vis Sci 2008;49: 1407–14.

**72.** Khanal S, Tomlinson A, Diaper CJ. Tear Physiology of Aqueous Deficiency and Evaporative Dry Eye. Optom Vis Sci 2009;86:1235–40.

**73.** Puri S, Sun M, Mutoji KN, et al. Epithelial Cell Migration and Proliferation Patterns during Initial Wound Closure in Normal Mice and an Experimental Model of Limbal Stem Cell Deficiency. Invest Ophthalmol Vis Sci 2020;61:27.

**74.** Marasini S, Swift S, Dean SJ, et al. Spectrum and Sensitivity of Bacterial Keratitis Isolates in Auckland. J Ophthalmol 2016;2016:3769341–8.

**75.** Panthi S, Paudel P, Chaudhary M, et al. Microbial Contamination of Contact Lens Care Accessories and Compliance with Care Regimens in Nepal. Cont Lens Anterior Eye 2014;37:2–10.

**76.** Khanal S, Rathod SN, Phillips JR. The Acute Effect of Atropine Eye Drops on the Human Full-field Electroretinogram. Doc Ophthalmol 2021;142:315–28.

**77.** Khanal S, Turnbull PR, Lee N, et al. The Effect of Atropine on Human Global Flash mfERG Responses to Retinal Defocus. Invest Ophthalmol Vis Sci 2019;60:218–25.

**78.** Sah RP, Ramasubramanian V, Reed O, et al. Accommodative Behavior, Hyperopic Defocus, and Retinal Image Quality in Children Viewing Electronic Displays. Optom Vis Sci 2020;97:628–40.

**79.** Khanal S, Phillips JR. Which Low-dose Atropine for Myopia Control? Clin Exp Optom 2020;103:230–2.

**80.** Flaxman SR, Bourne RR, Resnikoff S, et al. Global Causes of Blindness and Distance Vision Impairment 1990–2020: A Systematic Review and Meta-analysis. Lancet Glob Health 2017;5:e1221–34.

**81.** International Agengy for the Prevention of Blindness (IAPB), World Health Organization (WHO). Vision 2020—The Right to Sight. Global Initiative for the Elimination of Avoidable Blindness: Action Plan 2006–2011; 2007. Available at: https://www.iapb.org/learn/resources/vision-2020-action-plan-2006-2011/. Accessed November 18, 2022.

**82.** Pokhrel RP. Eye Care in Four Decades in Nepal. Nepal J Ophthalmol 2018;10:1–2.

**83.** Gurung R, Upreti R. Primary Eye Care in Nepal: Current Situation and Recommendations for Integration. Community Eye Health 2021;34:s13–4.

**84.** The College of Optometrists. Public Perceptions Survey Shows Confidence in Optometrists; 2021. Available at: https://www.college-optometrists.org/news/2021/april/public-perceptions-survey-shows-confidence-in-opto. Accessed December 20, 2022.

**85.** Aldebasi MH, Alsobaie NA, Aldayel AY, et al. Public Awareness Regarding the Differences between Ophthalmologists and Optometrists among Saudi Adults Living in Riyadh: A Quantitative Study. J Ophthalmol 2018;2018:7418269.

**86.** Ly A, Nivison-Smith L, Hennessy MP, et al. Collaborative Care of Non-urgent Macular Disease: A Study of Inter-optometric Referrals. Ophthalmic Physiol Opt 2016;36:632–42.

**87.** Mongan AM, Kerins F, McKenna B, et al. Changing Trends in Postoperative Cataract Care: Impact of Electronic Patient Records in Optometrist-delivered Shared Care. Ir J Med Sci 2018;187:529–35.

**88.** Jamous KF, Kalloniatis M, Hennessy MP, et al. Clinical Model Assisting with the Collaborative Care of Glaucoma Patients and Suspects. Clin Experiment Ophthalmol 2015;43:308–19.

**89.** Baker H, Ratnarajan G, Harper RA, et al. Effectiveness of UK Optometric Enhanced Eye Care Services: A Realist Review of the Literature. Ophthalmic Physiol Opt 2016;36:545–57.

**90.** Keenan J, Shahid H, Bourne RR, et al. Cambridge Community Optometry Glaucoma Scheme. Clin Experiment Ophthalmol 2015;43:221–7.

**91.** O'Connor PM, Harper CA, Brunton CL, et al. Shared Care for Chronic Eye Diseases: Perspectives of Ophthalmologists, Optometrists and Patients. Med J Aust 2012;196:646–50.

**92.** Paudel N, Adhikari S, Thakur A, et al. Clinical Accuracy of the Nidek ARK-1 Autorefractor. Optom Vis Sci 2019;96:407–13.