

The Journal of the Association of Schools and Colleges of Optometry

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Retention of Knowledge of Retinal Microanatomy by
Optometric Students, Faculty and Practitioners

The Effect of IOP on Clinicians' Perceptions
of Glaucomatous Optic Neuropathy

Optometry Students' Attitudes about Team-Based
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Impact of Optometric Residency Training on Future Career
Paths: A Survey of Perceptions of Optometry Students,
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Student Educational Background, Perceptions and Expectations
Toward Optometry: An Emerging Eye Health Profession in
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Special Report: Interprofessional Education and Collaborative Patient Care at U.S.
Schools and Colleges of Optometry

Association of Schools and Colleges of Optometry

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Now Available through Google Scholar!

Optometric Education can now be accessed using Google
Scholar. The process of indexing past issues at [http://
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INDUSTRY NEWS

The following companies support ASCO's national programs and activities benefiting the schools and colleges of optometry in the United States and Puerto Rico.*

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Company Supports ODs Via Several Programs



In addition to its comprehensive portfolio of eyecare products, Allergan provides educational programs, professional development and other outreach initiatives that support optometrists through all phases of their careers, including:

- Allergan Academic Partnership, which offers a full spectrum of resources for students, residents, faculty and teaching institutions
- Optometry Jumpstart, AllerganODJumpstart.com, which provides students and recent graduates with resources and information to help them make a strong start in their profession
- Pathways in Medical Optometry Boot Camp, AllerganODPathways.com, which provides practical guidance on growing a successful full-scope optometry practice, such as understanding and implementing ICD-10 codes, improving billing and medical record compliance and differentiating vision plan visits vs. medical plan visits.

According to Dave Gibson, Director, Optometric Professional Relations, "These innovative optometry initiatives demonstrate how the people of Allergan are working to help ODs strengthen their standing in the forefront of their profession."

New Global Giving Program Established



essilor

Seeing the world better

Essilor established Vision For Life, a new program dedicated to eliminating

uncorrected refractive error that furthers its mission of improving lives by improving sight. The global strategic giving program aims to accelerate initiatives targeting poor vision through awareness-raising, capacity-building and the creation of basic vision care infrastructure. The company says the sustainable development of local vision care will create jobs, help alleviate poverty and bring socio-economic development to individuals and the communities in which they live.

Also: Essilor of America is giving eyecare professionals (ECPs) a chance to win exciting prizes, including an Alaskan sightseeing adventure grand prize and a variety of monthly and weekly giveaways, through the "Change Your View" sweepstakes, which is going on now through April 30, 2015.

To enter the sweepstakes, ECPs can register online at EssilorTransitions.com and complete a short training session on how Transitions lenses can benefit their patients and their practice.

Free Online Optical Training and CE



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Hoya Vision Care launched Empower U, an online mentor-based training and continuing education program designed specifically to support independent eyecare practices. Empower U learning modules are divided into three main sections:

- "The First 90 Days" takes the participant through eye anatomy, an eye exam, the prescription, frames, lenses and more
- "Hoya Technology Improves Vision" is product-specific and shows the visual acuity benefits of Hoya lens designs, materials and treatments

* As of Feb. 10, 2015

- “Hoya Improves Business” includes case studies and other tools to help practices differentiate their brands from chains and the Internet.

Training is personalized so participants can keep track of their progress. It is free to all Hoya active accounts and includes free ABO and COPE modules.

Visit www.hoyavision.com or contact your Hoya territory sales manager.

Programs for Schools, Students, Alumni



International Vision Expo reminds optometry schools, students and alumni about the programs and benefits available to them at Vision Expo East in New York City, March 19-22.

- Deans and clinical directors can receive help with expenses to attend Vision Expo East: free exhibit hall registration, a 20% discount on education courses, free lunch every day in the exhibit hall and a travel stipend.
- The no-cost student program includes an interactive “Choose Your Own Adventure” course, which allows students to attend any topic of education and apply the resulting knowledge to real-time situations. In addition, students from SUNY, along with the New York State Optometric Association, have planned an interactive lunch program that offers networking with ODs and information on interdisciplinary practice. The day will wrap up with a reception for students who attended the course and lunch programs. National Vision is inviting students to attend the Eye Rock event Saturday night as its guest. They will receive a wrist band at the student reception.
- Members of the Young Professionals Club (ODs who have been out of school for five years or less) receive free exhibit hall registration, six free hours of education and special events for club members to

network.

- New England College of Optometry and Pennsylvania College of Optometry at Salus University will host receptions for their friends and alumni on Saturday night. International Vision Expo contributed \$1,000 toward each school's reception.

All of these benefits will also be available at Vision Expo West in Las Vegas in September. For more information, contact Kristen Reynolds, Professional Relations Manager, at KReynolds@thevisioncouncil.org.

Contact Lens Module Added to Eye Check



Volk Optical added the Eye Check Contact Lens Module to its Volk Eye Check device. By automatically providing objective and accurate measurements of key eye parameters such as HVID, pupils and lids, the new module enables a quicker fitting process and helps to reduce drop-out rates. The module fosters quick identification of patients who may require non-standard optics in their lenses, and it assists in the quick and smooth fitting of progressive, RGP and scleral lenses.

For more information about Volk Eye Check, visit www.volk.com/eyecheck, call (800) 345-8655 or contact your authorized Volk distributor.

Online Training for Diagnostic Instruments



Eyecare professionals who need to familiarize themselves with Topcon Medical Systems diagnostic equipment can rely on the Topcon Online University training system. The site debut featured the CV-5000S Automated Vision Tester, KR-1W Wavefront Analyzer and CL-300 Computerized Lensmeter, and instruments are added as training mate-

rials become available.

The Topcon Online University Training Program is designed for technicians, optometrists, ophthalmologists and other eyecare professionals who are getting started with Topcon instrumentation. Through a combination of narrated videos, graphics and step-by-step instructions, the system highlights the key features and operating procedures of each instrument.

Also: Now available from Topcon is the new, fully automatic TRC-NW400 Non-Mydriatic Retinal Camera. Using the TRC-NW400, operators do not need to spend time aligning, centering, focusing or capturing color retinal images because the unit automatically performs these steps once the camera is positioned in front of the eye. Visit www.topconmedical.com.

New Ad Campaigns are Multi-Faceted

Transitions

Transitions Optical announced that its 2015 consumer advertising campaign will surround consumers with messages of choice through an integrated mix of media partnerships and television, digital and social media advertising. To bring new groups of consumers to the photochromic category, the company is making the Transitions XTRActive lens and its benefits — extra protection from light outdoors, indoors and in the car — a focus of this year's campaign.

The company also created a new consumer PR and social media campaign called “See life through a new lens,” which features Transitions lens wearers articulating what it means to wear the product. Influencers who represent multiple areas of focus, including technology, lifestyle, fashion and the Hispanic community, will share their unique Transitions brand stories with core consumer audiences across the country.

Visit Transitions.com or Transition-sPRO.com for more information.

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Allergan Academic Partnership

Allergan is dedicated to supporting optometrists throughout all phases of their careers, and the Allergan Academic Partnership is the foundation of that support. We strongly believe that a commitment to optometric teaching institutions is a commitment to the future of optometry. The Allergan Academic Partnership program offers a full spectrum of resources, including:

The Allergan Academic Partnership Support Team

- Academic Development Manager—Liaison between Allergan and your institution's leadership teams
- Teaching Institution Sales Team—Representatives who provide product education to ensure faculty, residents, and students have a thorough understanding of the Allergan product portfolio
- Eye Care Business Advisor Team—Specialists who offer a suite of sophisticated, customer-focused practice management programs and services

Student Support

- Travel grants to attend *Optometry's Meeting*®
- Practice management education through Private Practice Clubs
- Expert guest lecturers on Allergan products and common ocular diseases
- 3D patient counseling app to educate patients in clinics on 7 common eye conditions
- American Academy of Optometry (AAO), American Optometric Student Association (AOSA), and National Optometric Student Association (NOSA) support

Resident Support

- Travel fellowships to attend AAO
- Interview skills training program to help prepare for future career opportunities
- Resident-practitioner networking event to assist in identifying potential employment opportunities
- Advisory board held at the Allergan corporate office to help us find the best ways to support students and residents
- Sponsorship of important events such as orientation, Resident's Day, and graduation

Faculty Support

- Product education and samples for patients who need them
- Allergan product presentations featuring nationally recognized experts in the field of optometry
- Allergan advisory board composed of faculty and administrators who provide direction on how to best support optometric teaching institutions
- ASCO Benefactor-Level Supporter
- Faculty conferences, grand rounds, and faculty retreats

Institutional Support

- Unrestricted grants to support continuing education of optometrists
- Sponsorship of award banquets, White Coat Ceremonies, graduations, and alumni events
- Practice management resources provided by the Allergan Business Consulting Services Team
- Philanthropic support provided through The Allergan Foundation
- Inspirational programs featuring *InfantSEE* and Tom Sullivan

**For more information, contact: Mark Risher, Senior Manager,
Optometric Academic Development (Risher_Mark@allergan.com)**

EDITORIAL

Becoming an Optometric Education Diplomate

Aurora Denial, OD, FAAO



At the recent 2014 American Academy of Optometry (AAO) annual meeting in Denver, I had the pleasure of becoming the first Diplomate in Optometric Education. It was exciting and thrilling to walk across the stage at the banquet and receive the Diplomate certificate. I felt a sense of personal and professional achievement along with the satisfaction that

barriers had been overcome. Becoming a Diplomate represented accomplishments on several levels since I was involved with the original proposal to institute a Diplomate program in 2010.

The Optometric Education (OE) section of the Academy was approved in 1971 and is currently comprised of 846 members.¹ The membership represents a diversity of clinicians, teachers and administrators all sharing a common bond of educating students to become the future of the profession. “The mission of the OE section is to serve the educational needs of its membership by advancing research, promoting innovation in optometric education, encouraging visionary thinking, supporting ethical practices, and affirming provocative concepts in optometric education worldwide.”² Although the section represents leadership in the profession of optometric education, prior to 2010 there was no opportunity for members of the section to obtain the status of Diplomate in Optometric Education. Previous efforts to establish a Diplomate program were met with concerns regarding the breadth of optometric education as well as the lack of a clinical component.

In 2011, the Academy revised policies related to criteria for defining sections and special interest groups. These revisions included the need for each section to offer a Diplomate process to remain a section. In 2010, I was Chair

of the OE section and believed that educators, who are the mainstay of the profession, should have an avenue for recognition. This was especially important to those educators who identified the educational process, “The Science of Optometric Education,” as a specialty area. I worked diligently to outline a process and write a proposal for achieving the Diplomate status that would win the approval of the American Academy of Optometry Board of Directors. In May of 2010, after extensive research, writing and revisions, the Board approved the Optometric Education Diplomate Program. “The Granting of Diplomate status in Optometric Education is recognition of a focus and expertise in education beyond the level of teaching responsibilities that are commonly held by most faculty and adjunct faculty. The Diplomate status will recognize advancement in the areas of scholarly activity, educational research, advanced education and the delivery and transfer of knowledge. The Diplomate status will distinguish those individuals who hold a deep commitment and a higher level of training in the educational process.”²

A Diplomate committee of distinguished educators was formed to implement and oversee the new program. The committee was tasked with further revision of the process and it set forth the current criteria for obtaining the status of Diplomate, which can be found at the AAO website: <http://www.aao.org/sites/default/files/OEDiplomateProcess.pdf>. The opportunity to become a Diplomate was now a reality. The initial step involves submitting an application including a brief personal statement regarding the reasons for becoming a Diplomate. Personally, I was interested in achieving the Diplomate status because it represented achievement, continual growth/development and my sincere commitment to the profession of optometric education. As part of the application process, the committee reviews evidence of advanced education in the Scholarship of Teaching and Learning. This requirement includes review of

conferences, course work, symposiums, workshops, lectures and other opportunities to advance the candidate's knowledge of the education process. I fulfilled this requirement by attending OE symposiums at the annual AAO meetings and educational conferences such as The Teaching Professor, International Lilly Conference on College Teaching, International Conference on Critical Thinking and The SoTL Commons, A Conference for the Scholarship of Teaching and Learning. These experiences increased my knowledge in the educational process and were very helpful to me as a teacher.

Once accepted as a candidate, I was required to submit four articles of publishable quality that represented my ongoing interest in teaching and learning. Acceptance of the four articles was followed by an oral presentation and a final examination by the Diplomate committee. At times, the overall process seemed overwhelming, but broken into elements each piece was achievable. More importantly, each criterion represented a new opportunity for growth and development as an optometric educator.

I started the journey in May 2011 and finished three plus years later in November 2014. Along the way, I often reflected on my motivation for seeking this distinction. Ideally, as faculty we should always seek to improve our knowledge, teaching and clinical skills. In the real world, personal and professional obligations often interfere with our goals. In committing to complete the Diplomate program, I was also committing to a structure that enhanced my opportunities for advancement and progress. My motivation was to enhance my professional growth, which will ultimately benefit

my students, and to be a role model for others who are contemplating the program. The criteria are rigorous, but the end goal is achievable and rewarding. I encourage all faculty to consider this opportunity and I would be happy to provide support, guidance and mentorship.

References

1. Denial, Aurora. Email correspondence with: Jenny Brown. 2015 January 28.
2. American Academy of Optometry. Optometric Education-Become a Diplomate. Orlando Florida; 2015 [cited 2015 Jan. 28]. Available from: <http://www.aaopt.org/fellows/Sections/OptEd/Diplomate>.

ANNOUNCEMENT

IPE Theme Issue

The peer-reviewed papers in the next issue of *Optometric Education*, Summer 2015, will center on the theme of Interprofessional Education (IPE).

The Special Report that begins on the next page of this current issue describes the results of an ASCO survey that identified current practices in IPE and interprofessional practice at the nation's schools and colleges of optometry. The report also provides information about the Association's plan to convene an IPE Summit in 2016. The ASCO Board of Directors recently confirmed IPE and Collaborative Practice as one of its core Strategic Objectives, formalizing its recognition of the importance of educating Doctor of Optometry students in multidisciplinary environments and preparing them to be part of collaborative healthcare teams.

Interprofessional Education and Collaborative Patient Care at U.S. Schools and Colleges of Optometry: A Special Report

John L. Baker, OD, MEd, and Melissa A. Vitek, OD, FAAO

Dr. Baker is an Associate Professor and the Assistant Dean for Patient Care Education at the Illinois College of Optometry. He is a National Boards Clinical Skills remote examiner, senior consultant for ACOE and a member of the ASCO Committee on Interprofessional Education and Collaborative Practice.

Dr. Vitek is the Director of Electives and Advanced Studies at the Pennsylvania College of Optometry at Salus University. She is an Assistant Professor and the PCO Academic Liaison to International Programs. Dr. Vitek is a member of the IPE Committee at Salus University and the ASCO Committee on Interprofessional Education and Collaborative Practice.

Interprofessional Education (IPE) and Interprofessional Practice (IPP) have been topics of discussion since the 1960s.^{1,2,3,4} Motivated by the changing healthcare environment over the past decades, this topic has increasingly gained prominence in the literature.

The Centre for the Advancement of Interprofessional Education (CAIPE) defines Interprofessional Education as occurring “when two or more professions learn with, from and about each other to improve collaboration and the quality of care.”⁵

In considering how health care might develop in subsequent decades, a committee within the World Health Organization (WHO) recognized the trend toward teamwork in 1977. What followed was a report recommending the inclusion of IPE in healthcare education as a means to improve collaboration and service delivery, as well as provide greater workforce flexibility. Explaining the rationale for IPE, the committee report stated that if different professions learn together they will work better together, which in turn improves care and delivery of service.⁶ This was in stark contrast to the traditional methods in healthcare education at that time in which each profession primarily trained students in

its own schools or colleges by members of the same profession.⁷

Six national education associations came together in 2009 to form the Interprofessional Education Collaborative (IPEC). The goal of their collaboration was to promote and encourage efforts to advance interprofessional learning experiences to help prepare future health professionals for enhanced team-based care of patients and improved population health outcomes. The original organizations included American Association of Colleges of Nursing, American Association of Colleges of Osteopathic Medicine, American Association of Colleges of Pharmacy, American Dental Education Association, Association of American Medical Colleges and the Association of Schools of Public Health.⁸

The Association of Schools and Colleges of Optometry (ASCO) became the first supporting organization of IPEC, which now also includes other supporters: Academic Consortium for Complementary and Alternative Health Care, American Association of Colleges of Podiatric Medicine, American Council of Academic Physical Therapy, American Physical Therapy Association, American Podiatric Medical Association, American Psychological Association, American Speech-Language-Hearing

Association, Council on Social Work Education, Physician Assistant Education Association and Society of Simulation in Healthcare.⁹

The efforts of the IPEC resulted in the 2011 report “Core Competencies for Interprofessional Collaborative Practice,” the tenets of which were included in ASCO’s 2011 revised “Attributes of Graduates of the Schools and Colleges of Optometry.”¹⁰ In 2013 ASCO formed an interprofessional education task force that was, in part, charged with identifying best practices within ASCO institutions to prepare graduates for team-based practice. With representation from different schools and colleges of optometry, this task force became an ad hoc committee of ASCO.

Identifying Current IPE and IPP Activities

To identify the current IPE and IPP activities at the schools and colleges of optometry, ASCO mailed a survey to each president and chief academic officer at the 21 schools and colleges of optometry in the United States. The 16-question survey, originally developed in 2011 by an ASCO Government Affairs staff member, was modified to ask about existing IPE activity as well as about attitudes, challenges and future

plans relating to IPE at each institution. (Appendix)

The results from the survey were collected and tabulated by ASCO staff and summarized for the ASCO task force.

All 21 schools and colleges of optometry took part in the ASCO survey. Nineteen reported their institution participated in IPE activities, and nine indicated IPE was a program requirement, as noted in Table 1.

The professions represented in the IPE activities included optometry, nursing, pharmacy, veterinary, law, physical therapy, medical doctor, opticianry, podiatry, dentistry, physician assistant, dental hygiene, psychology, social work, gerontology, speech-language pathology, low vision rehabilitation, public health, occupational therapy, doctor of osteopathic medicine, audiology and biomedical science professional students.

At the time of the survey, optometric faculty members participated in the IPE offerings of 18 of the 19 institutions with IPE activity. Most optometric faculty involvement was reported to be on a volunteer basis. Eight schools and colleges of optometry described IPE coursework involving students from different programs teaching one another (AZCOPT, MCO, MCPHS, NECO, PCO, PUCO, UABSO, and WUCO).

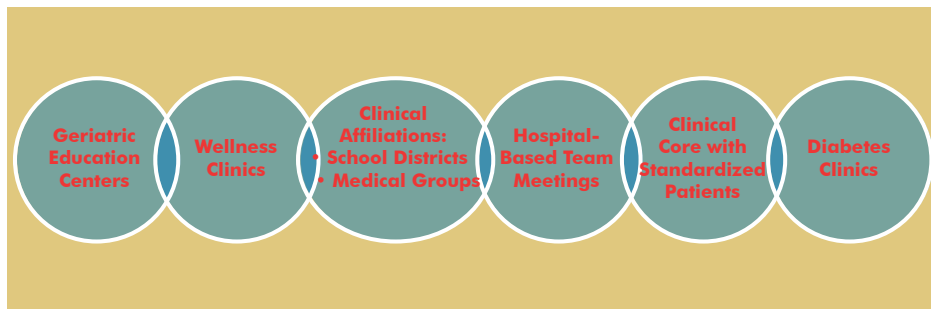
Examples of the IPE course offerings at U.S. schools and colleges of optometry include courses titled Interdisciplinary Healthcare, Clinical Reasoning, Team-Based Grand Rounds, Ethics in Healthcare, Interprofessional Education Series, Interprofessional Case Conference, Interprofessional Relations and Interprofessional Collaborative Practice, Evidence Based Practice, Global Health and Interdisciplinary Geriatric Care. Several schools and colleges of optometry include interprofessional education in various basic health science courses.

Twelve of the responding optometric institutions reported case-based discussion as an IPE activity (IUAPR, MCO, MCPHS, NECO, NOVA, PCO, PUCO, RSO, SCO, UABSO, UMSL and WUCO). Fourteen programs indicated they provide interprofessional patient care (IAUPR, ICO, MCO,

Table 1
Optometric Institutions Participating in IPE

U.S. College or School of Optometry	Participate in IPE	Program Requirement
Midwestern University Arizona College of Optometry (AZCOPT)	Yes	Yes
Inter American University of Puerto Rico School of Optometry (IAUPR)	Yes	No
Illinois College of Optometry (ICO)	Yes	No
Indiana University School of Optometry (IUSO)	No	No
Michigan College of Optometry at Ferris State University (MCO)	Yes	No
Massachusetts College of Pharmacy and Health Sciences School of Optometry (MCPHS)	Yes	Yes
New England College of Optometry (NECO)	Yes	Yes
NOVA Southeastern University College of Optometry (NOVA)	Yes	No
Northeastern State University Oklahoma College of Optometry (NSUOCO)	Yes	Yes
The Ohio State University College of Optometry (OSU)	Yes	No
Pennsylvania College of Optometry at Salus University (PCO)	Yes	Yes
Pacific University College of Optometry (PUCO)	Yes	No
University of the Incarnate Word Rosenberg School of Optometry (RSU)	Yes	No
Southern California College of Optometry at Marshall B. Ketchum University (SCCO)	Yes	No
Southern College of Optometry (SCO)	Yes	Yes
State University of New York College of Optometry (SUNY)	Yes	Yes
University of Alabama at Birmingham School of Optometry (UABSO)	Yes	Yes
University of California at Berkeley School of Optometry (UCB)	Yes	No
University of Houston College of Optometry (UHCO)	No	No
University of Missouri-St. Louis College of Optometry (UMSL)	Yes	No
Western University of Health Sciences College of Optometry (WUCO)	Yes	Yes

Figure 1
Examples of Interprofessional Practice Initiatives



MCPHS, NECO, NOVA, NSUOCO, PCO, PUCO, RSO, SCCO, SUNY, UABSO and WUCO). Eight institutions have partnerships with schools and programs outside of their own institution (ICO, MCPHS, NECO, NSUOCO, PCO, SCCO, SCO and UCB). **Figure 1** shows examples of in-

terprofessional practice initiatives that are taking place at various institutions either within their programs or through partnerships with other colleges and universities.

Nineteen programs reported barriers for initiating or furthering IPE at their institution. The barriers to IPE noted

Table 2
Barriers to IPE

Lack of Physical Resources	Geographical Barriers	Lack of Funding	Lack of Trained Faculty	Cultural Barriers	Scheduling Conflicts	Lack of Interest	Lack of Process Knowledge	Lack of Administrative Support
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by member institutions are summarized in **Table 2**.

Those institutions housed in universities with other healthcare degree programs were more likely to offer formal IPE courses. Institutions housed outside university settings were more likely to offer patient care oriented interprofessional activities.

Optometric IPE Summit to Convene in 2016

The surveyed schools and colleges of optometry suggested a variety of ways ASCO might support IPE at member institutions. These included funding, such as grants, faculty training/workshops, suggestions for curriculum, consulting services, recommendations for IPE literature, advocacy for inclusion of optometry in IPE activities at the national level, facilitation of IPE becoming a standard part of accreditation, and an IPE conference at a national optometric forum.

As a result, ASCO plans to convene an optometric-sponsored IPE conference in February 2016. The Southern California College of Optometry at Marshall B. Ketchum University will be the host institution. All ASCO member institutions as well as representatives from other stakeholders in optometry and optometric education will be invited to participate.

The goals and objectives for the IPE Summit, agreed upon by members of the ASCO IPE and Collaborative Practice Committee, are:

Goal: To assemble representatives from ASCO member institutions and other champions of interprofessional collaboration

- create opportunities among attendees for networking and collaboration

- raise the role optometry plays in interprofessional healthcare teams
- identify synergies in obtaining grant funding for developing and sustaining IPE and IPP

Goal: Share current best practices in IPE and IPP

- communicate techniques, strategies and considerations for IPE and IPP, including engagement of optometry in team-based patient care
- identify outcome measures and tools to assess the impact of IPE and IPP on student learning

Goal: Share ideas on future development of IPE and IPP

- explore future options for enhanced engagement in IPE and IPP
- develop strategies to assess the impact of IPE and IPP on patient outcomes

Discussion

Schools and colleges of optometry must individually develop their own rationale regarding what interprofessional experiences are feasible and best-suited for their students. At the time of the survey, university-affiliated institutions and non-university-affiliated institutions were approaching IPE activities differently. The former were more likely to be using academic coursework with programs within their university setting, while non-university programs were more likely to be partnering with other colleges and universities for patient care-based opportunities.

It is important to note that by definition IPE is not simply students from different health professions sitting in a classroom for the same course, or working separately from one another in the same healthcare facility. Student interaction, whether in the classroom

or the patient care setting, is the defining feature of IPE and IPP. While many responding institutions report shared coursework or patient care, it is not clear from the survey results that these activities strictly meet the definition of IPE.

The impetus for IPE often comes from national and/or international calls for programs that promote interprofessional practice.¹¹ ASCO has been a national driving force to encourage its member institutions to have optometry included in IPE initiatives. There are strong reasons for optometry to participate in IPE programs. As adapted from the dental education literature these include:

1. Optometry is a critical component of the primary care system in the United States, and its practitioners must be able to communicate effectively with other primary care providers.
2. Management of chronic health conditions, such as diabetes, has consequences for patients' eye health.
3. Efficient and quality eye care for both prevention and treatment of eye disease can best be achieved when members of the eye healthcare team work together collaboratively as well as with members of other health professions.
4. With special consideration for the Affordable Care Act, optometry is increasingly expected to interact with community public health systems to improve access to care and implement community-wide preventive measures.¹²

Schools and colleges of optometry within the United States note barriers to the implementation of IPE and IPP. These barriers are consistent with those

noted in the literature and include:

1. Lack of skilled or experienced teachers for IPE and also for evaluating students' competencies needed to function as a member of a team.
2. Shortage of learning and teaching materials and other resources for learning teamwork skills.
3. A feeling among teachers that planning, consultation and evaluation make undue demands on their time.
4. Insufficient opportunities for on-the-job training because of lack of role models for teamwork in health services.
5. Differences in the schedules of work, both clinically and educationally, which make it difficult to prepare curricula.
6. Complexity of the design required for IPE and considerable commitment and time required to create and sustain it.
7. Learners' age, educational level and clinical experience.
8. Differences in academic policies.
9. Attitudinal barriers, including historical rivalries and fears of dilution of professional identities.^{4,6,13,14}

There is growing interest in IPE and in its education and research agenda to develop best practice models based on evidence of effectiveness.¹⁵ IPEC periodically holds conferences that provide attendees the tools necessary to design and implement interprofessional initiatives. A requirement for registration and attendance at these conferences, however, is for attendees to assemble a team with representation from several different health professions. This requirement creates an additional barrier to IPE at some schools and colleges of optometry, particularly those not housed within universities. At the time of ASCO's survey, representatives from 11 institutions had taken part in an IPEC-sponsored workshop (AZCOPT, IUSO, MCO, MCPHS, NECO, NOVA, PUCO, RSO, UABSO, UMSL and WUCO). Clearly the desire exists among member institutions to develop IPE and IPP activities for their students.

For IPE and IPP activities to produce the most benefit, it is important that activities adhere to principles of adult learning. These include the need to create authentic learning experiences that replicate real-life patient care experiences for the learners.¹⁶ Cooperative learning is another feature of effective activities that promote teamwork and the transfer and application of knowledge to patient care experiences.¹⁷

Interprofessional education and interprofessional practice experiences for students are a growing part of the optometric curriculum. As evident by the number of U.S. schools and colleges of optometry currently participating in IPE, ASCO members are embracing this important healthcare trend. In scheduling an optometry IPE summit, it is ASCO's goal to provide optometry degree programs with the tools they need to break through existing barriers to IPE. This will help member institutions more effectively prepare their students for the healthcare delivery system within which they will practice.

ASCO remains committed to monitoring and supporting the implementation, assessment and expansion of both IPE and IPP offerings at its member institutions with the ultimate goal of improving patient outcomes.

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APPENDIX



Survey of Interprofessional Education Programs in the Schools and Colleges of Optometry

August 2013

1. Does your program participate in interprofessional education (IPE) activities?

If you answered yes please proceed to question 2; if you answered no please proceed to question 14.

2. What other health professions' programs participate in IPE activities with your students?

3. Does your program require participation for all optometry students?

4. Do optometry faculty participate in interprofessional activities?

If yes, is it voluntary or required?

5. Does your University require interprofessional activities in any other health professional programs? I.e., does your pharmacy program require that their students participate in interprofessional programs?

6. Are the interprofessional programs in which optometry students participate formal courses?

If yes, what interprofessional courses are offered?

7. Check all that apply:

- ☐ We offer in-person interprofessional courses
☐ We offer on-line interprofessional courses
☐ We offer interprofessional courses that are a blend of in-person and on-line

8. Are these general education courses that students from multiple programs take together, such as basic or applied pharmacology, anatomy and physiology, etc?

9. Are these interactive courses where students learn together and teach each other?

If yes, please describe some of the topics and format:

10. Do students from multiple professions discuss cases in an interprofessional setting?

11. Do the students in your program provide patient care in an interprofessional setting?

12. Please list specific examples of innovative programs at your institution where students learn in teams with health profession students of different disciplines.

13. Does your institution partner with schools or programs outside of your university to offer opportunities for interprofessional education (health professions related or other)?

If you answered no, please skip to question 14. If you answered yes, please answer the following:

- How does your institution partner with schools or programs outside of your university and with what colleges or universities?
- What, if any, joint courses are offered and with what disciplines?

14. Are there barriers to initiating or furthering IPE at your institution?

15. Has your institution attended any IPEC sponsored workshops?

16. What could ASCO do to support IPE at your institution? (Check all that apply):

Don't Miss It

Check your Inbox on or around April 13 for the announcement that the Spring 2015 issue of ASCO's online newsletter *Eye on Education* is available.

In addition to the news from the schools and colleges and industry that you've come to expect, the issue will include updates on the Association's various initiatives.

In the meantime, you can visit the ASCO website at www.opted.org for a wealth of tools and information, including the latest press releases, Faculty Directory, Optometry Resident Directory, Annual Faculty Data Report and past issues of ASCO publications.

Retention of Knowledge of Retinal Microanatomy by Optometric Students, Faculty and Practitioners

Barclay W. Bakkum, DC, PhD

Ruth A. Trachimowicz, OD, PhD, FAAO

Abstract

The purpose of this study was to identify the ability of fourth-year optometric students and clinical faculty members at an optometric college (including residents) and a cohort of private practice optometrists to label the 10 layers of the retina on a diagram. The private practitioners were least proficient in identifying the retinal layers. The faculty optometrists performed better. The students did the best. With increased use of advanced imaging technologies, optometrists may need to become increasingly proficient in retinal microanatomy. Basic and clinical science concepts should be correlated not only throughout optometric school curricula but also in continuing education courses.

Key Words: anatomy, retina, optical coherence tomography, long-term learning, optometry, education

Introduction

Anatomy can be considered one of the basic pillars of medical training. Recent evidence has shown that although some areas of patient management differ in relevancy to anatomical education, some areas of clinical care are uniformly ranked as relying heavily on anatomical knowledge, e.g., imaging and diagnostic studies, physical examination and arrival at correct diagnosis.¹ A recent study of clinicians indicated that they generally agree that anatomy is “fundamental” to daily clinical practice.²

Typically, anatomy is taught in the first year of medical school, but most of the clinical application of this knowledge does not usually occur until the third or fourth years of the curriculum, during clinical rotations and in clinical training after graduation. Studies have shown that there is a considerable loss of anatomical knowledge among medical students within a year after completing their anatomy studies³ and that specific radiologic anatomy information was “poorly retained” by fourth-year medical students.⁴

Several studies have used labeling the carpal bones on a diagram of the hand to assess retention of anatomical knowledge. The anatomy of the carpal bones was chosen as a benchmark for anatomical knowledge because it is easily and objectively examined and has relevance to clinical practice in a number of disciplines.⁵ One study using this task compared the performance of medical students with the performance of junior doctors.⁵ The overall recognition scores achieved by medical students were “poor” [4 of 25 (16%) of the students could identify seven or eight of the bones]; however, the junior doctors’ scores were “more reassuring” [7 of 10 (70%) could do the same]. In another study, physical therapy students exhibited better retention of the anatomy of the carpal bones than medical students.⁶ In that study, 23 of 54 (42%) of the physical therapy students vs. 16 of 80 (20%) of the medical students could identify all eight carpal bones. It has also been shown that the results of chiropractic students on the carpal bone test was generally better than those of previously tested final-year medical students, although only 32 of 84 (38%) of

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the chiropractic students identified all eight bones.⁷ Another study asked 102 junior doctors in accident and emergency and orthopedic departments to identify nine wrist landmarks by palpation on normal wrists and name the carpal bones on plain film radiographs.⁸ None of the subjects identified all nine wrist landmarks using palpation and only 61 of 102 (60%) could name all eight carpal bones on a plain film radiograph.

A search of the literature found no published studies concerning the retention of pertinent anatomical knowledge by optometric students or doctors of optometry. With the development of advanced imaging techniques with increasingly better resolution, knowledge of microscopic anatomy is becoming more and more important in clinical practice. An example of this is optical coherence tomography (OCT). OCT has a variety of applications in clinical practice.⁹ One of the most common uses of OCT, especially spectral domain OCT (SD-OCT), is in eye care, where it can produce high-resolution cross-sectional images of the subsurface retina, with resolutions that allow differentiation of all retinal layers from the internal limiting membrane to the retinal pigmented epithelium. OCT is used to detect and monitor macular diseases including age-related macular degeneration (AMD), retinal vein occlusion, diabetic retinopathy, macular holes, epiretinal membranes and other disorders of the vitreoretinal interface.¹⁰ It is especially helpful in quantifying and monitoring macular thickness in diseases that cause macular edema or subretinal fluid accumulation.¹¹ Experts in the field consider OCT to be an essential part of the diagnosis and follow-up of patients with diabetic macular edema (DME) and AMD.¹² Some think that OCT-guided treatment for chronic conditions such as AMD and macular edema can be considered a de facto standard of care.¹³ SD-OCT is one of the objective tests recommended by the American Academy of Ophthalmology for the screening of chloroquine and hydroxychloroquine retinopathy.¹⁴ The International Vitreomacular Traction Group has developed an OCT-based anatomic classification system for diseases of the vitreomacular interface, i.e.,

vitreomacular adhesion, vitreomacular traction and macular holes.¹⁵

Given the increased use of OCT in eye care, it was hypothesized that identifying the 10 layers of the retina on a diagram could be a comparable benchmark for anatomical knowledge for those in the optometric profession. Therefore, the purpose of this study was to identify the ability of fourth-year optometric students and clinical faculty members at an optometric college (including residents) and a cohort of private practice optometrists to label the 10 layers of the retina on a diagram.

Methods

Subjects were recruited from the fourth-year student population and the clinical faculty having an optometry degree (including residents) at the Illinois College of Optometry (ICO) and from among private practice optometrists who participated in a continuing education (CE) program at ICO. Inclusion in the study was based on the subject's willingness to participate in the study and his/her attendance at the venue where the test was administered. Fourth-year students were tested at the end of grand rounds (where retinal cas-

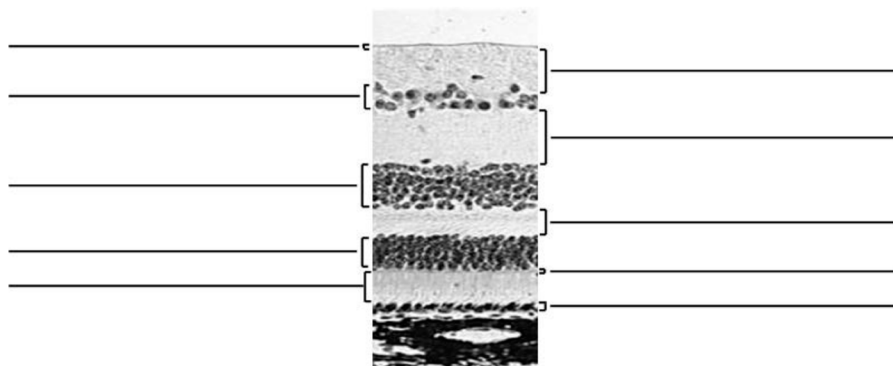
es were not discussed); faculty members were tested during a faculty retreat; and the private practitioners were tested at a CE program held at the college. Subjects who had prior knowledge of the task involved in the study were excluded to allow a fair representation of subjects' level of knowledge without prior preparation.

After an IRB-approved consent process, subjects (the faculty members and private practice optometrists) were asked to report the number of years since they graduated and any optometric specialties they considered themselves to have, e.g., primary care, contact lenses, pediatrics, low vision or a combination of these specialties. They were allowed five minutes maximum to label the layers of the retina on a line drawing provided to them (**Figure 1**). Abbreviations were not allowed. The test was given without prior warning. At least one of the authors was present when the test was administered.

Data were recorded and tallied in Excel spreadsheets. Descriptive data, including percentages, means and standard deviations, were calculated where appropriate. A one-way analysis of variance (ANOVA) was calculated for both

Figure 1
Histologic Cross-Sectional Image of the Retina
Used as the Task in the Study

Please identify the labeled layers. Do NOT use abbreviations. You have 5 minutes to complete this task.



the average number of layers correctly identified and years since graduation, and post hoc analysis was performed with the Games-Howell test. Chi squares were calculated for both the percentage of times each layer was correctly identified and percentage of answers that were blank or non-retina. All statistics were computed using SPSS, V17.0 (Chicago, IL).

Results

A total of 172 participants were recruited for this study: 35 fourth-year optometry students out of approximately 40 that attended the grand rounds, 41 clinical faculty members (including nine residents) out of approximately 45 that attended the session of the retreat, and 96 private practice optometrists out of approximately 225 that attended the CE program. The number of years since graduation and the self-selected specialty information for clinical faculty members and private practice optometrists are shown in **Figures 2 and 3**, respectively.

The students had the best performance on the task, followed by the clinical faculty members and then the private practice optometrists (**Figure 4**). The mean number of layers correctly identified differed significantly by group ($F=69.2$, $p<0.05$). In general, for both groups of optometrists, the more time since the subject graduated, the fewer layers that were correctly identified (**Figure 5**). The number of years since graduation significantly affected performance ($F=9.7$, $p<0.05$). The outermost and innermost layers (i.e., retinal pigmented epithelium and inner limiting membrane, respectively) were correctly identified most commonly (**Figure 6**). There were significant differences between the groups in identifying the remaining layers ($\chi^2=39.4$, $p<0.05$). The group that had the most subjects that either left the task completely blank or had non-retina answers was the private practice optometrists, followed by the clinical faculty members and then the students (**Figure 7**). The numbers of subjects in these groups that either left the task blank or had non-retina answers were significantly different from each other ($\chi^2=9.51$, $p<0.05$).

Figure 2
Number of Years Since Graduation for Clinical Faculty Members and Private Practice Optometrists

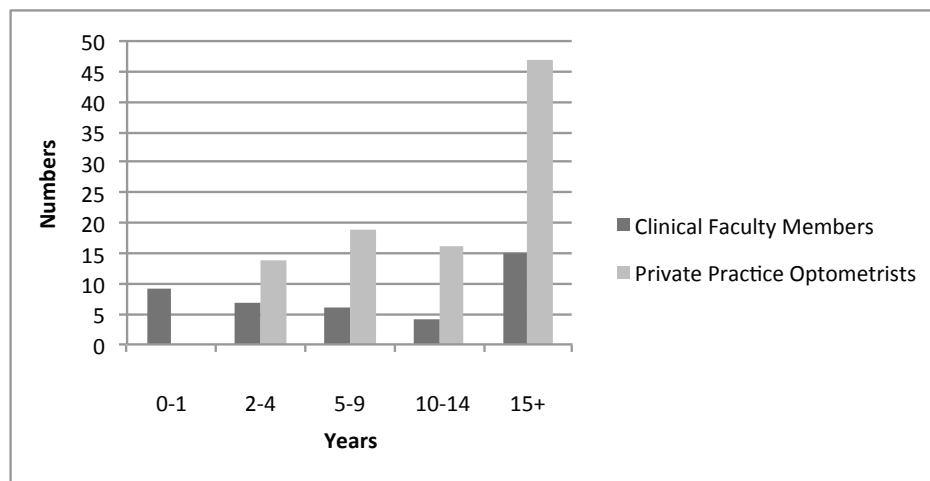
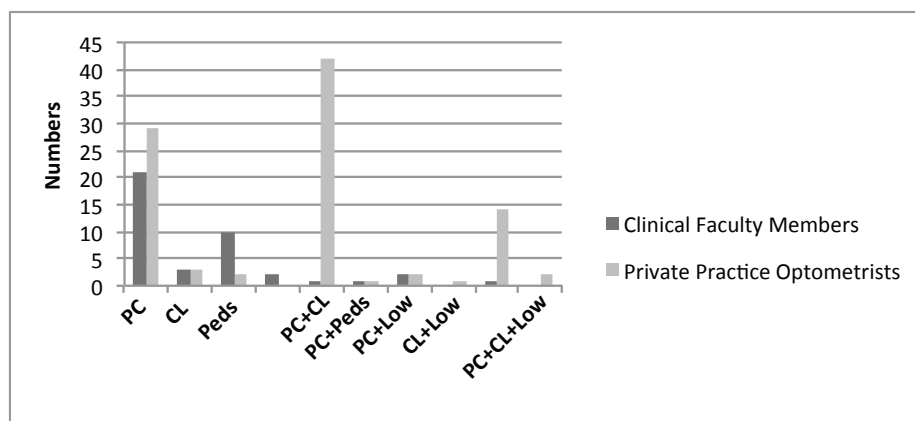
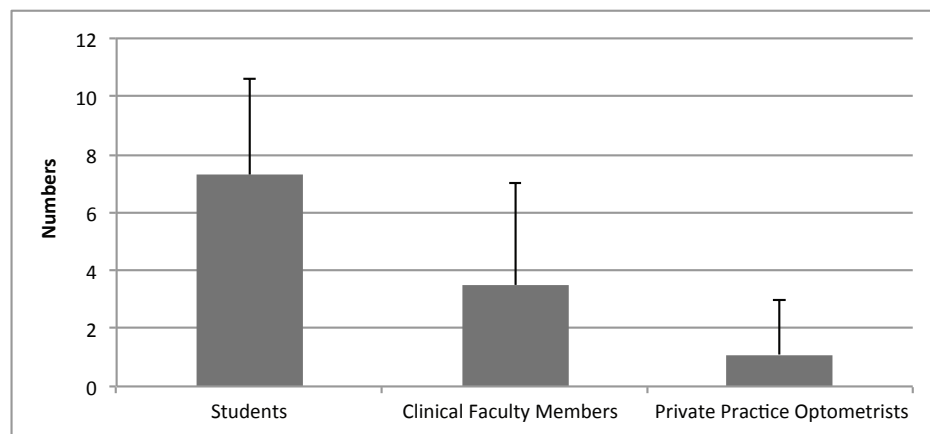


Figure 3
Self-Selected Specialty for Clinical Faculty Members and Private Practice Optometrists



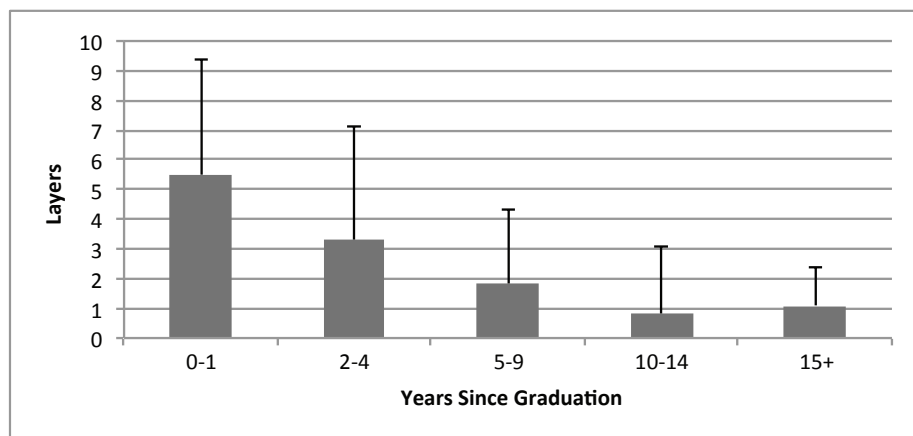
PC: primary care; CL: contact lenses; Peds: pediatrics; Low: low vision.

Figure 4
Average Number of Retinal Layers Correctly Identified



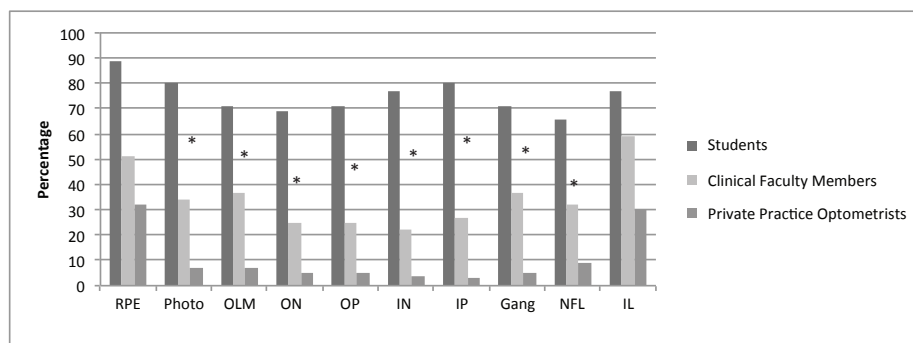
Error bars show standard deviations.

Figure 5
Average Number of Retinal Layers Correctly Identified



Error bars show standard deviations.

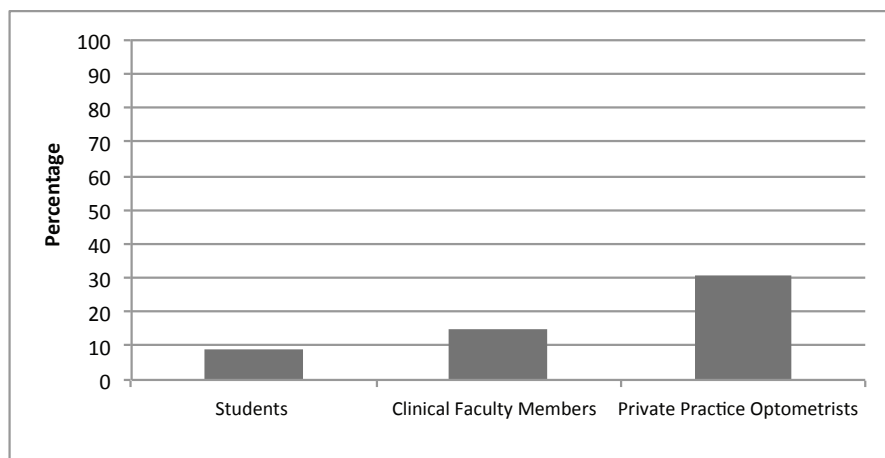
Figure 6
Percentage of Times Each Layer was Correctly Identified*



RPE: retinal pigmented epithelium; Photo: photoreceptor layer; OLM: outer limiting membrane; ON: outer nuclear layer; OP: outer plexiform layer; IN: inner nuclear layer; IP: inner plexiform layer; Gang: ganglion cell layer; NFL: nerve fiber layer; IL: inner limiting membrane.

* $p < 0.05$.

Figure 7
Percentage of Answer Sheets Left Completely Blank or Containing Non-Retina Answers



Discussion

About half (47 of 96) of the private practice optometrists group had graduated more than 15 years before the study. Likewise, if the residents are not counted, almost half (15 of 32) of the clinical faculty cohort had graduated more than a decade and a half ago.

The private practice optometrists appeared more likely to consider themselves experts in more than one specialty as compared to the clinical faculty optometrists. Nearly two-thirds (62 of 96) of the private practitioners classified themselves as experts in more than one specialty, while approximately 10% (5 of 41) of the faculty optometrists did so.

The private practice optometrists were least proficient in identifying the retinal layers. The clinical faculty members performed better. The students, who were preparing for national board exams, did the best. The results of this study suggest that specific knowledge of the retinal layers is not uniform across the groups in this study cohort.

Because time since graduation had a significant effect on the number of layers labeled correctly, it is not surprising that the two groups of optometrists did not perform as well as the students. This may be especially true because the students had studied the information more recently in class and were also preparing for national board examinations.

The innermost and outermost layers of the retina were the ones that were most frequently identified correctly. This may not be too surprising because these layers may have the most frequent clinical significance. This identification pattern is most clearly seen for the two optometrist groups. The student cohort data did not really show this pattern, although the retinal pigmented epithelium was most frequently identified correctly.

Nearly one-third (31 of 96) of the private practice optometrists either wrote down non-retinal answers, implying that they did not recognize the figure as the retina, or left their sheet blank. Those who left the sheet blank may have done so for several reasons, including they did not recognize the im-

age as the retina, they recognized the retina but could not identify any of the layers, and/or although they consented to participate in the project, once they saw the task they did not “buy into” the project and refused to attempt to answer. These reasons are speculative because data were not gathered as to why the sheets were left blank.

The results of this study suggest that specific knowledge of the cross-sectional microanatomy of the retina is not currently necessary for successful practice of optometry in this cohort. While OCT has revolutionized the clinical practice of ophthalmology in terms of early detection of retinal diseases, monitoring not only disease progression but also the effects of treatments, it may not currently be considered a standard of care in optometric practice. However, there are those who think that this may change.¹⁶ This may be especially true as more optometrists choose to not only diagnose retinal and other eye disease and make appropriate referrals but also offer follow-up care to these patients. As the use of advanced imaging procedures, e.g., OCT, grows, and as imaging technologies advance such that better resolution of ocular structures becomes possible,¹⁷ optometrists may need to become increasingly proficient in their knowledge of ocular microanatomy in order to analyze and correctly interpret these images. Therefore it may be beneficial for optometric educators to correlate basic and clinical science concepts not only throughout optometric school curricula but also in continuing education courses as the use of these technologies expands.

This study has several limitations. The task given to the subjects was to name the retinal layers on a histologic image. Because most optometrists are not routinely exposed to this type of image, it may have not been readily recognizable to some of the members of the two optometrist groups. Using a retinal image that practitioners may encounter more frequently, such as an OCT image, may have been more helpful. Also, an OCT image may have aided in giving some relevance of the task to daily practice. Gathering information from the subjects regarding the relevance of the task to their clinical situation may have added interesting data as well. Al-

though the choice of using an image of the cross-sectional microanatomy of the retina seemed logical because of its relevance to advanced imaging techniques, opting for a different anatomical subject that would be more routinely used in practice, such as the cornea or the crystalline lens, may have been more appropriate.

Additionally, only a small cohort of students and optometrists at a single college of optometry was sampled, limiting generalizations to all optometrists and optometry students. Also, only one specific anatomical structure viewed in a single orientation was used in this study; therefore, it should be pointed out that no conclusion can be drawn about the overall knowledge of ocular anatomy of the subjects in this cohort. It is not known whether similar results would be found if other ocular structures were similarly tested. While nothing can be inferred about the clinical skills of the members of this cohort, the results of this study reiterate the idea of “use it or lose it,” i.e., retention of details (such as the layers of the retina) needs reinforcement by continued exposure in practice.

Conclusion

The results of this study suggest that specific knowledge of the retinal layers is not uniform across the groups in this study cohort. As the use of advanced imaging technologies expands, optometrists may need to become increasingly proficient in their knowledge of ocular microanatomy. It may be beneficial for optometric educators to correlate basic and clinical science concepts not only throughout optometric school curricula but also in continuing education courses.

Acknowledgement

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The Effect of IOP on Clinicians' Perceptions of Glaucomatous Optic Neuropathy

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Abstract

Background: Clinicians' determination of glaucomatous optic neuropathy may be biased by other aspects of the case, including patient intraocular pressure (IOP).

Methods: Optic disc photos rated as glaucoma, normal or uncertain along with an IOP reading were shown to clinicians with various levels of experience. The clinicians were asked to label the photos as glaucomatous or normal. One month later, they were asked to re-evaluate the photos using the same or different IOP.

Results: Reclassification was extensive across all levels of clinician experience. Reclassification based on IOP change was greater for less experienced clinicians, who were also more likely to reclassify when IOP was decreased.

Conclusions: Less experienced clinicians may be more likely than those with more experience to change perceptions of glaucomatous optic neuropathy based on IOP. Training should be aimed at evaluating the optic nerve independent of other variables.

Key Words: glaucoma, optic nerve assessment, clinical education

Background

Evaluation of the optic nerve is essential to the diagnosis and management of glaucoma. However, the evaluation may be difficult based upon the particular disc. Assessment of the nerve is subjective, without well-established criteria of what constitutes glaucomatous optic neuropathy. Fundus photography and, more recently, imaging instruments such as OCT, HRT and GDX have been used to gather additional information to assist in evaluation of the disc and identifying and monitoring glaucomatous damage.

Intra- and inter-examiner variability in evaluating the optic nerve is well-documented.¹⁻³ Studies have shown this variability to be associated with profession, level of experience in managing glaucoma and practice setting.⁴⁻⁸ Moreover, evaluation of the nerve may be contaminated by bias. Additional examination findings may influence the clinician's judgment in describing the nerve and whether it is labeled as glaucomatous or normal. Clinicians with less experience may be particularly likely to be influenced by factors other than the nerve itself. Thus, teaching non-biased optic nerve evaluation becomes a critical task for the optometric educator.

One potential source of bias that is associated with, but does not define, glaucoma is intraocular pressure (IOP). An optic nerve with a given high IOP may be more likely to be labeled as glaucomatous, while the same nerve with a lower IOP may be more likely to be labeled as normal. As glaucoma educators, in a pilot study, we examined whether the given IOP at the time of evaluation influenced clinicians' impression of whether or not a disc was glaucomatous and if this impression was associated with level of experience.

Methods

Twenty-six optic nerves of 26 patients seen at the Glaucoma Institute at SUNY College of Optometry were used. All patients had either the diagnosis of glaucoma or glaucoma suspect. Photos of the nerves were viewed on a non-stereo slide viewer. All of the photos were of good quality. Two experienced glaucoma clinicians (the

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authors) classified the nerves as glaucomatous, non-glaucomatous or uncertain. When they agreed, the nerve was labeled as per their classification. If they disagreed, it was labeled as uncertain. **Figures 1a, 1b and 1c** show examples of nerves classified as glaucomatous, non-glaucomatous and uncertain.

Nine clinicians, whose clinical experience spanned a wide range, were asked to evaluate the optic nerves. The evaluators consisted of:

- one ophthalmologist who was fellowship-trained in glaucoma
- two optometrists within the Glaucoma service: one with more than 20 years' experience in managing glaucoma, one with less than 10 years' experience
- one optometrist in the Primary Care clinic, with 20 years' experience in general practice
- two optometric residents: one based in the Ocular Disease service (which includes the Glaucoma service), and one based in the Vision Therapy service
- two fourth-year optometry students in their final rotation
- one third-year optometry student who had recently completed the glaucoma course but who had little

clinical experience in examining glaucoma patients.

The clinicians were asked to evaluate the optic nerves in two sessions. In session one, the clinicians were given the following instructions:

"I'm going to show you images of 26 optic nerves. I want you to classify them as either having glaucomatous optic neuropathy or not having glaucomatous optic neuropathy. This is a forced choice, so you must select Glaucoma or Normal. You should consider this your first time seeing the patient. The IOP at that visit is in the upper right corner of the image. I recognize that you are not viewing the images stereoscopically as you would clinically and that a forced choice of Glaucoma or Normal is not how you would function when seeing patients."

In session two, conducted one month later, the clinicians were given the same instructions. However, the IOP was changed for 20 of the 26 images, 10 upward and 10 downward. The magnitude of change was always greater than 6 mmHg and always enough to cause the IOP to go from being within the normotensive range to the high tension range or vice versa. The order of presentation of the nerves was also changed.

We evaluated whether classification was

changed from one session to another for the nine clinicians and whether any reclassification was associated with a change in IOP. We defined an *IOP-influenced* reclassification as one in which the clinician changed from glaucoma to normal if the IOP at session two was lower or from normal to glaucoma if the IOP was higher.

Results

Of the 26 nerves, four were classified as glaucomatous, nine as normal and 13 as uncertain by the two original evaluators.

We divided the clinicians according to level of experience in treating glaucoma:

More experienced (4)

- fellowship-trained ophthalmologist
- two optometrists in the Glaucoma service
- optometrist in the Primary Care clinic

Less experienced (5)

- two optometric residents
- two fourth-year optometry students
- one third-year optometry student.

Figure 1

a: An Optic Nerve Classified as Glaucomatous b: An Optic Nerve Classified as Non-Glaucomatous c: An Optic Nerve Classified as Uncertain

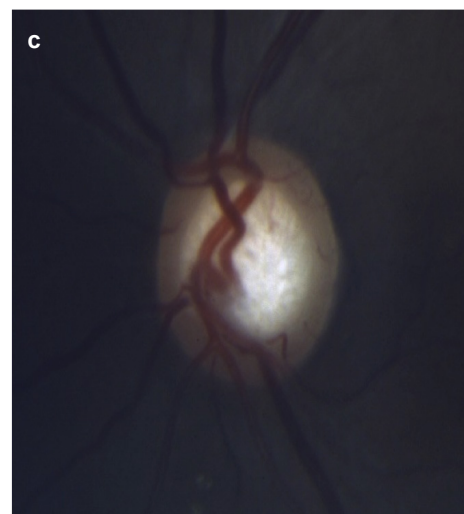
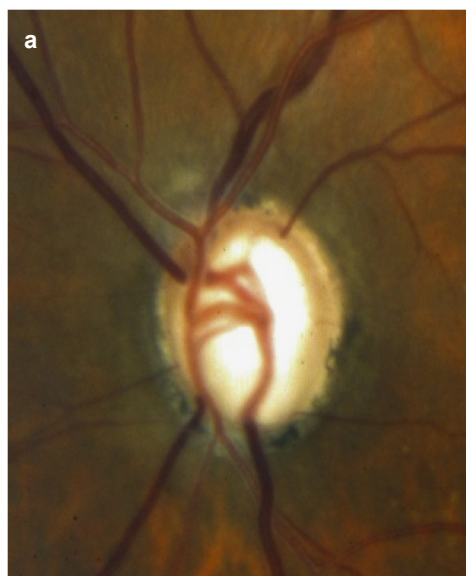


Figure 2 shows the number of changed classifications for each clinician. For the 26 nerves, the number of reclassifications ranged from 4-13, with an average of 8.7. Reclassifications were spread across the range of clinician levels of experience. The more experienced clinicians made an average of 7.75 reclassifications, while the less experienced made an average of 9.60. The difference was not statistically significant.

Figure 3 shows the percentage of reclassifications by clinician for glaucomatous, normal and uncertain nerves. It shows that reclassification was pervasive across all categories without a clear trend for one type of nerve in terms of reclassification.

In total, reclassifications were not greater when the IOP was changed than when it was not. However, as shown in **Figure 4**, there was a greater percentage of IOP-influenced reversals for the less experienced clinicians as compared to the more experienced clinicians.

Figure 5 illustrates clinicians' change in classifications for the 13 discs labeled as uncertain when the IOP was increased, decreased and remained the same. Taken as a whole, the data do not show a clear trend by clinician type or impact of IOP change on reclassification of these discs.

Figure 6 shows reclassifications in uncertain discs with respect to change in IOP for the most and least experienced clinicians. It shows that there is little difference between the two in reclassifications when IOP is the same or increased. However, there is a large difference between the groups when IOP is decreased. Less experienced clinicians differed from the more experienced in reclassifying from glaucoma to normal when the IOP is decreased but not from normal to glaucoma when the IOP is increased.

Discussion

One of the challenges in educating the developing optometric clinician is in teaching him or her how to properly evaluate ocular structures. An accurate, consistent evaluation of the optic nerve is important not only in glaucoma diagnosis and treatment but also in working in an environment in which more than one clinician may examine the pa-

Figure 2
Number of Changed Classifications by Clinician (n=26 nerves)

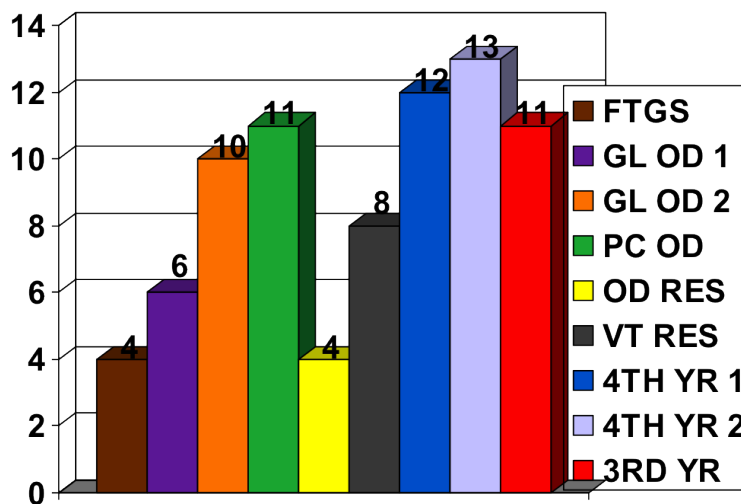


Figure 3
Percent Changed Classifications per Clinician for Normal, Glaucomatous and Uncertain Nerves

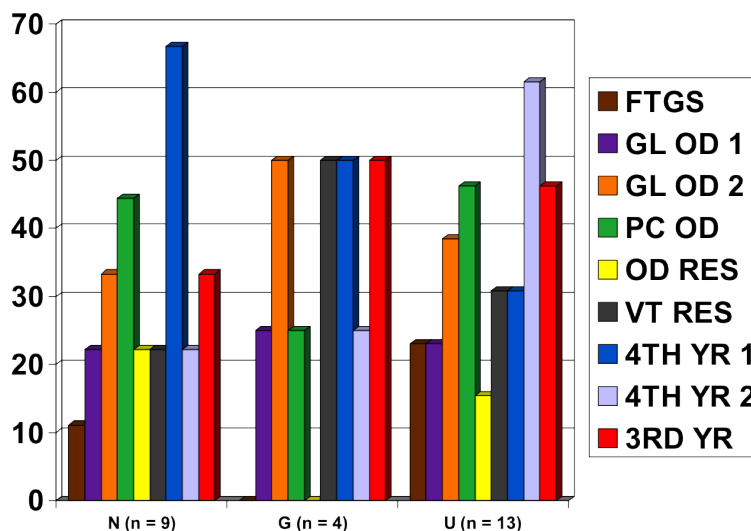
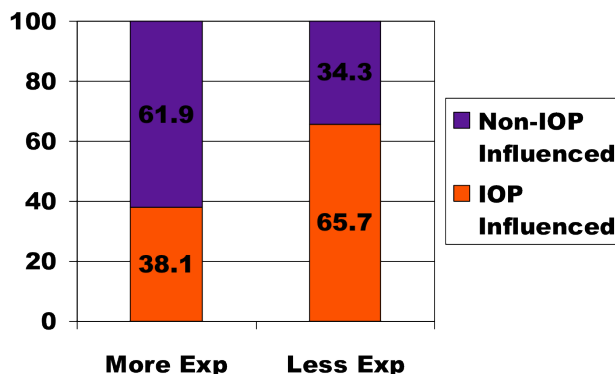


Figure 4
Percent of IOP-Influenced Changed Classifications By Clinician Experience



tient over time. In line with our investigation, other studies have examined variability in evaluating the optic nerve head among those with different levels of training.

Spalding,⁶ in an evaluation of 56 optometrists, showed that there tended to be more inter-observer agreement in estimating cup-to-disc ratios and perception of glaucomatous damage in optometrists who were residency-trained, had more glaucoma patient encounters, and who did not practice in commercial settings. In a study across professions, Harper found a higher level of agreement in disc evaluation between the more experienced optometrists and ophthalmologists than between those with less experience.⁵

In a study similar to the present study, Hanson⁷ and colleagues investigated subjects that included third- and fourth-year optometry students as well as optometrists who estimated cup-to-disc ratios based on photographs. They found that inter-observer but not intra-observer agreement increased with level of experience. The authors speculate this is because observers come to adopt similar criteria for making the assessment. They suggest that if we adopt a common method for evaluating optic nerve parameters during training, it may be useful in reducing variability.

In the present study, we evaluated intra-observer variability with respect to level of experience, but added a unique feature. We altered the intraocular pressure to see what influence this had on the clinician opinion of labeling an optic nerve glaucomatous. Our clinicians represented a wide variety of experience from fellowship-trained glaucoma specialist to third-year optometry student.

Our data show a relatively large number of changed classifications. In total, approximately one-third of the classifications were changed in part two of the study. Overall, there was a general trend to fewer reversals with more experience, but there was wide variability in the data. Of the nine clinicians, the two with the least number of changes were the fellowship-trained ophthalmologist and one of the two residents. Another resident had fewer reclassifications than the more experienced doctors. There was not a significant difference in re-

Figure 5
Percent of IOP-Influenced Change in Classification for Uncertain Nerves

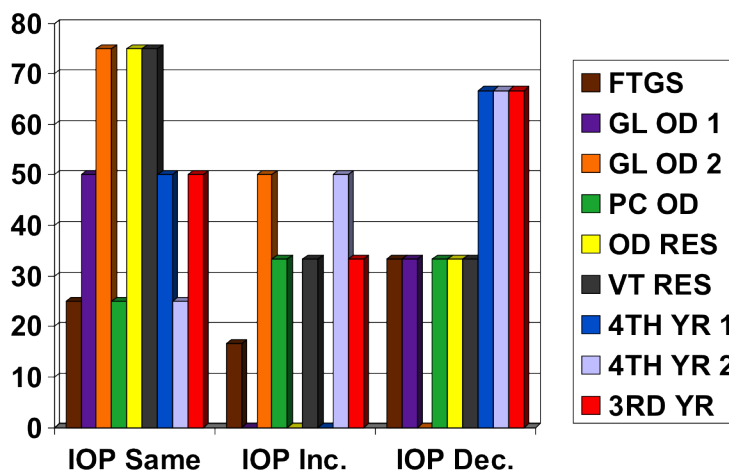
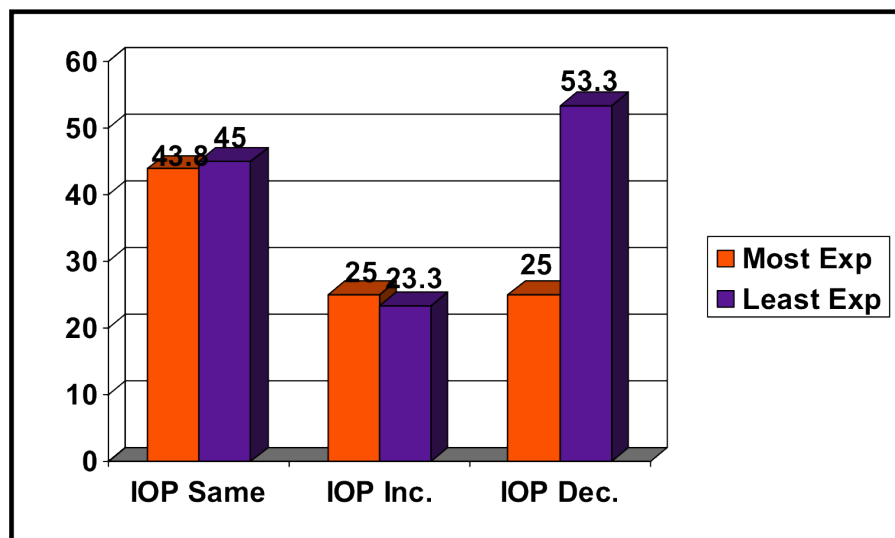


Figure 6
Percent of IOP-Influenced Change in Classification of Uncertain Nerves by Clinician Experience



classification when the nerve was labeled normal, glaucoma or uncertain.

In examining the influence of IOP on reclassifications, we found that the reversals for the less experienced group were more likely to be associated with IOP change than they were for the more experienced group.

Perhaps the most unique finding of our study was that with respect to nerves labeled as uncertain, an IOP decrease was more likely to be associated with a reclassification than an increase in the group with less experience. This implies

that the less experienced clinicians are more likely to label a disc normal with high IOP, in effect diagnosing ocular hypertension, than to label a disc with a lower IOP as glaucomatous. It is thus possible that normotensive glaucoma patients may be undiagnosed.

Establishing more standardized ways of evaluating the optic nerve may provide a more accurate assessment of the nerve and reduce bias. Educating students and residents may help bridge the gap between more and less experienced clinicians.

A number of studies have looked at the impact of training on this. Breusegem⁹ compared experts and non-experts in evaluating glaucomatous disc changes using serial stereo photographs. Agreement of non-experts was significantly lower than that of experts, which was moderate. After training the non-experts, the inter-observer agreement and accuracy of the non-experts showed a small but statistically significant improvement.

Sheen¹⁰ and colleagues evaluated differences between student and expert observers. They showed students stereo discs and compared their evaluations to those of experts before and after a stereo teaching program. Following the program, the two groups of observers showed a greater correlation in their evaluations than before.

The above studies indicate that training may reduce optic disc evaluation differences between more and less trained clinicians. But they do not address the issue of how this assessment is affected by accompanying findings such as IOP. Our data suggest that there is significant variability in all subjects' impressions of the same optic nerves, but that the level of IOP may play a greater role in affecting the impressions of clinicians with less experience.

While there is certainly educational benefit to teaching the case in a holistic fashion, students may be biased in their evaluation of one aspect of the case that is independent of others. Glaucoma educators should work to insure that their students recognize that glaucomatous optic neuropathy is an independent finding and that its evaluation should not be biased by others that accompany it. Our data suggest that, to the extent possible, clinical teaching of optic nerve evaluation be done independently from knowledge of the IOP.

There are limitations to our study. One noteworthy one is the small sample size of subjects. Although there were nine clinicians, there were only a few in each level of experience. For example, there were only two residents, each giving very different responses as to their changes in classification. There was only one fellowship-trained glaucoma clinician and only one third-year student. We grouped the subjects into the

four with the most and the five with the least experience, but in doing so more specific information for level of experience may have been masked.

Another limitation is that the evaluations were conducted using non-stereoscopic viewing conditions. It is recognized that this is not the most reliable way to evaluate the nerve. Perhaps if we had used stereoscopic conditions there would have been less variability. Additionally, a magnified version of the optic discs was presented, without the surrounding retinal area. This made it easier for the evaluator to observe details on the disc but not size cues that would have provided more information for determining whether or not the disc was glaucomatous.

Additionally, the number of nerves across the three categories of normal, glaucomatous and uncertain was not the same. There were four glaucomatous nerves, nine normal and 13 uncertain. Thus, there was significant disagreement on the part of the two classifiers as to whether or not the nerves were glaucomatous. This made a robust statistical analysis of the three categories difficult. The comparatively low number of glaucomatous nerves made it difficult to differentiate how subjects responded to each classification. This difficulty was increased by the fact that there were only two original classifiers without substantial agreement between them on the nerves. Half the nerves were deemed uncertain and this may have increased the number of reclassifications and variability among the clinicians. Building upon this pilot study, a future investigation could yield more robust results by limiting classification of nerves into only normal or abnormal categories and increasing both the number of nerves and evaluators.

Conclusion

Lowering the intraocular pressure was associated with increased reclassifications from glaucomatous to normal optic discs among less experienced evaluators. However, even without IOP change, there was considerable variability among all categories of clinicians. This made it more difficult to determine how much variability was due to IOP change and how much was independent of IOP change. It may be that

evaluation of the optic nerve for glaucoma by looking at slides is an inherently subjective and variable process. It is important that educators take into account potential biases in training students to evaluate the optic disc.

Our study suggests the need for more standardized parameters in evaluating the optic nerve for glaucoma. A noteworthy one is the cup to disc ratio. Others include the size of the disc, health of the rim tissue, whether the nerve obeys the ISNT rule, abnormalities in the rim vasculature, the presence of disc hemorrhage, and the existence of a beta zone of peripapillary atrophy. A methodological approach including these elements should be incorporated into clinical training.

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Optometry Students' Attitudes about Team-Based Learning

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Marlee M. Spafford, OD, MSc, PhD, FAAO

Abstract

Background: Team-based learning (TBL) is a method for fostering critical thinking skills in high functioning teams. This study examined optometry student attitudes about TBL. **Methods:** Students (N=91) completed a 15-item, five-point, Likert-scale survey regarding their attitudes about two consecutive four-month TBL courses. Four peer evaluation items were added to the second survey. Mann Whitney U tests ($p=0.05$) compared course differences. **Results:** Term response rates were 95% and 98%. First-term student satisfaction across four categories was: team experience (4.29), quality of learning (3.75), clinical reasoning ability (3.96) and professional development (3.78). There were significant second-term satisfaction increases with 8 of the 15 statements and no significant decreases. Peer evaluation satisfaction was 3.58. **Discussion:** Optometry student satisfaction with TBL was favorable and improved with additional experience.

Key Words: team-based learning, student satisfaction, optometric education, teaching methods, evaluation

Background

Two important competencies in any healthcare practice are the ability to think critically and work effectively in a team.¹ Students need to learn and apply critical thinking skills before offering viewpoints and evaluating statements made by others. Ideally, these competencies should be taught using appropriate methods that are based in educational theory.

Traditional education in the healthcare professions is teacher-centered and content-driven.² The goal is to transfer information from teachers to students, who then memorize facts. Recalling facts is important but it does not ensure that students have gained a true understanding of the material and developed an ability to apply the information in novel contexts.³ Alternatively, dialectic teaching is the practice of logical discussion used when determining the truth of a theory or opinion.³ Team-based learning (TBL) is a form of dialectic teaching that was developed by Larry Michaelsen in the 1990s and grounded in constructivist educational theory.⁴ It is an example of a flipped classroom approach where the content is learned by independent study and the application occurs in the classroom.⁵

TBL is increasingly used in North America, Europe, Asia and Australia in medical and other healthcare education, targeting multiple levels of learners and a variety of content areas.⁶ TBL has been shown to have a positive impact on learning in a recent systematic review of the literature.⁷ TBL in optometric education is relatively new. While its inclusion has been reported,⁸ no studies of its implementation have been published. This paper briefly reviews TBL concepts and evaluates a Canadian Doctor of Optometry program's student attitudes about teamwork experienced within a TBL framework.

TBL Key Concepts

The educational theory that informs TBL is published elsewhere;⁴ however, key points are summarized herein. TBL is an active learning method that is "learner-centered and instructor-led."⁹ It is used for large classes that are divided into smaller groups of 5-7 students

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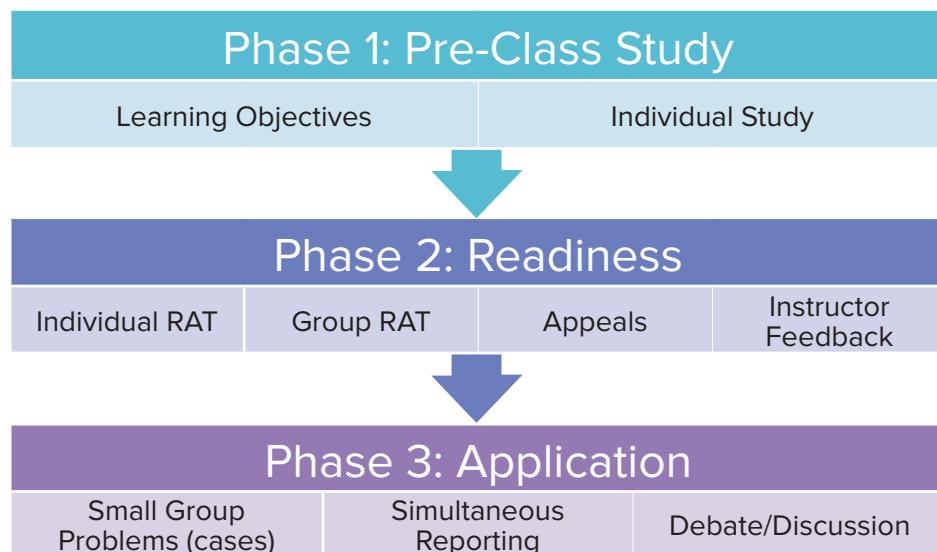
(referred to as teams). Ideally, diversity is maximized within teams and minimized between teams. In that way, each team has access to the range of knowledge and experience of the members that can be drawn upon when collaboratively solving problems.⁴

TBL consists of modules with three repeating phases (**Figure 1**). The first phase involves a prior learning assignment where the instructor assigns students study material in advance of the learning session based upon pre-determined learning objectives.³

The second phase has four steps that focus on readiness assurance. The students first take an individual readiness assurance test (IRAT), which is a multiple-choice test that assesses concepts from the prior learning assignment. This test assesses recall of factual material. Second, the team takes the same test as a group; this step is called the group readiness assurance test (GRAT). Using an Immediate Feedback Assessment Technique (IF-AT) scratch card, which contains the correct answer for each question, the group members work together on the answers until all correct answers are known. Typically, teams perform better than the highest score of any individual member.^{10,11,12} Third, the teams are allowed to challenge, in writing, any questions that they do not feel are fair or appropriate. Each challenge is carefully considered by the instructor, who may then discount the question. In the final step, any outstanding misconceptions around the content as measured by a high error rate on the test are addressed by the instructor in a mini-lecture format to the entire group.³

In the third and final phase of the process, the teams solve problems that are based on the material that has been learned. These problems are called application exercises and are designed to follow what Michaelsen et al.³ calls the '4 S' principle: the problems are the same for all of the groups; the problems are significant for the learners; the groups must make a specific choice for the correct answer (e.g., a multiple-choice question); and the results are simultaneously reported by all groups.³ Ideally, the problems have multiple solutions that allow for debate of the correct answer among teams who de-

Figure 1
The Three Phases of the Team-Based Learning Process
 (Reproduced from Hrynchak P, Batty H. The educational theory basis of team-based learning. *Med Teach* 2012;34:796-801.)



RAT = Readiness Assurance Test

fend their answer to other teams. The instructor facilitates the discussion among teams without lecturing.³

Once or twice during the course, team members give feedback to other members of their group regarding team performance. This peer evaluation allows the students to practice giving and receiving feedback to members about their ability to work in a productive team.³

TBL facilitates the development of certain skills that may not be addressed by other established active learning strategies such as problem-based learning (PBL). While TBL and PBL are both case-based small-group teaching methods, the methods diverge in significant ways. For example, in PBL, there is one tutor per group and the case is the starting point of the learning session. The students set their own learning goals and engage in independent study that they bring back to the group to share under the guidance of the tutor.¹³ The structure of TBL requires fewer tutors, reduces tutor variability and creates unique opportunities for learners to develop their critical thinking skills within functional teams.

University of Waterloo Implementation of TBL

TBL was first employed in the University of Waterloo's Doctor of Optometry program in 2011 to supplement lectures in a third-year case analysis course. The school's four-year Doctor of Optometry program admits 90 students annually (approximately 67% are female; approximately 98% have completed a BSc or Honors BSc degree). The non-clinical curriculum is primarily delivered through didactic lectures, skills laboratories and basic science laboratories. While some instructors may use group assignments, small-group integrative teaching methods such as problem-based learning are not formally part of the curriculum. Evaluation of a program of learning is important to determine the impact on the learner.

Methods

This study followed the tenets of the Declaration of Helsinki and received ethics clearance from the University of Waterloo's Office of Research Ethics.

A paper survey was administered to 91 students in the third year of the Doctor of Optometry program; the students attended two required consecutive case

analysis courses that employed a TBL framework. The survey was administered anonymously during class time at the end of the Fall 2011 and Winter 2012 terms. The survey results were compared for the two sessions.

In the case analysis courses, lectures were supplemented with five three-hour TBL sessions held in the fall course and four three-hour sessions in the winter course. The TBL sessions accounted for 20% of the course grade in the fall term and 30% for the winter term. The individual readiness assurance test, group readiness assurance test and peer evaluation contributed to the TBL grade. The course instructor (PKH) developed the TBL sessions in 2011.

The TBL sessions were designed to closely follow Michaelsen's guidelines³ for the teaching method. The teams were formed by the instructor to have maximum diversity using previous grade position in an optics course and a disease course. The students were aware of the process for team formation and it appeared to be successful in producing diversity within the teams. Students were given material to study one week before the sessions. At the outset of the session, the students individually took a multiple-choice question quiz of 10 to 12 questions. After the papers were collected, the teams then took the same quiz as a group using IF-AT cards until all the correct answers were known. The teams were then allowed to challenge questions, and successful challenges resulted in elimination of one or more questions. If there were any common misconceptions revealed by the quiz, a mini-lecture was given by the course instructor. A clinical case was then presented to the teams as the application exercise. Up to 10 multiple-choice questions were answered by the teams. Michaelsen et al.'s³ '4 S' principle (same, significant, specific, simultaneous) was applied to the application exercise. Once the teams answered, they were encouraged to debate the answer among the teams. Peer evaluation also followed Michaelsen's method: Students divided points (10 X the number of other team members) between the team members.³ At least one member had to receive more than 10 points.³ The peer evaluation score was the average of the points awarded by the team

members. The students stayed in the same teams for the two terms.

The survey items used in this study were first developed and validated by Parmalee et al.¹⁴ in their study of medical students' attitudes toward TBL in a pre-clinical curriculum. The survey was based on the Minnesota Satisfaction Questionnaire and developed within Wright State University's Department of Communication's Organizational Communication classes over a five-year period. The survey consisted of 19 statements to which the students responded from Strongly Disagree (1) to Strongly Agree (5) on a Likert-type scale. The statements about satisfaction were grouped into five categories: Overall Team Experience, Learning Quality, Peer Evaluation, Clinical Reasoning Ability, and Professional Development.¹⁴ The satisfaction with Peer Evaluation section was not included the first term because the students did not have their peer evaluation results at the time of the survey. Therefore, this section was added in the winter term after the optometry students had an opportunity to experience the results of the peer evaluation process in the fall term. The exact questions asked in the survey are included in **Table 1**.

The mean and standard deviation for the responses to each statement in all sections except Peer Evaluation were calculated for the fall and winter terms. Between-term differences were tested using the Mann Whitney U test at a $p=0.05$ significance level. The aggregate scores for each of the categories were calculated by averaging the means of each of the statements in that category.

Results

Of the 91 students who were given the survey, a response rate of 98% was achieved in the fall term and 95% in the winter term course. The results of the survey are presented in **Table 1**.

Optometry student satisfaction with TBL was generally favorable after the first and second course (category range: 3.75 to 4.33). Category satisfaction was highest with Overall Team Experience (4.29, 4.33) and Clinical Reasoning Ability (3.96, 4.24). Category satisfaction in the second term increased across all four categories (range 0.04 to 0.33).

Regarding statements within the categories, there were significant increases in winter satisfaction with eight of the 15 statements ($p<0.038$) and no significant decreases in any category. The significant increases in satisfaction were most apparent in the Clinical Reasoning Ability category (3 of 3 statements) and least apparent in the Overall Team Experience category (1 of 5 statements).

Peer evaluation satisfaction in the second term was relatively lower than other categories (3.58). Within-category satisfaction was highest for students judging their peers' contributions to the team and lowest for liking the use of peer evaluation as part of the experience.

Discussion

Student attitudes toward an instructional method are invariably context dependent. The case analysis course at the University of Waterloo had previously used a small-group case-based learning method.¹⁵ In this instructional strategy, small groups worked with a tutor to discuss a case and then presented the case to their peers. Several problems were noted, including "social loafing,"³ in which some students did not contribute effectively or at all to the group work; insufficient integration of learning objectives across the group members; and variable instruction by tutors. TBL was chosen as the replacement teaching method, with the intention of addressing some of the disadvantages experienced with case-based learning.

In this study, optometry student satisfaction with learning in a team was generally favorable and it increased with greater TBL experience, particularly in the categories of Learning Quality and Clinical Reasoning Ability. This finding is supported by the work of Ofstad and Brunner,¹⁶ who studied pharmacy student experiences with TBL. As they noted, many health professions students gain admission to their program on the strength of their individual achievement in a competitive environment. Students report negative experiences with group work and hesitate to have a portion of their grade depend upon that work. The normally higher group readiness assurance grades than individual grades in TBL can show students that teams are worthwhile and that, over time, they

Table 1
Team-Based Learning Survey Results

Question	Fall Mean	Fall Std Dev	Winter Mean	Winter Std Dev	P value
Overall Satisfaction with Team Experience	4.29	0.82	4.33	0.86	
I have found working in a team as part of my class to be a valuable experience	4.26	0.77	4.36	0.81	0.243
The other team members have generally contributed as much as I have	4.21	0.82	4.05	0.91	0.261
The team has worked well together	4.38	0.81	4.39	0.91	0.599
I have felt the other team members respected me	4.51	0.68	4.49	0.72	0.970
I have found teamwork to be a productive use of course time	4.12	0.93	4.36	0.90	0.037*
Team Impact on Quality of Learning	3.75	1.03	4.08	0.94	
I have found that the team helped me learn the course material more than if I had studied alone	3.88	1.06	4.13	0.93	0.107
I have learned more in this course than in others because I have been part of a team	3.83	0.92	4.10	1.00	0.019*
I have found being part of a team improved my course grades	3.54	1.09	4.02	0.88	0.004*
Satisfaction with Peer Evaluation			3.58	0.99	
I have found that my peers have been fair in judging my contributions to the team			4.21	0.79	
I have found that peer evaluation motivates me to work harder			3.42	1.01	
I have generally liked the use of peer evaluation as part of my team experience			3.25	1.07	
I have found that peer evaluation motivates me to work more collaboratively			3.45	1.07	
Team Impact on Clinical Reasoning Ability	3.96	0.81	4.24	0.76	
I have found that being on a team has helped me become better at problem solving	3.83	0.87	4.11	0.82	0.023*
I have found that teams make good decisions	4.01	0.74	4.30	0.69	0.009*
Being part of a team discussion has improved my ability to think through a problem	4.03	0.81	4.31	0.74	0.017*
Professional Development	3.78	0.96	4.07	0.92	
I have found that working with a team helps me develop skills in working with others	4.07	0.74	4.38	0.71	0.003*
I have found that working with a team has helped me develop cooperative leadership skills	3.88	0.83	4.24	0.81	0.002*
I have found that working with a team has helped me develop more respect for the opinions of others	3.97	0.82	4.12	0.85	0.142
I have found that working with a team has enhanced my sense of who I am	3.18	1.16	3.49	1.04	0.112

1=strongly disagree 2=disagree 3=mixed opinion 4=agree 5=strongly agree; *significance at 0.05 level

may develop into high functioning units.¹⁶

These results show a more positive aggregate score in comparison to those found by Parmelee et al.'s study¹⁴ of medical students in all categories, except for the fall term Professional Development results. Student experience with TBL ranges across studies. A systematic review⁷ of the effectiveness of TBL in health professions education found positive and neutral effects on knowledge scores and mixed learner reaction. Of the seven studies that employed a controlled comparison, Fatmi found the learner reaction favored TBL in one study. Even when the method produced superior learning outcomes, only one of four studies showed positive student reaction. It was hypothesized that this could be due to the potential for increased workload, the

peer assessment component and increased accountability. Fatima found TBL satisfaction was highest when it was compared with traditional lectures rather than other small-group learning strategies. It has also been shown in other healthcare contexts that students: prefer passive lectures; dislike advanced preparatory work and the inability to skip lectures; and miss the "sage on the stage" of faculty members sharing their expertise.¹⁶ Therefore, the favorable response of this group in this study could be a result of the primarily lecture-based curriculum and the instructor's careful attention to the amount of preparatory work required so as not to overload the students with work.

These results show that the aspect of TBL that optometry students least preferred was the peer evaluation process. Consistent with the findings of this

study, students can view group evaluation processes negatively, especially when they are required to differentiate among group members and the evaluation counts toward their grade.^{11,14,17} It is important that an assessment tool be reliable and valid and there is limited evidence for this in the literature.¹⁸ Team-based learning can be conducive to peer assessment as the team members have a unique view of each other's behaviors, are capable of perceiving and interpreting the behaviors that support good teamwork and are needed to improve the team performance.¹⁹ This component is increasingly important as performance evaluation of healthcare workers is increasingly done by patients, colleagues, administrators and inter-professional colleagues.²⁰ Additionally, the ability to give feedback is an important skill.²¹

In order for the full benefits of TBL to be realized, the method should be used in its entirety rather than some components that are modified to suit the instructor or institution. In order for students to embrace this method, it should integrate well with the demands of other courses in the curriculum and have administrative support. For example, the individual study that students face should not conflict with their other assignments and examinations.¹⁷ When these conditions are met, the instructional method can produce a positive attitude about learning in teams.

The study is limited by its examination of a small sample of students over a one year period of time, thus the results may not be generalizable to other cohorts. Also, the peer evaluation component was only given once so change over time could not be determined.

Team-based learning has been a new teaching method at the University of Waterloo's School of Optometry and Vision Science. Introducing a novel teaching method into individual courses outside of a formal curriculum development plan can be met with challenges, including being able to ensure there are suitable resource supports (e.g., space, development time) for the new teaching method. Unlike lectures, many teachers have not experienced the TBL method as learners, and development time needs to be given for appropriate implementation.

TBL has gained popularity in recent years in medical education with a growing literature to support its continued use.²¹ It is an active and interactive learning process that provides immediate feedback and appeals to the millennial student.²² With its relatively new introduction into optometric education, further research on the feasibility of this teaching method is warranted. A particularly valuable area of study involves developing ways to use peer feedback effectively and decrease resistance among learners. This preliminary study suggests TBL is perceived as a positive teaching method by a group of optometry students.

Acknowledgement

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Impact of Optometric Residency Training on Future Career Paths: A Survey of Perceptions of Optometry Students, Residents and Alumni

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Abstract

Background: Knowledge regarding the perceived impact of optometric residency training on a future career path is limited. **Methods:** Fourth-year optometry students, residents and alumni from the New England College of Optometry were surveyed regarding perceived benefits of residency training and career path.

Results: Students and residents shared similar reasons for pursuing residency training and preferred similar modes of practice to residency-trained alumni. The mode of practice chosen and degree of participation in professional activities differs between alumni who completed residency training and those who did not.

Conclusions: Survey respondents shared similar views regarding the perceived benefits of residency training and its impact on a future career.

Key Words: optometry residency, optometric education, mode of practice

Background

An optometric residency program is defined by the Accreditation Council on Optometric Education (ACOE) as a “planned program of post-OD clinical education that is designed to advance significantly the optometric graduate’s preparation as a provider of patient care services beyond entry level practice.”¹ Approximately 20% of graduating optometrists participate in residency programs.^{2,3} Participation in such programs may enhance clinical skills, widen breadth of knowledge and increase clinical confidence.^{4,5} In addition, certain modes of practice, including hospital-based optometry and optometric education, may look favorably on residency training when considering individuals for employment.^{1,6,7} It has been suggested that the impact of residency training on the optometric profession can be judged by the measurement of post-training placement and participation in professional activities.⁷ However, there is limited information available regarding these outcomes for residency programs.⁶

Although acquisition of advanced or specialty clinical skills is commonly stated as the objective for residency programs, many programs also believe that their graduates will acquire skills during residency training that are necessary to facilitate other professional contributions. These contributions include, but are not limited to, actively participating in optometric organizations, performing research and becoming involved in optometric education. Surveys of residents completing a Veterans Affairs Medical Center-affiliated residency⁸ and a Pediatric Residency⁹ indicate that most individuals completing these residencies were satisfied with their residency experience and have contributed to the optometric profession through clinical, academic and research accomplishments after completion of their residency. However, the effect of residency training on professional and leadership activities has not been adequately addressed.⁶

Despite the potential benefits of residency training, a majority of graduating optometrists do not complete a residency program and thus choose to enter the optometric workforce directly

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upon graduation. These individuals may have different career objectives compared to those who complete a residency, or perhaps these individuals feel they can achieve the same goals as residency-trained optometrists without completing a residency. Personal and financial considerations may also play a role in the decision to pursue residency training.³

Another barrier to obtaining residency training is that the number of residency programs available is less than the total number of optometry students graduating each year. Currently, there are approximately 400 residency positions that are accredited by the ACOE, which equates to approximately 20% of optometry school graduates participating in a residency program.¹ Therefore, it is likely that some individuals who apply to residency programs are not matched with a program.

The purpose of this study is twofold:

1. To determine whether there is agreement among the perceptions of fourth-year optometry students, residents and alumni in regard to the perceived benefits of completing an optometric residency program.
2. To compare the career paths and professional contributions of optometry school graduates who completed a residency with those who did not complete a residency program.

Methods

Separate surveys, conducted on Zoomerang, were utilized in this study. The surveys were designed by the investigators and were reviewed and approved by the New England College of Optometry (NECO) Institutional Review Board. One survey was distributed to alumni from NECO graduating between 1995 and 2011. Alumni received an email with a letter introducing the survey via Constant Contact with the assistance of the NECO Office of Institutional Advancement. Additional surveys were distributed by email to 104 fourth-year students enrolled at NECO who were expected to graduate in May 2012 and 33 residents enrolled in NECO-affiliated optometric residency programs between July 2011 and June

2012. Questions pertaining specifically to each of these subsets of individuals were asked and can be found in **Appendices 1 and 2**. The surveys were conducted in February 2012. All survey responses were collected on March 1, 2012, which was before the optometry residency match date. Responses to both surveys were anonymous.

Results

The surveys were distributed to a total of 104 fourth-year students and 33 residents. The survey response rates for fourth-year students and residents were 43% (n=45) and 49% (n=16), respectively. Seventy percent (n=31) of fourth-year students responding to the survey indicated that they were considering residency training. A total of 270 NECO alumni responded to the survey. Forty-two percent (n=114) of the respondents reported having completed an optometric residency, and 58% (n=156) of the respondents reported having not completed a residency. The number of years in practice for the alumni respondents is presented in **Table 1**.

Perceived benefits of completing a residency program

Both fourth-year students considering residency training and residents responding to the survey believed that the following factors were most important in their decision to pursue residency training: improving clinical skills (students (S) 84%, residents (R) 81%), improving confidence as a clinician (S 84%, R 81%) and obtaining clinical training in an optometric subspecialty (S 56%, R 56%). Additional factors that motivated responding optometry students and residents to pursue residency training were networking opportunities (S 47%, R 50%) and that

residency was required for their preferred mode of future practice (S 43%, R 38%).

Alumni survey respondents that completed a residency perceived that residency training impacted their career in the following ways: improved confidence in clinical skills (97%) and patient management (94%), expanded employment opportunities (87%), provided networking opportunities (73%) and established an identity in an optometric subspecialty (57%).

Reasons for not selecting residency programs

The most common factors that impacted the fourth-year student respondents' decision not to pursue residency training included the perception that the financial burden of residency training was not equal to financial compensation (71%), that four years of optometry school adequately prepared them to be an optometric provider (50%) and that residency training was not perceived to be advantageous for the geographic location where they planned to practice optometry (50%). Seventy percent indicated that they would be more likely to complete an optometric residency if residents were financially compensated to a higher degree.

Prior knowledge of residency programs

A majority of students and residents responding to the survey (S 80%, R 62%) reported that they had been educated on residency programs prior to applying for residency and completing this survey. Information about residency programs was obtained both formally through residency information sessions and informally through discussions with residency directors and residency-trained optometrists.

Table 1
Years in Practice of Alumni Respondents

Years in Practice	Residency Trained, N (%)	Non-Residency Trained, N (%)
0-2	23 (20.17)	38 (24.51)
3-5	34 (29.82)	33 (21.29)
6-10	36 (31.58)	39 (25.16)
11-15	21 (18.42)	45 (29.03)

Professional and leadership activities

All three surveys (to alumni, residents and fourth-year students) queried professional and leadership activities that optometrists may participate in. The activities surveyed were presenting a poster, preparing a manuscript, attaining fellowship in a professional organization, participating in didactic or clinical teaching, leadership or involvement in optometry-related organizations, and clinical research. Student and resident respondents identified activities perceived to be most important to their professional development, while alumni identified which of these activities they participated in during their career. Students and residents viewed becoming a fellow in professional organizations, lecturing to colleagues, clinical precepting and presenting posters at professional conferences to be important activities related to professional development. Alumni who completed residency training were more likely to participate in these activities than those who did not complete residency training. Other activities that were more commonly performed by residency-trained respondents than by non-residency-trained respondents were preparing manuscripts, didactic teaching and research. Alumni respondents who did not complete residency training were more likely to become involved in political aspects of optometry than residency-trained respondents. Both groups were equally likely to hold leadership positions in optometric organizations (**Table 2**).

Preferred modes of practice

Group private practice was the preferred practice modality for a majority of fourth-year students (**Figure 1**) and resident respondents (**Figure 2**). Neither solo private practice nor commercial practice was chosen as the preferred modality by any respondent to the student and resident surveys. The current mode of practice for both residency-trained and non-residency-trained alumni was surveyed (**Figures 3 and 4**). The most common mode of practice for both groups was group private practice. Residency-trained respondents were more likely to work in hospitals (21%) and optometric education (10%). Alumni who did not complete a residency were more likely to work in

Table 2
Alumni Professional and Leadership Activities

Activities	Residency Trained	Non-residency Trained
Presented Poster	90%	26%
Prepared a Manuscript	47%	10%
Fellowship in Professional Organization	54%	10%
Lecturing to Colleagues/Community	81%	46%
Clinical Precepting	89%	35%
Didactic Teaching of Students	50%	12%
Political Aspects	28%	38%
Leadership in Professional Organizations	22%	22%
Clinical Research	45%	26%

Figure 1
Fourth-Year Students' Preferred Modes of Practice

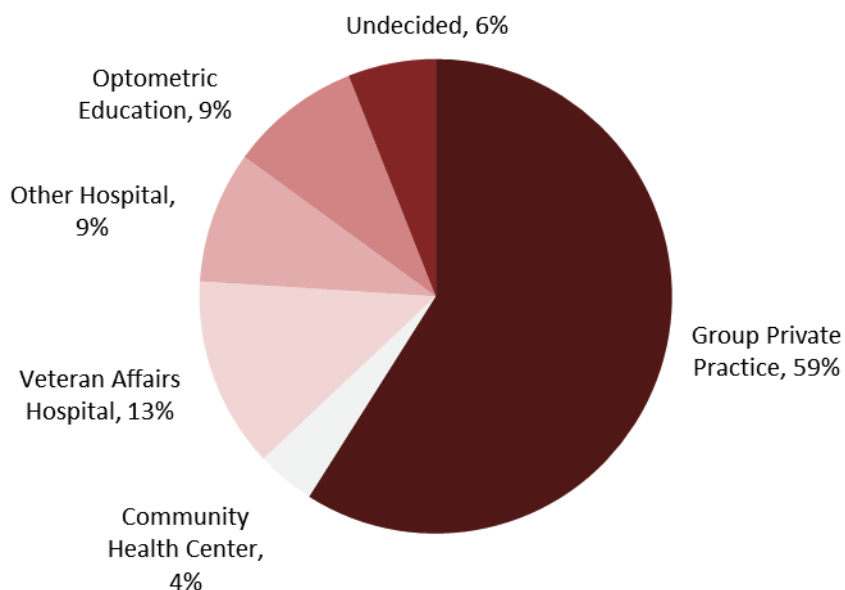
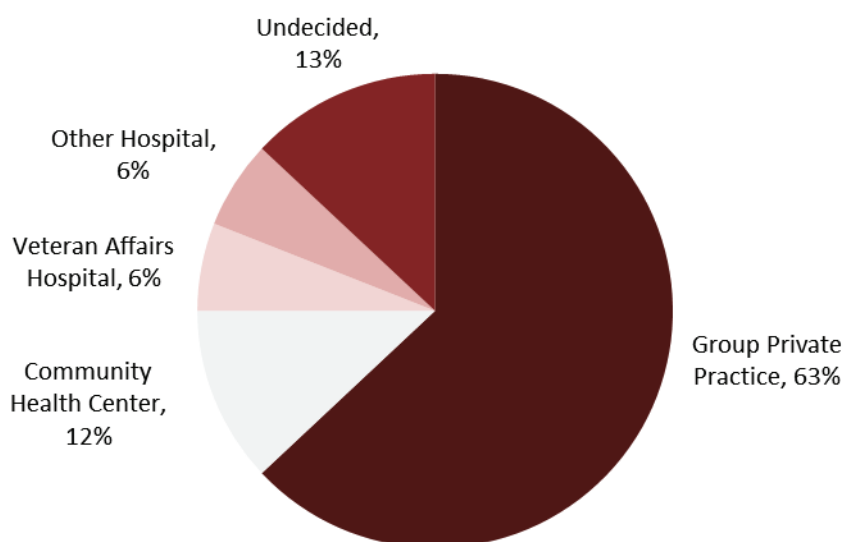


Figure 2
Current Residents' Preferred Modes of Practice



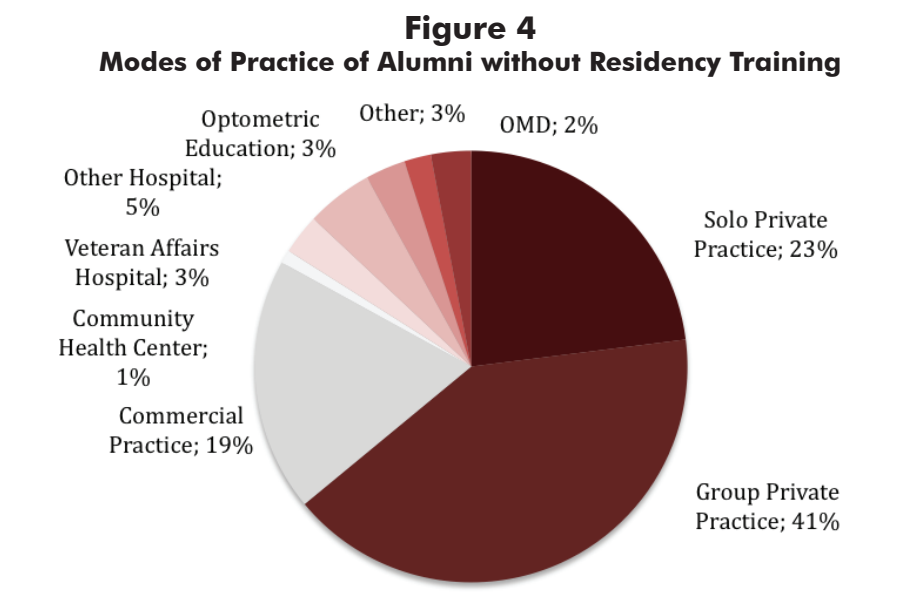
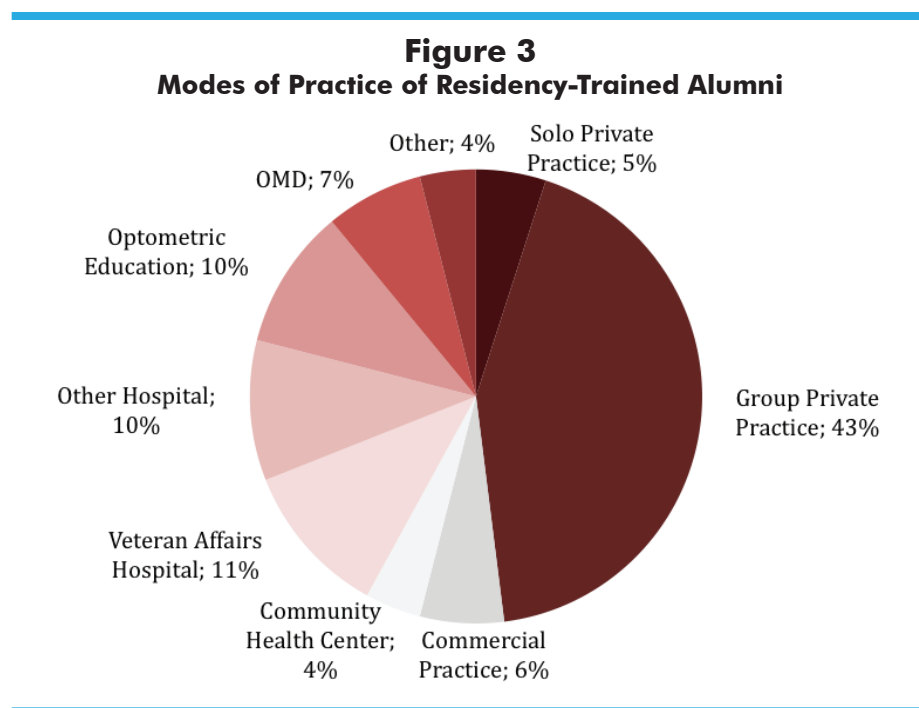
solo private practice (23%) or commercial settings (19%). The alumni who responded “other” most commonly indicated that they were employed in research, industry or multiple venues. Fifty percent of residency-trained respondents reported being currently employed in a setting that recommends or requires residency training; whereas, 3.2% of non-residency-trained respondents report working in this type of setting.

All of the residents responding to the survey and 96% of residency-trained alumni believed that residency has provided them with the opportunity to achieve their goals, and that their expectations were met by the program they completed. Approximately 95% of both groups would complete a residency program again and would recommend optometric residency training to current optometry students. Thirty-seven percent of alumni respondents who did not complete residency training would recommend optometric residency training to current optometry students. These respondents stated that completing a residency may increase employment opportunities in areas such as optometric education and hospital-based modes of practice and facilitate board certification and subspecialization within optometry.

Discussion

The results of this survey indicate that fourth-year students and residents share similar perceptions regarding the benefits of residency training, including improved clinical skills and confidence and subspecialization. Alumni respondents who completed residency training perceive that their residency impacted their career in a manner that is congruent with the expectations expressed by the students and residents completing the survey. This indicates that it is likely that the students and residents pursuing residency training have realistic expectations of the benefits they will gain from completing a residency. Similar motivating factors were identified in other surveys of residents,^{3,4} indicating that these perceptions are consistent among individuals surveyed from different educational institutions and over time.

A majority of survey respondents had received information about residency



programs before responding to this survey. This is consistent with findings of previous surveys indicating that optometry students receive information regarding residency programs early in their education.³ It is possible that these educational experiences, which are provided annually in many venues such as individual optometry schools, the American Academy of Optometry and American Optometric Association meetings, may contribute to the agreement between students' expectations and actual residency experience. The agreement about the perceived benefits of residency training between students, residents and alumni suggest that the

findings of this survey could be used to educate current optometry students regarding these perceptions.

Residents and residency-trained alumni responding to the survey were nearly unanimous in their belief that completing residency training effectively allowed them to accomplish their career goals and would recommend residency training to current optometry students. These findings indicate that the benefits of residency training were perceived to be valuable both at the time of residency training and throughout an optometric career, which is also in agreement with previous surveys.⁵

Concern regarding financial compensation for optometric residents is a barrier to pursuing residency training for a majority of students responding to our survey. Similar concerns were noted in previous surveys.^{3,8} Despite these concerns, one survey found that school loan debt was similar between students pursuing residency training and those who were not.³ The concern about financial compensation may be greater for current optometry students, due to the increasing debt load accrued over the past decade. Further study is required to elucidate whether increasing residency stipends would encourage a stronger applicant pool for residency positions.

Both student and resident respondents felt that obtaining residency training would improve their ability to successfully participate in certain professional and leadership activities throughout their career. The activities queried included presenting a poster, preparing a manuscript, attaining fellowship in a professional organization, participating in didactic or clinical teaching, leadership or involvement in optometry-related organizations, and clinical research. Alumni respondents who completed residencies were more likely to be involved in the professional activities perceived to be valuable by students and residents than those who did not; these activities included clinical precepting, obtaining fellowship in an optometric organization, presenting posters at professional meetings, and lecturing to colleagues and/or members of the community. The almost universal reporting of participation in the surveyed professional activities by residency-trained respondents may reflect their exposure to certain types of scholarly and leadership activities during residency training. Additional research is needed to identify which types of activities continue to be performed as an optometrist moves through his/her career.

Differences in career paths between residency-trained alumni and those who did not complete a residency were identified through the survey. The distribution of practice modalities in this sample of residency-trained alumni is similar to the desired modes of practice of surveyed optometry students and residents at NECO. The residency-trained alumni reported higher rates of

employment in hospital-based settings and optometric education. This indicates that obtaining residency training may increase the likelihood of obtaining employment in certain modes of practice that are appealing to students and residents, most notably the hospital setting, community health centers and optometric education. Similar trends have been presented in other surveys of employment placement after completion of residency training.^{5,6,8}

Half of the residency-trained alumni responding to this survey reported practicing in settings that recommended or required residency training. A survey of alumni of the Southern California College of Optometry's residency programs indicated that 65.6% practiced in settings that recommend or require residency training.⁶ Those graduating from "college clinic-based" programs, which provided specialty training in pediatric and cornea and contact lens, were most likely to practice in such specialty settings. In our survey, the respondents were not asked to specify the type of residency in which they participated. However, residency-trained NECO alumni were more likely to be practicing in hospital-based clinics and participating in optometric education, which are settings that are reported to consider residency training a prerequisite for employment.

Potential limitations of this project are that the majority of fourth-year students who responded to the survey indicated that they were considering residency training at the time that they completed the survey. This may have created bias in their responses. In addition, the alumni survey did not query the precise timing of the professional activities in which they have participated, or the frequency of participation. This makes it more challenging to define the depth of the impact residency training has on an individual's tendency to continue the activities throughout his or her career.

Conclusion

Fourth-year students and residents at NECO share similar motivating factors for pursuing residency training and perceive that completing a residency program will impact their ability to accomplish their career goals. These perceptions are consistent with those

of alumni respondents who completed residency programs. The results of this study's surveys suggest that there are differences in mode of practice and involvement in professional activities between alumni who completed an optometric residency program and those who did not. This information can be used to help educate current optometry students on the possible impact of residency training on their future career. It also forms a foundation for future areas of research, including further delineation of the timing of professional contributions in optometrists' careers and the depth of participation in professional and leadership activities

Note: For a copy of the survey, please contact Nicole Quinn, OD, at QuinnN@neco.edu.

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Appendix 1

Alumni Survey Questions

1. Did you complete an optometric residency?
 - a. Yes
 - b. No
2. Was completion of a residency program recommended or required to attain employment in your current practice setting?
 - a. Yes, required
 - b. Yes, recommended
 - c. No
3. What is your current practice setting?
 - a. Solo private practice
 - b. Group private practice
 - c. Commercial practice
 - d. Veterans Affairs hospital
 - e. Community health center
 - f. Other hospital setting
 - g. Optometric education
 - h. Other (please specify)
4. Do you plan to change to a different practice setting in the future?
 - a. Yes
 - b. No
 - c. Unsure
5. How many years have you been in practice?
 - a. 0-2
 - b. 3-5
 - c. 6-10
 - d. 10-15

If you have completed a residency, please answer questions 6-12; if not, please skip to question 13.

6. Have you ever participated in any of the following professional activities? Select all that apply.
 - a. Presented a poster at a professional conference
 - b. Prepared a manuscript
 - c. Become a fellow of AAO, COVD or other professional organization
 - d. Lectured to colleagues or members of your community
 - e. Served as a clinical preceptor for optometry students
 - f. Lectured or taught labs at an optometric institution
 - g. Become involved in the political aspects of optometry (e.g., policy initiatives, professional organizations)
 - h. Held leadership positions in optometry related organizations (e.g., served on committees in MSO, AOA)
 - i. Participated in clinical research
 - j. Other (please specify)
7. If you have presented a poster or prepared a publication, when?
 - a. As a student
 - b. While a resident
 - c. 1-2 years post residency
 - d. 3-5 years post residency
 - e. 6-15 years post residency
8. If you currently hold any professional leadership positions, please describe them.
9. How do you feel your residency impacted your career? Select all that apply.
 - a. Improved confidence in clinical skill execution
 - b. Improved efficiency in unique clinical skills

- c. Improved ability to correctly diagnose and treat patients
 - d. Increased time efficiency in completing eye exams
 - e. Established an identity within a specialty area of optometry (e.g., pediatrics, contact lens, low vision, etc.)
 - f. Expanded potential employment opportunities
 - g. Provided networking opportunities with colleagues and members of the optometric community
 - h. Introduced research opportunities
 - i. Other (please specify)
10. Would you do the residency again?
- a. Yes
 - b. No
 - c. If no, why?
 - d. No, but I would do a different optometric residency program
11. Would you recommend completing a residency to current optometry students?
- a. Yes
 - b. No
 - c. If no, why?
12. Do you feel your expectations prior to completing a residency were met by your residency program?
- a. Yes
 - b. No
 - c. If no, why?

Graduates who did not complete a residency:

13. Have you ever participated in any of the following professional activities? Select all that apply.
- a. Presented a poster at a professional conference
 - b. Prepared a manuscript
 - c. Become a fellow of AAO, COVD or other professional organization
 - d. Lectured to colleagues or members of your community
 - e. Served as a clinical preceptor for optometry students
 - f. Lectured or taught labs at an optometric institution
 - g. Become involved in the political aspects of optometry (e.g., policy initiatives, professional organizations)
 - h. Held leadership positions in optometry related organizations (e.g., served on committees in MSO, AOA)
 - i. Participated in clinical research
 - j. Other (please specify)
14. If you have presented a poster or prepared a publication, when?
- a. As a student
 - b. 1-2 years post graduation
 - c. 3-5 years post graduation
 - d. 6-15 years post graduation
15. If you currently hold any professional leadership positions, please describe them.
16. Do you feel that your professional goals and expectations have been met thus far in your career?
- a. Yes
 - b. No
17. Do you plan to complete an optometric residency in the future?
- a. Yes
 - b. No
 - c. Unsure
18. Would you recommend the completion of a residency to current optometry students?
- a. Yes
 - b. No
 - c. If yes, why?

Appendix 2

Fourth-Year Students Survey

1. Are you considering doing a residency?
 - a. Yes (Please answer question 1a)
 - b. No (Please answer question 1b)
- 1a. If Yes, why are considering doing a residency?
 - a. Improve clinical skills
 - b. Improve confidence as a clinician
 - c. Residency is required for my future mode of practice
 - d. In order to stay in a particular geographical location
 - e. Specialize in an optometric subspecialty (e.g., pediatrics, contact lens, etc.)
 - f. To network within the optometric community (e.g., to gain/work with a mentor)
 - g. Other (please specify)
- 1b. If No, why are you not considering doing a residency?
 - a. Feel adequately prepared to be an optometric provider with 4 years of optometry school education
 - b. Residency not required for my interested mode of practice
 - c. No perceived benefit for residency training in the geographical location I would like to live (e.g., Canada)
 - d. Financial burden too great for resident's salary
 - e. Value of residency not equal to the financial compensation
 - f. Personal circumstances not related to finances
 - g. Other (please specify)
2. Have you attended any residency specific events or residency information sessions? (e.g., AAO-Residency Networking Luncheon, NECO residency information session, spoke to residency directors or people who have previously completed residencies)
 - a. Yes
 - b. No
3. Which of the following do you feel would be an important accomplishment toward your professional development? Select all that apply.
 - a. Presenting a poster at a professional conference
 - b. Publishing a manuscript
 - c. Becoming fellow of AAO, COVD or other professional organization
 - d. Lecturing to colleagues or members of the community
 - e. Serving as a preceptor for optometry students
 - f. Lecturing or teaching labs at an optometric institution
 - g. Becoming involved in the political aspect of optometry (e.g., policy initiatives, professional organizations)
 - h. Holding leadership positions in optometry-related organizations (e.g., serve on committees in MSO, AOA)
 - i. Participating in clinical research
6. What is your estimation of the likelihood of accomplishing one or more of the above having completed a residency?
1=Extremely unlikely 2=Somewhat unlikely 3=No impact 4=Somewhat likely 5=Extremely likely
 - a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
7. What is your estimation of the likelihood of accomplishing one or more of the above without completing a residency?
1=Extremely unlikely 2=Somewhat unlikely 3=No impact 4=Somewhat likely 5=Extremely likely
 - a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
8. In what ways do you think a residency may impact a student's future career path?
 - a. Improve confidence in clinical skill execution
 - b. Improve efficiency in unique clinical skills
 - c. Improve ability to correctly diagnosis and manage patients
 - d. Increase time efficiency in completing eye examinations

- e. Expand potential employment opportunities
 - f. Increase long-term salary
 - g. Increase networking opportunities with other members of the optometric community
 - h. Allow you to establish an identity within a specialty area of optometry (e.g., pediatrics, contact lens, low vision)
 - i. Introduce research opportunities
 - j. None of the above
 - k. Other (please specify)
9. If residents were financially compensated to a higher degree than they currently are, would you be more likely to do a residency?
- a. Yes
 - b. No
 - c. If yes, what is the minimum compensation that you would accept?
10. What type of setting is your desired mode of practice after graduation or completion of a residency program?
- a. Solo private practice
 - b. Group private practice
 - c. Commercial practice
 - d. Community health center
 - e. Veterans Affairs hospital
 - f. Other hospital
 - g. Optometric education
 - h. Other (please specify)

Current Residents Questionnaire

1. Why did you decide to do a residency?
 - a. Improve clinical skills
 - b. Improve confidence as a clinician
 - c. Residency is required for my future mode of practice
 - d. In order to stay in a particular geographical location
 - e. Specialize in an optometric subspecialty (e.g., pediatrics, contact lens, etc.)
 - f. To network within the optometric community (e.g., to gain/work with a mentor)
 - g. Other (please specify)
2. Which of the following were included in your decision to pursue a residency? Rank in order of importance.
 - a. Increase confidence in clinical skill execution
 - b. Become more efficient in unique clinical skills
 - c. Improve ability to correctly diagnosis and manage patients
 - d. Increase time efficiency in completing eye examinations
 - e. Establishing an identity within a specialty area of optometry (e.g., pediatrics, contact lens, low vision, etc.)
 - f. Expand future employment opportunities
 - g. Increase long-term salary
 - h. Networking opportunities with other members of the optometric community
 - i. Other (please specify)
3. Do you think your residency has been effective in helping you to accomplish your goals?
 - a. Yes
 - b. No
 - c. If no, why?
4. Prior to your residency, did you attend any residency events or residency information sessions? (e.g., AAO Resident's Networking Luncheon, NECO residency information session, spoke to residency directors)
 - a. Yes
 - b. No
5. Which of the following do you feel is an important accomplishment toward your professional development?
 - a. Presenting a poster at a professional conference
 - b. Publishing a manuscript
 - c. Become fellow of AAO, COVD or other professional organization
 - d. Lecture to colleagues or members of the community
 - e. Serve as a preceptor for optometric students
 - f. Teach lectures or labs at an optometric institution
 - g. Become involved in the political aspect of optometry (e.g., policy initiatives, professional organizations)
 - h. Hold leadership positions in optometry-related organizations (e.g., serve on committees in MSO, AOA)

- i. Participate in clinical research
6. What is your estimation of the likelihood of accomplishing one or more of the above with having completed a residency?
1=Extremely unlikely 2=Somewhat unlikely 3=No impact 4=Somewhat likely 5=Extremely likely
- a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
7. What is your estimation of the likelihood of accomplishing one or more of the above without having completed a residency?
1=Extremely unlikely 2=Somewhat unlikely 3=No impact 4=Somewhat likely 5=Extremely likely
- a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
8. What type of setting are you considering to be your mode of practice after completion of your residency?
- a. Solo private practice
 - b. Group private practice
 - c. Commercial practice
 - d. Community health center
 - e. Veterans Affairs hospital
 - f. Other hospital
 - g. Optometric education
9. Do you believe that completing a residency creates more employment opportunities?
- a. Yes
 - b. No
10. If you were to choose again, would you complete a residency program?
- a. Yes
 - b. No
 - c. If no, why?
11. Would you recommend a residency program to current optometric students?
- a. Yes
 - b. No
 - c. If no, why?

Student Educational Background, Perceptions and Expectations Toward Optometry: An Emerging Eye Health Profession in Mozambique

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Abstract

Background: The University of Lurio, School of Optometry in Mozambique is a new program in Africa. The school, the first to serve Portuguese-speaking Africa, can act as a template for such initiatives in other African countries and other limited-resource settings around the world. A major challenge facing such programs is the lack of knowledge about the profession, which impacts the recruitment of students and their expectations of the program. This study was conducted to understand students' pre-enrollment educational background, perceptions and career expectations as an optometrist in Mozambique so as to inform future enrollment and other similar initiatives. **Methods:** First-year optometry students were asked to complete a questionnaire containing open-ended, close-ended and Likert-scale questions. **Results:** Respondents perceived their language literacy skills as average or good. The majority of participants acknowledged that there is lack of eyecare personnel in Mozambique and agreed that optometry training will resolve this challenge. Students retained high expectations regarding their expected salary and work placement. **Conclusion:** The timely understanding of the poor self-rating of the students' English language ability, gaps in their perception of the role of optometry in Mozambique, and expectations can assist planning for student support, awareness strategies for prospective students and sustainable eye health professional training. The results from the study can be useful when setting up new professional programs in other Lusophone African countries and similar settings, with particular relevance to optometry programs.

Key Words: competencies, expectations, optometry, education, Mozambique

Introduction

In October 2008, a consortium set out with the ambition of training Mozambique's first optometrists through a four-year optometry degree program. The training of optometrists and development of a new optometry cadre was viewed as a means to contribute to the development of a sustainable, cost-effective and comprehensive public eye health system, which is lacking in Mozambique and more broadly across sub-Saharan Africa.^{1,2} Optometry education is seen as a core and sustainable mechanism for overcoming the significant barrier of insufficient local eyecare human resources, and thereby represents a means to address the problem of avoidable blindness and visual impairment in developing nations.³ The Mozambique Eyecare Project's (MEP's) focus on Mozambique is timely and necessary given that resources in Lusophone Africa are particularly deficient, with 17 ophthalmologists and five expatriate optometrists for a population of 24 million.⁴ Various organizations continue to engage governments in developing countries to create education programs that produce optometrists and other eye health professionals. However, the underdeveloped status of underlying education systems in such countries⁵ poses significant challenges, which must be addressed if the optometry profession is to contribute meaningfully to the eyecare needs of people in Africa and in developing countries more generally.

In preparing the first optometrists in the country, initial student selection is an important component that can facilitate the graduation of optometrists who will prove to be competent practitioners. They will demonstrate a willingness to serve the public and to be integrated within the community following graduation. The selection process requires the development and implementation of strategies that ensure that the most appropriate students are selected into the program.⁶ Factors that generally influence career choices include academic achievements, exposure to career options, career guidance provided by teachers, family influence and admission and selection processes.⁷⁻⁹

Despite these influential factors, the process in Mozambique, as in many

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countries,¹⁰⁻¹³ is to allocate students to courses based on the score they achieved on a national university admission examination (high school examination). The higher their score on the national university admission examination, the higher the chance they are allocated to their first choice of study. Students are then given two options for their courses of interest. The University Administrative Committee oversees the allocation process at the university level. In the first year of their studies, optometry students are registered for basic science courses, such as biology, chemistry, physics and mathematics. Students also can enroll in elective courses, such as the English language, which is valuable because many educational materials are only available in English. Students are only exposed to optometry courses in the second semester of their studies. While a grade point traditionally used in student selection may provide some information regarding applicant average academic skills, it does not guarantee aptitude, motivation or knowledge of the program or the future profession.^{14,15}

In the academic environment, curriculum review is an integral and ongoing activity aimed at keeping the curricula up to date with current societal needs, meeting the requirements of governmental higher education accrediting bodies, and remaining accountable to stakeholders.^{16,17} However, there is a paucity of research relating to self-reported educational background and to student initial expectations toward a new program in a country.

The purpose of this paper is to provide an understanding of students' self-reported educational background, perceptions of the newly launched optometry program and expectations toward their future career as an optometrist in Mozambique, a country with limited prior experience or knowledge of optometry. The knowledge generated informs key decision-makers and educators with regard to the support needs of future students in neglected areas, informs awareness strategies for prospective students, and guides eye health human resources and service delivery planning.

Methods

Twenty-seven students (15 male, 12 female) who were newly enrolled in

the first and only Mozambican optometry education program at UniLúrio in Northern Mozambique were recruited into the study. To ensure that student perceptions were not biased, the data were collected during the first semester of study before the students registered for any optometry-related subjects. The only exposure of the students to the profession was the orientation given to them before they were recruited into the optometry program.

Each participant completed a four-part anonymous questionnaire, which addressed the following areas: socio-demographic characteristics, self-reported educational background, perceptions about the optometry profession and expectations of a career as an optometrist after leaving the university. The questionnaire was translated into Portuguese as this was the official language used at the university. The self-reported educational background section contained questions pertaining to participant reading, writing, speaking and computer skills and was included in the Likert-scale questionnaire, with three options to choose from: 3 Good, 2 Average or 1 Poor. At the time of the study, these students were enrolled in science-based subjects (biology, physics and chemistry) and numeracy skills subjects (mathematics).

Participants' perceptions were assessed by a series of questions designed to understand their choice of studies, the reasons for choosing the optometry program, and the reason for the need for an optometry program in Mozambique. We further explored knowledge of the

profession and expected plans on completion of their studies through a series of questions in relation to the 1) functions of an optometrist; 2) sector intended to work in; 3) area (geographic) intended to work in; 4) expected salary; and 5) countries intended to work in.

The study was conducted in accordance with the Tenets of the Declaration of Helsinki, and in line with normal quality assurance mechanisms in place at UniLúrio. Participants were provided with a description of the nature and intent of the study, and informed consent was obtained from each participant.

The data were entered into a Microsoft Access database and analyzed with Statistical Package for Social Sciences (SPSS edition 17.0). The results were analyzed using descriptive statistics.

Results

Demographic profiles of respondents

There were 27 students included in the study. Thirteen students (48.1%) joined the program immediately after completing their high school education, while the remaining students joined after a gap of one or two years following graduation from high school. The average age of participants was 21.9 years. Slightly more than half (55.6%) of the students were male (average age 21.7 years old) and 44.4% were female (average age 22.2 years old). The majority of students (63%, 10 males and 7 females) were from urban areas, and the remaining respondents were from semi-rural (11.1%, 2 males and 1 female) and rural areas (3.7%, 1 female). A demographic profile is provided in **Table 1**.

Table 1
Demographic Profile of Respondents

Demographic Characteristic	n (%)
Age (years)	
17-20	11 (40.8)
21-24	9 (33.3)
25-27	7 (25.9)
Sex	
Male	15 (55.6)
Female	12 (44.4)
Home location	
Rural	1 (3.7)
Semi-rural	3 (11.1)
Urban	17 (63)
No response	6 (22.2)
Last year of study	
2007	4 (14.8)
2008	7 (25.9)
2009	13 (48.1)
No response	3 (11.1)
Total	27 (100)

Self-reported educational background

The significant majority of students (66.67%) reported their English language skills as poor. Portuguese language skills were more typically categorized as good (77.78%). Females tended to rate their skills in languages higher than males, for both English and Portuguese. While a considerable number of students (22.2%) did not respond regarding their computer skills, the majority rated their computer skills as good, except for e-mail use, where 33% of the students rated their skills as poor. Full breakdowns of self-perceived literacy skills and computer skills are provided in **Table 2** and **Table 3**.

Perceptions of the optometry program

The highest proportions of students reported that general medicine (29.6%) or nutrition (22.2%) was their first choice of study. Only one student selected optometry as the first choice.

There was almost unanimous agreement regarding the need for the optometry training program because of the lack of other optometry programs in Mozambique (96.3%) and the need for optometry skills to address the eyecare provision problems in Mozambique (40.7%). A breakdown of the participants' perceptions of optometry is provided in **Table 4**.

Expectations toward a future career as an optometrist

The majority of students perceived the role of the optometrist as maintaining eye health, treating cataract and eye disease, and performing surgery. Nineteen students (70%) expressed a desire to work within the government sector on completion of their degree. In terms of the expected salary upon graduation, 10 students responded that their expected salary would be more than 20,000 Meticaís (652 USD) per month. However, even though the students opted to work within the public sector, almost the same number of respondents expressed their desire to work in urban areas. A full breakdown of the expectations of participants toward a future career in optometry is provided in **Table 5**.

Discussion

For the vast majority of people in Africa, eyecare services are not available, and

Table 2
Self-Perceived Literacy Skills of Respondents

Skills	Portuguese		English	
	Female n (%)	Male n (%)	Female n (%)	Male n (%)
Reading				
Poor	1 (3.7)	1 (3.7)	10 (37)	8 (29.6)
Average	0 (0)	2 (7.4)	5 (18.5)	1 (3.7)
Good	13 (48.1)	8 (29.6)	0 (0)	2 (7.4)
No response	1 (3.7)	1 (3.7)	0 (0)	1 (3.7)
Writing				
Poor	1 (3.7)	2 (7.4)	11 (40.7)	8 (29.6)
Average	0 (0)	1 (3.7)	4 (14.8)	2 (7.4)
Good	13 (48.1)	8 (29.6)	0 (0)	1 (3.7)
No response	1 (3.7)	1 (3.7)	0 (0)	1 (3.7)
Speaking				
Poor	1 (3.7)	2 (7.4)	10 (37.0)	7 (25.9)
Average	0 (0)	1 (3.7)	5 (18.5)	3 (11.1)
Good	13 (48.1)	8 (29.6)	0 (0)	1 (3.7)
No response	1 (3.7)	1 (3.7)	0 (0)	1 (3.7)

Table 3
Self-Perceived Computer Skills of Respondents

Computer skills	No response n (%)	Good n (%)	Average n (%)	Poor n (%)
Windows	6 (22.2)	12 (44.0)	4 (14.8)	5 (18.5)
E-mail	6 (22.2)	8 (29.6)	4 (14.8)	9 (33.3)
Internet	6 (22.2)	11 (40.7)	3 (11.1)	7 (25.9)
Word processor	6 (22.2)	9 (33.3)	6 (22.2)	6 (22.2)

Table 4
Perceptions of Respondents Toward the Optometry Program

Perceptions Questions	n (%)
First choice of program	
a. Dentistry	1 (3.7)
b. General medicine	8 (29.6)
c. Nutrition	6 (22.2)
c. Optometry	1 (3.7)
d. Pharmacy	1 (3.7)
e. Science biology	1 (3.7)
f. No response	9 (33.3)
Reasons for choosing to study optometry (multiple response)	
a. Optometry is necessary to solve the eye problem in Mozambique since there is a lack of optometrists	24 (63.1)
b. Optometry is new and interesting	5 (13.2)
c. I want to work in this area of health and it's my dream to work with people	5 (13.2)
d. I did not get accepted to do my first choice of study	2 (5.3)
e. I like physics and biology and this subject combines them both	1 (2.6)
f. It is nearly the same as general medicine	1 (2.6)
Need for an optometry program in Mozambique	
a. Yes	26 (96.3)
b. No	1 (3.7)
Reasons for the need of optometry program in Mozambique	
a. There is an absence of optometrists in Mozambique	11 (40.7)
b. Mozambique has a lot of eye problems	10 (37.0)
c. Many people are operated on without an optometrist and this can damage the eye	2 (7.4)
d. Because of the many climate problems which might affect vision	1 (3.7)
e. It highlights the large problems with vision in Africa	1 (3.7)
f. Optometry is a new course and no one knows about it	1 (3.7)
g. Motivates students to help minimize the problem of cataracts	1 (3.7)

the value of optometry services remains unknown or under-appreciated despite optometrists having a long history of practicing in parts of Africa.¹⁸ While some countries such as South Africa, Nigeria and Ghana have a long history of training optometrists, optometric teaching institutions are emerging for the first time in some African countries,¹⁸ such as Mozambique, Malawi, Eritrea and Kenya. The lack of familiarity with the profession is clearly reflected in the fact that only one student selected optometry as a first choice of study, compared to eight students who selected general medicine as their first choice. This can be due to the fact that the optometry profession is relatively new to Mozambique, and students are unaware of optometry as a profession or its potential in terms of scope of practice. Moreover, the social standing of an unfamiliar profession might not rank highly compared to medical doctors, who are usually well-respected within the community.¹⁸ Monetary return may also play a part in their choice of studies. Although students might acknowledge that there is a lack of optometrists to manage eye conditions in the country, they are faced with a dilemma of choosing the profession with a perceived income much lower than that of a medical doctor.¹⁹ This pilot project highlights the need to investigate the effect of recruiting students into programs that are not their first choice as well as to ascertain the value of recruiting students who did not select optometry at all into the program.

This study reveals that the majority of subjects rated their literacy skills in English as poor and their computer skills as good. A good command of the English language is important because, even though it is not an official language at the university, reference books, educational materials and online resources are predominantly written in English. Furthermore, the university encourages the learning of English as a second language. The use of online resources during assignments, for example, may be dependent on the Internet, suggesting that computer skills are equally important. This finding serves as a motivation for extra support and resources to be allocated to these areas of deficit.

The perceptions of optometry and the

Table 5
Expectations of Respondents
Toward a Future Career as an Optometrist

Expectations Questions	n (%)
Functions optometrists perform (multiple responses)	
a. To maintain eye health	25 (27.8)
b. To treat cataract and eye diseases	18 (20)
c. To improve quality of life by prescribing glasses and lenses	14 (15.6)
d. To perform surgical operations	10 (11.1)
e. To promote eye health care	9 (10)
f. To provide general optometry services	6 (6.7)
g. To develop new eye testing methods	3 (3.3)
h. To provide affordable eye care	2 (2.2)
i. To observe and analyze visual problems	2 (2.2)
j. To minimize blindness	1 (1.1)
Sector intended to work in after studies	
a. Government	19 (70.4)
b. Private practice	4 (14.8)
c. Non-profit organization	1 (3.7)
d. Academia/postgraduate	2 (7.4)
e. Private clinic	1 (3.7)
Types of area planned to work in	
a. Rural	1 (3.7)
b. Semi-rural	9 (33.3)
c. Urban	16 (59.3)
d. No response	1 (3.7)
Expected salary per month on completion of studies (Meticais)	
a. <3,000	3 (11.1)
b. 3,000-<10,000	1 (3.7)
c. 10,000-<20,000	3 (11.1)
d. 20,000-<45,000	5 (18.5)
e. 50,000-<100,000	3 (11.1)
f. 100,000-<150,000	1 (3.7)
g. >150,000	1 (3.7)
Countries to work in on completion of studies	
a. Mozambique	20 (74.1)
b. Overseas	7 (25.9)

general lack of knowledge of the profession further demonstrate the need to increase awareness of the profession in the country through advocacy efforts, which may bring about mobilization of resources for service delivery from government and the private sector and lead to the expansion of optometric practice.^{20, 21} More important is the identification of the need to build a marketing and recruitment strategy for prospective students to increase their familiarity with the profession and ideally make optometry a career of first choice.

In 2013, for a population of approximately 24 million, Mozambique had approximately 12 ophthalmologists, five expatriate optometrists and few mid-level ophthalmic technicians.⁴ The enormous demand may serve as a basis for expansion of the scope of optometric practice; however, currently, the scope does not involve the treatment of eye diseases and surgery.²¹

Also, a mismatch of expectations and reality may cause disappointment and dissatisfaction in career choices and might further cause attrition or decreased academic performance.²² The students' perception that the scope of practice of optometrists includes cataract surgery warrants an intervention that seeks to increase the understanding of the role of optometrists among potential students to avoid disappointment and thus drop-out of students. More importantly, there needs to be a focus on the value that optometrists add to the eyecare equation as well as on the research required to ensure such claims are evidence-based. The confusion about the different scopes of practice may be explained by the fact that Mozambique is grossly underserved by eyecare personnel, resulting in limited exposure of students to the various professionals and their respective scopes of practice. It is important to note that

the graduates are trained to use pharmaceutical agents for diagnosing eye diseases and therapeutic drugs for treating eye diseases. However, they are not allowed to use them at this stage due to the health professions regulations in the country. Defining the scope of practice of optometry, although not done in the study, is not always an easy task, but is important for the profession and optometric education.²³ Additionally, in some African languages the description of an optometrist translates to eye doctor and a similar terminology is used to describe ophthalmologists.

The majority of students (70%) expressed an interest in working within the government sector on completion of their studies. This decision may be influenced by the perception that working within the Government Ministries provides a stable form of employment. The introduction of this additional human resource into the public sector is significant because in most developing countries the public sector serves the majority of the population. The Ministry of Health, which is driving the educational agenda, will deploy graduates as the human resource to provide optometric services across the country. The strategic deployment of graduates will serve to contribute to efforts to address the refractive and eye health problems in Mozambique. To ensure sustainability and success of the program, there is a growing need to develop a strategic plan that would ensure that the financial and other resource needs of the education establishment can and will be met and training optometrists to solve the human resource challenge has proven to be cost-effective.²

It is significant that almost 60% of the students would want to work in an urban as opposed to rural area upon completion of their degree. This may be due to the fact that these students reside in an urban area and their familiarity with their own home environment might have influenced their preference to stay in an urban location.²⁴ The standard of living is also known to be relatively better in urban areas. While this is an inevitable phenomenon, it has the potential to perpetuate the imbalanced distribution of health workers between the rural and urban areas. The expectation to have to work in a rural area might also

be an indicator of job dissatisfaction and attrition. Therefore, it is important that students understand very early in the program that eye care is provided at district and regional levels. This approach to service delivery is adopted by the optometry program with the specific aim of increasing access and reaching out to the underserved rural areas in the country. The approach is also in line with VISION 2020: The Right to Sight campaign to combat avoidable blindness and low vision by placing sustainable, affordable and equitable comprehensive eye care within Primary Health Care Systems of developing and low-income countries, which includes human resource development as one of the pillars of the campaign.²⁵ Moreover, this also indicates that there is a need to consider enrolling students from rural areas in the student recruitment process to avoid high attrition rates in the future.

The salary expectations of the surveyed students appeared to be generally realistic. This most likely reflects the fact that public sector salaries in Mozambique are pre-determined on the basis of education level. Bachelor of Science (BSc) graduates typically earn a salary that is equivalent across multiple career disciplines (23,000 Metical, 750 USD per month). It is interesting to note that almost 26% of the students reported that they wish to work overseas after the completion of their studies. Although this creates opportunities for cross-country service delivery in Lusophone countries within Africa (Angola, Cape Verde, Guinea-Bissau, Sao Tome and Principe), it may also pose a challenge if these students emigrate and leave their country permanently. This highlights a need for Lusophone countries to work together to define strategies for preventing poorer nations from educating optometrists merely for "export." Most optometry programs are struggling in difficult economic and/or political environments, but recent developments in communication and cooperation between the African countries will be a positive force toward seriously addressing the need for more optometric practitioners throughout the African continent.²⁶

The scope of this study is limited to the Mozambique experience, and caution

should be applied when interpreting its relevance to the Lusophone African countries. The small sample of 27 subjects makes it difficult to make broader projections, but does point to areas of further investigation and concern. Since there was no formal assessment of students' literacy skills in the school, we can only rely on self-reported information, and this may have introduced respondents' bias.

Conclusion

This study served to provide baseline information on the pre-competencies, perceptions and expectations of students in a new optometry program in Mozambique and can inform recruitment, education and service delivery efforts. Students enrolled in the Mozambican optometry education program at UniLúrio in Northern Mozambique held positive perceptions toward the program at the university and demonstrated a positive view toward their future careers as optometrists. Even though signs of confusion regarding scope of practice exist, the appreciation of the need for optometrists to address the eye health needs of the country was encouraging. Effort should thus be placed on giving students the necessary support and creating appropriate awareness of the profession in order to promote the development of optometrists as frontline health professionals who can help meet the eyecare needs in Mozambique. The information learned from the study can be useful for planning new professional programs in other Lusophone African countries and in similar settings, with particular relevance to optometry programs, and should be reinforced by prospective studies involving graduates of the program following their entry into clinical practice.

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