Optometric Education: Volume 41 Number 3 (Summer 2016)

OPTOMETRIC EDUCATION

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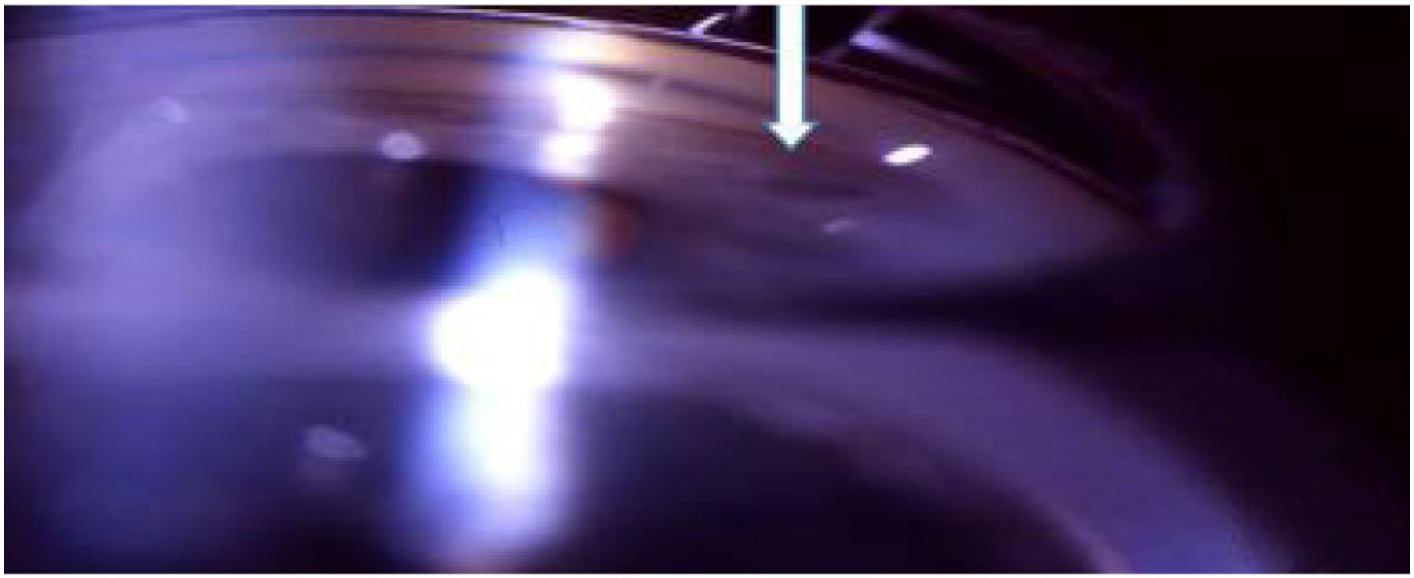

Initial Evaluation of an Optometric Outreach Educational Program

Perceived Enhanced Clinical Readiness for Second-Year Optometry Interns

The Effect on Knowledge and Attitude of an Interprofessional Education Curriculum for Optometry and Physician Assistant Students

Teaching Case Report: Plateau Iris Syndrome and Acute Angle Closure Glaucoma

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ASCO ASSOCIATION *of* SCHOOLS *and* COLLEGES *of* OPTOMETRY

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Deadline Extended for Upcoming International Optometric Education Theme Edition

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International Optometric Education: Global Expansion and Transformation

(New deadline to submit papers: March 1, 2017)

Over the past 20 years, the profession of optometry has undergone dramatic global changes: expanding scope of practice, increasing quality assurance expectations, significant diversification of students, and the accelerating impact of information technology. Underpinning these changes has been the critical role of international optometric education in supporting and catalyzing this transformation. The same global forces that are driving the transformation of the profession are also creating challenges and opportunities for optometric educational institutions. Student, faculty, patient and institutional expectations are converging and greater accountability is expected. This includes such areas as clinical competency, professional ethics, interprofessional collaboration and curricular innovation.

This theme issue builds on the work of the ASCO International Optometric Education Committee and International Optometric Educators Special Interest Group (SIG).

Authors are invited to submit scholarly articles that address this theme and underscore innovation and the impact educational institutions are having on their students, the profession and the communities they serve. We encourage scholarly articles that are translational and promote global dissemination. Please submit manuscripts by March 1, 2017. Submit a cover letter and intact and blind copies of the manuscript with original figures electronically to submissions@opted.org. Please identify in the cover letter that the manuscript is intended for the international theme edition of the journal.

We are pleased to have Anthony F. Di Stefano, OD, MEd, MPH, Salus University, serve as the Guest Editor of this issue. For more information, please e-mail journal Editor Aurora Denial, OD, FAAO.

Upcoming Theme Edition Will Focus on Diversity, Cultural and Linguistic Competence

| Optometric Education: Volume 41 Number 3 (Summer 2016)

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A future edition of *Optometric Education* will focus on the theme of diversity, cultural and linguistic competence. The edition will focus on diversity of our students, faculty and profession and all aspects of cultural and linguistic competence, including professional, organizational and individual responsibility.

Please submit manuscripts by Dec. 31, 2016. Submit a cover letter and intact and blind copies of the manuscript with original figures electronically to submissions@opted.org. Please identify in the cover letter that the manuscript is intended for the diversity theme edition of the journal.

For additional information on the theme edition, please contact Gary Chu, OD, MPH, FAAO, or Aurora Denial, OD, FAAO.

Social Media: Opportunities and Challenges

Aurora Denial, OD, FAAO | Optometric Education: Volume 41 Number 3 (Summer 2016)

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Aurora Denial, OD, FAAO

The internet has created the opportunity for social media to thrive. Participating in social media forums, known collectively as "Web 2.0," allows communication and information-sharing with large groups of people instantaneously. Social media can fall into one of six primary categories:[1]

- Social networks: sites that allow users to connect and share with people who have similar interests and backgrounds. Example: Facebook.
- Bookmarking sites: sites that allow users to save and organize links to any number of online resources and websites. Example: Stumble Upon.
- Social news: sites that allow users to post news links and other items to outside articles. Example: Reddit.
- Media sharing: sites that allow users to share different types of media, such as pictures and video. Example: YouTube.
- Microblogging: sites that allow users to submit short written entries, which can include links to products and service sites as well as links to other social media sites. Example: Twitter.
- Blog comments and forums: sites that let users engage in conversations by posting and responding to community messages.

How Social Media is Being Used in Health Care and Education

The use of social media in health care and education has climbed in recent years,[2] leading to numerous opportunities and challenges. In hospital settings, social media can be used to alert patients to wait times, update patient status, deliver public health messages, recruit for research and communicate with staff. Healthcare providers also use social media to disseminate information, answer questions and communicate with patients. Several studies indicate that 70-90% of students in healthcare professions use social media.[3] This is not a surprising finding because most of the current students in healthcare professions are in the Millennial generation, born after 1982. Millennials are accustomed to staying connected with the outside world using handheld, wireless devices and are considered "digital natives."[4]

In the education environment, the opportunities intrinsic to social media are plentiful. Some of the potential opportunities include collaboration and connectivity among users, access to clinical experts, access to information from a number of different sources, and the ability to disseminate information. The development of content within social media, such as learning to concisely communicate through Twitter, can also be a valuable skill. In healthcare professions, storytelling or relaying clinical experiences are common and allow students the opportunity to reflect and share. When storytelling occurs on social media, feedback is immediate, camaraderie can provide emotional support, and input from others can enrich a learning experience. However, relaying clinical experiences via social media can also present significant challenges. Complying with the Health

Insurance Portability and Accountability Act (HIPAA), maintaining professionalism, and respecting patient privacy and confidentiality are common challenges.

The following example represents a posting on social media by a medical student. “I had my first patient death, a man who served his country in combat. … I will never forget the last conversation I had with him, about his wife of 50 years. They met when they were just kids and had such a great life together, raising three daughters. … The wife never saw this coming, she looked so shaken and scared.”[5] Although this example does not violate HIPAA, it raises the question of whether it respects the patient’s privacy. The patient may have felt comfortable sharing these personal details with his doctor, but the patient and/or family members may not have intended the information to be shared on Facebook.[5] Several professional medical organizations have attempted to address these types of challenges. In 2013, the American College of Physicians published a position paper that states “Consideration should be given to how patients and the public would perceive the material …”[6] Therefore, clinicians and healthcare students should ask themselves before posting: Would my patient or his or her family want me to post about them on Facebook?[5]

In addition to the challenges related to storytelling, inappropriate postings on social media can negatively impact careers or the public’s perception of a healthcare profession. Chretien et al. found that 47 out of 78 medical schools reported incidents of students posting unprofessional online content.[7] The content included profanity, pictures of intoxication, and sexually suggestive material. At a recent medical education conference in Boston, medical school faculty relayed a case where a student posted on social media: I cannot believe how wasted I was this morning. I needed to be at the hospital early so that I could participate in a renal transplant. A reply to the post: Are you my daughter’s doctor?[8] Clearly this post has numerous implications including the potential to damage the public trust in the profession.

Facing the Challenges

The American Medical Association (AMA) has added the following to its Code of Ethics. “Physicians must recognize that actions online and content posted may negatively affect their reputation among patients and colleagues, may have consequences for their medical careers (particularly for physicians-in-training and medical students), and can undermine public trust in the medical profession.”[9] Social media is an incredible tool. Optometric educators should reflect on the formal training offered to students regarding the use of social media in the educational and professional settings. Are we doing enough to prepare our students to be responsible users of social media? Are they able to take advantage of the many opportunities and effectively deal with the challenges?

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2016 Educational Starter Grants

| Optometric Education: Volume 41 Number 3 (Summer 2016)

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The Association of Schools and Colleges of Optometry (ASCO) is pleased to announce a call for applications for its 2016 Educational Starter Grants dedicated to supporting educational research. A generous donation from Johnson & Johnson Vision Care, Inc., has provided funding for this year's grant program.

ASCO's Educational Starter Grants have been awarded in each of the past five years with the goal of encouraging and supporting research focused on optometric education. According to the American Educational Research Association, education research is defined as:

"Education research is the scientific field of study that examines education and learning processes and the human attributes, interactions, organizations, and institutions that shape educational outcomes. Scholarship in the field seeks to describe, understand, and explain how learning takes place throughout a person's life and how formal and informal contexts of education affect all forms of learning. Education research embraces the full spectrum of rigorous methods appropriate to the questions being asked and also drives the development of new tools and methods."

Securing one of ASCO's Educational Starter Grants provides faculty with a great opportunity to get involved in doing educational research, which can impact teaching, student learning and the profession.

Check out information about our past Educational Starter Grants here.

To apply for a 2016 Educational Starter Grant, submit a completed application via e-mail to Sara Lau. The deadline for applications is midnight, Aug. 8, 2016. Confirmation of received applications will be sent via e-mail within 36 hours of receipt.

Click here for the 2016 application form.

Final decisions will be made and notifications to applicants will be completed by Aug. 22, 2016.

Student Award in Clinical Ethics

Krystal Chee, OD | Optometric Education: Volume 41 Number 3 (Summer 2016)

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Patient's Request Presents Ethical Dilemma

Krystal Chee, OD

A 57-year-old Caucasian female presented to a community clinic for an eye exam with the chief complaint of being "unable to see anything." This patient was being followed by an outside ophthalmologist, whose previous records revealed a history of dense panretinal photocoagulation (PRP) for proliferative diabetic retinopathy OU, a macular hole OD and macular scarring OS. Her medical history was significant for diabetes mellitus type 2 and hypertension.

On observation of the patient walking from the waiting area to the exam room, she displayed difficulty ambulating down hallways and expressed trouble distinguishing clinicians. During the exam, her visual acuities (VAs) were counting fingers at 40 cm OD and 20/50 OS. VAs did not improve with pinhole or manifest refraction. A threshold visual field was performed, and it revealed constricted visual fields OU. The right eye's widest visual field was 15 degrees; the left eye's visual field was constricted superiorly and inferiorly, but subtended a full 54 degrees horizontally. Dilated ocular health exam confirmed the patient's history of PRP, macular hole OD and macular scarring OS. We informed the patient that a spectacle correction would not improve her vision and advised her to schedule an appointment to be seen in our low vision clinic. The patient then requested a diagnosis of legal blindness and stated that she had received benefits through being legally blind in the past. She provided physical documentation of this diagnosis in the form of a letter from her ophthalmologist, which stated she was legally blind. However, it was clear she did not qualify as legally blind per the U.S. Social Security Administration's definition.

Low Vision vs. Legal Blindness

As optometrists, we encounter situations in which we need to appropriately draw the line between patients with low vision and patients who can be defined as legally blind. The law defines legal blindness for public safety reasons (driving) as well as for determining eligibility for disability benefits funded by the government. Legal blindness is defined by the U.S. Social Security Administration (SSA) as best-corrected visual acuity of 20/200 or worse in the better eye, or visual field of 20 degrees or less in the better eye.[1] In addition to monetary assistance, government-funded programs for people with legal blindness can provide

other services and resources.[1] The Americans with Disabilities Act calls for reasonable accommodations by employers to allow for equal employment opportunity, such as closed-circuit televisions, screen magnifiers, etc.[2] While these benefits are of great assistance to legally blind patients, factors other than visual acuity and visual field affect a patient's visual functionality, e.g., contrast sensitivity. While a patient may not qualify as legally blind under the U.S. SSA's guidelines, use of his or her low vision can still be very challenging if one or more of these additional hindrances are present.

As stated in the American Optometric Association (AOA) Code of Ethics, one of an optometrist's duties is "to advance professional knowledge and proficiency to maintain and expand competence to benefit our patients."[3] Part of our job as optometrists is to ensure that legally blind and low vision patients are properly diagnosed and directed to the appropriate resources and services that can help them to achieve the highest quality of life possible. According to *An Optometrist's Guide to Clinical Ethics*, "Optometrists must serve as patient advocates and help their patients receive the best available care."[4] This means we must be up-to-date with SSA requirements and how to direct patients towards receiving disability benefits. While we are to be advocates for the well-being of our patients, we must also recognize that these benefits are not to be abused. We also have an "obligation to protect the health and welfare of society,"[3] including appropriate allocation of resources to those who are in serious need.

Patients may want to be classified as legally blind, as the patient in this case wanted, especially if they have been granted related benefits in the past. While one of our ethical principles is to help others (beneficence), it is necessary to be truthful regarding our exam findings in order to uphold our ethical standards. Additionally, we should consider rehabilitation for these patients by way of low vision services and aides. If we do not have the means to provide these services ourselves, we must follow the Code of Ethics, which states our responsibility to "advise our patients whenever consultation with, or referral to another optometrist or other health professional is appropriate."[3] This goes along with being an advocate for our low vision patients, especially those who feel overwhelmed or helpless in their daily functioning because of their reduced vision. The SSA states that even if a patient is not "legally blind" per their definition, a visual impairment may still make him or her eligible for Social Security benefits on the basis of disability.[1] For these cases, directing our patients to a Social Security disability attorney or advocate may be the best option to help them benefit from necessary services.

Patient Education and Management

Considering that this patient's visual acuity and the extent of visual field were both better than the definition of legal blindness per the U.S. SSA, we determined we could not diagnose her with legal blindness despite her previous documentation and receipt of benefits. We consulted thoroughly with her and advised her of all of her options for low vision rehabilitation. Another aspect of optometric ethics is to strive to ensure that all patients have access to eye and vision care[3] regardless of transportation or financial limitations. We connected this patient to the local Department of Rehabilitation, which would be able to help her set up services through our low vision clinic. We also advised her that despite not qualifying as legally blind, her visual impairment could still allow her to gain services through the SSA and that an advocate could help her determine the appropriate options. After discussing at length the potential benefits of low vision services to improve her employment opportunities and quality of life, our patient was thankful for our advocacy and was optimistic about maximizing the functionality of her vision.

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Student Award in Clinical Ethics

| Optometric Education: Volume 41 Number 3 (Summer 2016)

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Krystal Chee, OD

ASCO and its Ethics Educators SIG are pleased to announce Krystal Chee, OD, as the winner of the 2016 Student Award in Clinical Ethics. The winner of this annual national award receives $1,000 and an engraved plaque.

Dr. Chee is a 2016 graduate of the University of California at Berkeley School of Optometry. Her winning essay, "Patient's Request Presents Ethical Dilemma," appears in this edition of *Optometric Education*.

Nurse Practitioner Students, Optometry Students and Faculty Members Engage in Community-Based Interprofessional Practice

Linda Casser, OD, FAAO, FNAP, Mary Ann Dugan, DNP, CRNP, FNP-BC | Optometric Education: Volume 41 Number 3 (Summer 2016)

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The Salus University Pennsylvania College of Optometry and the La Salle University School of Nursing and Health Sciences have partnered in health professional education and collaborative patient care by developing and implementing an interprofessional healthcare model in which graduate nurse practitioner students participate in eye and vision patient care at The Eye Institute, a community-based healthcare facility in Philadelphia, Pa.

A nurse practitioner is a registered nurse who has a graduate degree and advanced knowledge. Nurse practitioners have didactic and clinical education that prepares them to practice in advanced areas of primary or acute care. Nurse practitioners examine, diagnose, manage and educate patients in primary care settings.

Project Description

The Family Nurse Practitioner Coordinator at La Salle University identified the need to expand ophthalmic patient care experiences for nurse practitioner students. Nurse practitioner students typically enter graduate programs without previous registered nurse experience in ophthalmic care/assessment of patients. Collaborating with The Eye Institute at Salus University was one solution to support nurse practitioner students gaining more clinical experience in this important area.

TABLE 1
Student Experience Survey
(distributed to La Salle University nurse practitioner students following their clinical assignments at The Eye Institute)

1. How knowledgeable were the providers?
2. How knowledgeable were the fourth-year optometry students?
3. How easy was it to talk to the staff about questions?
4. How often were you able to apply what you learned in classes at La Salle to the clinical experience?
5. How responsive was the staff at this clinical facility to your questions?
6. How often did the staff explain assessment findings, diagnoses, medication side effects or plan of care?
7. How often did the providers provide explanations in a way you could understand?
8. Were you satisfied with this clinical experience?
9. How likely are you to recommend this experience to others?
10. How likely are you to draw on this experience in your work as a nurse practitioner?

Click to enlarge

Beginning in August 2013 and following the execution of a Memorandum of Understanding, family and adult-gerontology nurse practitioner students were assigned to The Eye Institute (TEI) on a voluntary basis for active clinical observation of assessment, differential diagnosis, treatment and management/follow-up care. The clinical observation activity is scheduled in the Primary Care Optometric Suites and one or more Specialty Services at TEI. Fourth-year optometry students, graduate nursing students, optometry residents and optometry faculty members collaborate in the following areas: assessment and care of patients with hypertension, diabetes and other systemic conditions, including ocular manifestations of systemic disease; the differential diagnosis of patients with ocular urgencies; the clinical presentation and management of glaucoma; and the ophthalmic evaluation of the pediatric patient. A total of 74 nurse practitioner students engaged in the new clinical education program over 18 months.

From August 2013 to March 2015, a nonprobability, convenience sample of nurse practitioner students was invited to participate in a 10-item Likert scale Student Experience Survey. Participants were informed that because the program was new, their feedback would be valuable in the continued collaborative relationship between Salus University and La Salle University. Signed consent was obtained at the end of the survey, and data were kept confidential. The Family Nurse Practitioner Coordinator invited participation during a class and noted that participation was voluntary and would not affect grades.

The 10 items on the Student Experience Survey addressed the knowledge base of the optometry students and faculty member optometrists; ease of communication and responsiveness to nurse practitioner student questions; knowledge of optometric assessment, diagnosis, and medication side effects; application to nurse practitioner clinical experience; frequency of optometrists' explanations; satisfaction with the clinical experience; and likelihood of recommending the experience and using the experience in nurse practitioner work. **(Table 1)** The survey was administered on La Salle University's learning management system immediately following the clinical activity at The Eye Institute.

Results/Conclusion

TABLE 2
Nurse Practitioner Student Experience Survey Outcomes Data
(N = 20 / 74; Survey Participation = 27%)

Survey Item	Mean	Standard Deviation	Standard Error
1. Provider knowledge	4.53	0.51	0.12
2. Optometry student knowledge	4.21	0.63	0.15
3. Asking questions of staff	4.37	0.96	0.22
4. Apply classroom to clinical	3.74	1.15	0.26
5. Staff responsive to questions	4.32	0.82	0.19
6. Staff describe findings	4.16	0.81	0.18
7. Understandable explanations	4.26	0.79	0.18
8. Satisfaction with the experience	4.05	1.00	0.22
9. Recommend to others	4.05	0.95	0.21
10. Draw on the experience as an NP	4.00	1.03	0.23

NP=nurse practitioner
Response Scale
5 = Extremely/Always
4 = Very/Most
3 = Moderately likely/About half the time
2 = Slightly/Once in a while
1 = Not at all/Never

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Student responses to the survey items were scaled using the following choices: 5 = Extremely/Always, 4 = Very/Most, 3 = Moderately likely/About half the time, 2 = Slightly/Once in a while, and 1 = Not at all/Never. Nurse practitioner students reported the greatest satisfaction with provider knowledge (mean 4.53) and responsiveness of staff to their questions (mean 4.32). They reported satisfaction with this clinical experience (mean 4.05). The lowest scale related to ability in applying classroom material to the clinical experience (mean 3.74). The responses to this survey item may have been low if a student had attended the experience months after the content was delivered in the classroom. Student experience responses were very positive overall. **(Table 2)**

Qualitative feedback about this initiative has also been positive, as evidenced by these samples of nurse practitioner student comments:

"The examinations were very interesting."

"I really learned a lot at this site."

"The residents were very helpful."

"I feel more comfortable with the eye exam."

"I am learning a lot about the eye."

Additional qualitative feedback was received from an optometry faculty member at The Eye Institute:

"I want to tell you how much I have enjoyed working with the nurse practitioner students. They are all very mature students and eager to learn. They ask questions that show a good depth of knowledge and learn quickly. An additional plus, if we are having blood pressure problems, or any systemic issues with a patient, including medications, they have stepped in and helped. Keep this program, it helps us and them."

Health professional education has recognized the importance of interprofessional education and practice, and has responded

with a variety of initiatives, projects and events aimed at improving communication, addressing challenges and barriers, and enhancing the effectiveness of teams.

The Salus University – La Salle University collaboration has provided an opportunity for students from the professions of optometry and nursing to gain a more direct understanding of each profession's contribution to patient care. This collaboration has yielded significant improved knowledge for nursing students about caring for patients with eye disorders and also the availability of referral services. This clinical educational collaboration is an ongoing one with a continuing positive community impact on patient care. Anecdotal feedback indicates that graduates of the nurse practitioner program who are practicing locally have referred patients to The Eye Institute, thereby creating virtual care teams in follow-up to the in-person team experience. Salus University and La Salle University remain committed to the enhancement and expansion of effective community-based health professions education, interprofessional education and collaborative patient care.

Acknowledgements

We extend sincere thanks and appreciation to:

Aliceanne Manning, Assistant Educational Coordinator, Department for Optometric Clinical Affairs, Salus University Pennsylvania College of Optometry and The Eye Institute, Philadelphia, Pa., for her dedicated efforts in facilitating the scheduling, orientation and clinical assignments of the La Salle University graduate nurse practitioner students at The Eye Institute of Salus University.

Elizabeth Eisenhart, MPH, Clinical Coordinator for the Graduate Nursing Nurse Practitioner Program, La Salle University School of Nursing and Health Sciences, Philadelphia, Pa.

Mary Wilby, PhD, CRNP, ANP-BC, Assistant Professor, Adult-Gerontology Nurse Practitioner Track Coordinator, La Salle University School of Nursing and Health Sciences, Philadelphia, Pa.

Joseph Ruskiewicz, OD, MPH, Associate Professor, Salus University Pennsylvania College of Optometry, for his efforts in supervising and instructing the La Salle University graduate nurse practitioner students at The Eye Institute.

The La Salle University graduate nurse practitioner students for their involvement and participation in the Student Experience Survey.

The Effect on Knowledge and Attitude of an Interprofessional Education Curriculum for Optometry and Physician Assistant Students

Raymond Chu, OD, MS | Optometric Education: Volume 41 Number 3 (Summer 2016)

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Background

The complexities of patient care have necessitated increased specialization within the U.S. healthcare system. This has created potential schisms in care as well as potential safety issues. Distinction among professionals has led to a lack of knowledge of the expertise of other health professionals and pre-conceptions and stereotyping that negatively affect collaborative practice. Pham et al. estimated that a typical Medicare physician coordinates with 229 other physicians in 117 different practices who also provide care to that same patient, yet communication errors between providers have resulted in poor patient outcomes.[3,4] In response to the growing concern for the burden of care coordination, the American Academy of Family Physicians (AAFP), American Academy of Pediatrics (AAP), American College of Physicians (ACP) and American Osteopathic Association (AOA) issued a joint statement endorsing the concept of a "patient-centered medical home" where team-based care could be delivered effectively and efficiently in the interest of better patient outcomes and reducing healthcare cost.[5]

The World Health Organization and the Institute of Medicine have advocated to health profession programs to make interprofessional education (IPE) a priority in order to cultivate a collaborative, practice-ready workforce that is able to meet the call for team-based care.[6,7] IPE aims to encourage students from different professions to work with one another in meaningful interactive learning activities that target the four core competency domains for interprofessional collaborative practice (IPC): 1) values/ethics for interprofessional practice, 2) roles/responsibilities, 3) interprofessional communication, and 4) teams and teamwork.[8] Values and ethics for interprofessional practice reflect the common interests of providers working together to deliver safer, more efficient and more cost-effective care. Roles and responsibilities reflect how providers understand their role as well as the role of other team members. Interprofessional communication, where information is presented to all team members in an understandable manner, is crucial for effective interprofessional collaboration. Teams and teamwork reflect the need for providers to work together to reduce gaps and redundancies as well as share responsibility for problem-solving and decision-making.

The educational effectiveness of key elements of IPE has not been well-established because of the varied lengths of instruction and teaching methodologies.[2] It is common for students from different health professions to attend the same course; however, some have argued that this is not truly IPE because of the limited opportunities for interaction among students.[9] To foster participant engagement, some programs have employed problem-based learning or case-based learning, which have been helpful in developing the knowledge and behavior related to working in an interdisciplinary team.[10] Institutions implementing IPE courses within their diverse health programs have commented that providing interprofessional learning experiences is a logistical challenge. Finding congruent times and locations to have students meet for IPE courses, meeting space conducive for small group discussions, and faculty modeling the desired behaviors are all challenges for an institution to address. Some have also suggested that meaningful collaboration can only occur when students have an adequate foundation regarding their own roles as healthcare providers. This would suggest that introduction of IPE should occur later in the curriculum as opposed to earlier. However, IPE curriculum introduced later in a professional program may not be as well-received because stereotypes and biases have already been formed.[11] General consensus is that an IPE curriculum is best received when introduced early and with regular intervals of interaction.[8,11]

During the 2014-2015 academic year, Marshall B. Ketchum University delivered an IPE curriculum to its optometry and physician assistant students. The purpose of this study was to determine whether the IPE curriculum changed students' readiness for interprofessional collaboration and their knowledge of each other's roles within a healthcare team.

Methods

Interprofessional curriculum

In 2013, Marshall B. Ketchum University became home to the Southern California College of Optometry (SCCO) and the School

of Physician Assistant Studies. The university identified coursework common to SCCO and the School of Physician Assistant Studies that could foster mutual respect between students from each program, help them to develop the communication skills for working as part of an interprofessional healthcare team, and provide knowledge about the role of the other provider.

The School of Physician Assistant Studies offers a 27-month (nine quarters) program with the bulk of didactic instruction during the first year followed by 12 six-week external clinical rotations. Conversely SCCO offers a four-year program (14 quarters) with the bulk of didactic instruction during the first three years and the final year focused on direct patient care in various clinics and health centers. Didactic courses were selected based on common coursework between the two professions. In the fall quarter, first-year optometry students and first-year physician assistant students were enrolled in the Professional Ethics course. In the winter quarter, second-year optometry students and first-year physician assistant students were enrolled in the Evidenced-Based Practice course. In the spring quarter, third-year optometry students and first-year physician assistant students participated in an interprofessional case-based conference.

In the Professional Ethics course, multidisciplinary faculty lectured weekly for one hour, which was followed by a one-hour small group (eight optometry and two physician assistant students with one faculty facilitator) case discussion. Topics such as Health Information Portability and Accountability Act, medical mistakes, errors in medical billing, and professional dishonesty were covered in the course and addressed using case-based learning in the discussions. Case-based learning utilizes a guided inquiry approach in which students are required to prepare ahead of the discussion in order to be a “content expert” so that meaningful dialogue can occur.

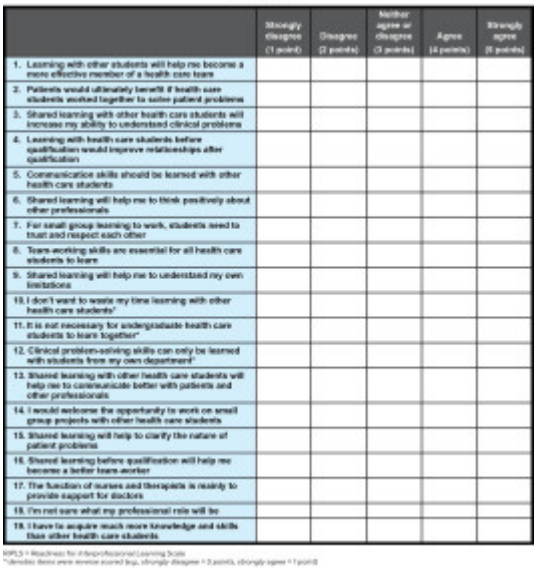
The Evidenced- Based Practice course was a lecture-based course taught by multidisciplinary faculty. Physician assistant and optometry students attended a weekly two-hour lecture with faculty presenting topics such as critical appraisal of the literature, application of evidence to clinical practice, and case studies of health outcomes as a result of interprofessional care.

In the interprofessional case-based conference, optometry and physician assistant students sat together at round tables with 8-10 students per table. A multidisciplinary team of faculty facilitators aided the one-hour discussion of the management of a poorly controlled diabetic patient. Portions of the case were presented with prompting questions within the table discussions. Representatives from each table, from both the optometry and physician assistant programs, were later asked to contribute to the large group discussion.

The cumulative experience for the physician assistant students was the opportunity to see the progression of learning of the optometry students (from first through third year) over the course of their one year of didactic instruction. Although the cumulative experience for optometry students was incomplete during this one-year study, first-year optometry students will eventually witness the progression of learning of the physician assistant students across the next three years of didactic instruction.

Readiness for Interprofessional Learning Scale (RIPLS)

FIGURE 1



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The Readiness for Interprofessional Learning Scale (RIPLS) survey was selected for this study because of its ability to evaluate student attitude and perception of IPE as well as its widespread use within research relating to IPE. The RIPLS survey was originally published by Parsell and Bligh and was revised by McFadyen, Webster and Maclaren **(Figure 1)**.[12,13] The RIPLS survey is a validated survey consisting of 19 questions used to measure student attitude towards: teamwork and collaboration (Items 1-9), negative professional identity (Items 10-12), positive professional identity (Items 13-16), and roles and responsibilities (Items 17-19). Items within the teamwork and collaboration subscale reflect student attitude towards cooperative learning and mutual respect for one another. A higher score implies that students value those qualities. Items within the negative professional identity subscale relate to stereotypes and biases. These items were reverse scored (e.g., Strongly Disagree = 5, Strongly Agree = 1) so that a higher score implies that students value the opportunity for cooperative learning. Items within the positive professional identity subscale relate to students' desire to improve communication and team skills, and a high score implies they value these shared learning experiences. Items within the roles and responsibilities subscale relate to students' own roles. A high score implies an unclear perception of their role within the team.

During the 2014-2015 academic year university orientation, prior to the start of didactic instruction, first year students in both programs were administered the RIPLS survey. In addition to the RIPLS survey, knowledge of the role/responsibility of the counterpart profession was evaluated using a survey asking the following open-ended questions:

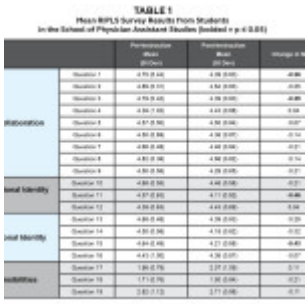
1. Identify 5 (or as many as you can) unique occupational duties of the counterpart profession. (For optometry students, identify duties of a physician assistant; for physician assistant students, identify duties of an optometrist)
2. What is the entry level of education needed to practice the counterpart profession?
3a. For physician assistant students: What is the difference between an optician, optometrist, and ophthalmologist?
3b. For optometry students: What is the difference between a nurse, nurse practitioner, physician assistant, and physician?

At the end of the 2014-2015 academic year, first-year students from both programs were re-administered the same surveys. In order to maximize participation, all participants were entered into a drawing for two $100 gift cards to Amazon.com. An application was submitted to the Institutional Review Board at Marshall B. Ketchum University, and the research was found to be exempt due to the anonymity of the surveys.

Statistical methods

A work-study student compiled the results of the two surveys into a Microsoft Excel spreadsheet. Items 10 through 12, which deal with negative professional identity, were reverse scored. Responses to the open-ended questions were classified for their accuracy based on the Occupational Outlook Handbook from the Bureau of Labor Statistics.[14,15] Excel was used to calculate the mean and standard deviation within the sample for the two surveys. Due to the anonymous nature of the survey responses and the unequal number of participants within the optometry student responses, an unpaired t-test was used to evaluate the statistical significance between the pre-instruction and post-instruction RIPLS survey results.

Results



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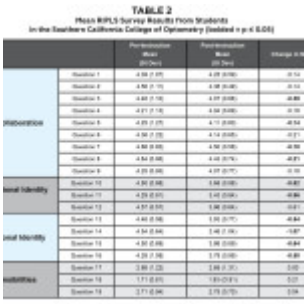
During the initial administration of the RIPLS survey and the survey on roles/responsibilities, 99 (99%) optometry students and 28 (100%) physician assistant students responded. During the re-administration of the surveys at the conclusion of the academic year, 92 (93.8%) optometry students and 28 (100%) physician assistant students responded.



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The results of the two administrations of the RIPLS survey are reported in **Table 1** for the physician assistant students. Prior to IPE instruction, physician assistant students generally considered themselves ready for IPC. As a result of the IPE instruction, physician assistant students demonstrated a statistically significant decrease ($p \leq 0.05$) in their readiness for IPC in two of nine questions within the teamwork and collaboration subscale, one of three questions in the negative professional identity subscale, and one of four questions in the positive professional identity subscale. The other 15 items within the RIPLS survey did not reflect a statistically significant change from pre-instruction to post-instruction.

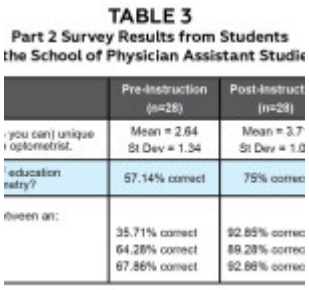

TABLE 3
Part 2 Survey Results from Students
the School of Physician Assistant Studie

	Pre-Instruction (n=28)	Post-Instruct (n=28)
you can) unique optometrist.	Mean = 2.64 St Dev = 1.34	Mean = 3.7 St Dev = 1.0
education istry?	57.14% correct	75% correc
ween an:		
	35.71% correct	92.85% correc
	64.28% correct	89.28% correc
	67.86% correct	92.86% correc

Click to enlarge

The results of the two administrations of the RIPLS survey are reported in **Table 2** for the optometry students. Prior to IPE instruction, optometry students also considered themselves generally ready for IPC. As a result of the IPE instruction, optometry students showed a statistically significant decrease ($p \leq 0.05$) in four of nine questions within the teamwork and collaboration subscale, two of three questions in the negative professional identity subscale, and four of four questions in the positive professional identity subscale. The other nine items within the RIPLS survey did not reflect a statistically significant change from pre-instruction to post-instruction.

With respect to understanding one another's roles and responsibilities, each student population was asked to identify the occupational duties of the counterpart profession **(Tables 3 and 4)**. As noted in **Table 3**, the physician assistant student cohort demonstrated an improvement in understanding of one additional job responsibility by the end of the academic year and a 17.86% increase in correctly identifying the entry level of education. At the end of the academic year, physician assistant students also showed an increased ability to correctly differentiate between the role of an optometrist (+25% change), optician (+57.14% change) and ophthalmologist (+25% change).

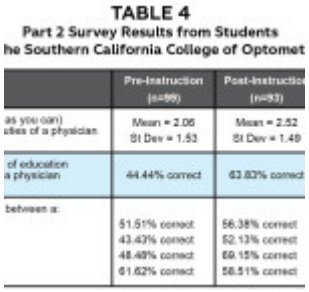

TABLE 4
Part 2 Survey Results from Students
he Southern California College of Optomet

	Pre-Instruction (n=99)	Post-Instructio (n=93)
as you can) ties of a physician	Mean = 2.06 St Dev = 1.53	Mean = 2.52 St Dev = 1.49
of education a physician	44.44% correct	63.83% correct
between a:		
	51.51% correct	56.38% correct
	43.43% correct	52.13% correct
	48.48% correct	69.15% correct
	61.62% correct	58.51% correct

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As noted in **Table 4**, the optometry student cohort demonstrated an improvement in understanding of 0.45 additional job responsibilities by the end of the academic year and a 19.38% increase in correctly identifying the entry level of education. At the end of the academic year, optometry students showed an increased ability to correctly differentiate between the role of a nurse (+4.87% change), nurse practitioner (+8.69% change) and physician assistant (+20.66% change) but a reduced ability to differentiate the role of the physician (-3.10% change).

Discussion

Kirkpatrick proposed a four-tiered framework for assessing learning outcomes in IPE: 1) learners' reactions: learners' view on the learning experience, 2) acquisition of learning: changes in knowledge, skills, competencies and attitude, 3) behavioral changes: the transfer of learning into workplace behavior, and 4) changes in organizational practice/changes to the organization.[16] Assessing learners' reaction to an IPE curriculum is a commonly employed outcome assessment of IPE. The results of our study were similar to the experience at Salus University where students' self-perception of their readiness to practice in an interprofessional collaborative setting entered at a high level and continued to remain high after instruction.[17] Although the results of the RIPLS survey showed statistically significant changes in some of the subscale items, the IPE curriculum is interpreted to have had no impact on student readiness for IPC. The limitation in this survey study was that measuring the impact of the IPE curriculum for the optometry students is premature due to their limited exposure of one course. At the time of the post-instruction survey, the optometry students had only taken one course with a lapse in time of about six months from the end of the course to post-instruction survey administration. Assessment of the impact of the IPE curriculum for optometry students will be more meaningful when the first-year optometry cohort completes its third and fourth years of study.

Most validated instruments for evaluating knowledge, skills and abilities focus on the knowledge of the instructor to deliver an interprofessional curriculum or evaluation of students' abilities through interview or observations of clinical care teams. Assessment of IPE outcomes often does not assess knowledge acquisition about other professions. The open-ended questions used in this study were an attempt to assess a change in students' knowledge of roles and responsibilities. Based on the results of the study, the IPE curriculum was able to increase students' knowledge of the professional roles and responsibilities of those they were learning with.

Barr described the outcome of IPE as having three main themes: 1) preparing students for collaborative practice, 2) learning to work in teams, and 3) rendering services within an interdisciplinary team to improve care.[18] Bridges et al. described the IPE training model at three universities in which the curricula included three common components: 1) a didactic program, 2) interprofessional simulation experience, and 3) a community-based experience.[19] Thus, to prepare students with the knowledge, attitude and behavior for interprofessional collaborative practice, an IPE curriculum needs to include more than shared classroom experiences. It should also provide hands-on clinical opportunities within patient simulation and actual patient care.[21]

Conclusion

Best practices and key features of IPE for training health professionals to work together effectively are not yet established. Even less established is the understanding by other providers of the role of an optometrist in contributing to an interprofessional collaborative team.[21] Marshall B. Ketchum University continues to refine its IPE curriculum with a focus on applying the lessons learned from the first iteration of the didactic curriculum and the additional focus of seeking IPE opportunities within co-curricular activities and culminating clinical experiences in model IPC settings.[22]

Acknowledgement
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Initial Evaluation of an Optometric Outreach Educational Program

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PDF of Article

Background

Experiential learning is key in the education of healthcare professionals.[1] It is a significant and valued component in the education of third- and fourth-year optometry learners at the University of Waterloo School of Optometry and Vision Science (WOVS). As part of the clinical program, external geriatric and pediatric services are provided by optometrists and students to underserved populations at several facilities including nursing and retirement homes, elementary schools and public health facilities. The populations served include the elderly, children, people with special needs and Mennonite communities throughout the region. The intended purpose of this program is to improve the quality of life of those populations, while providing optometry students with a rich clinical experience to develop the competencies needed to continue this care within their own community after graduation. Evidence shows that the introduction of a clinical outreach program does produce this intended result.[2]

Curricular planning based on predetermined outcomes is standard in healthcare education.[3] An important component of curriculum development is program evaluation, which determines whether intended (or unintended) outcomes are achieved and provides feedback for improvement and enhancement.[4]

Several different models of program evaluation are used to assess outcomes or process depending on the need. For this study, we chose to follow the Kirkpatrick Model, which is a common method for evaluating the outcomes of a training program.[4] It is comprised of four levels: reaction, learning, behavior and results. In the reaction level, students subjectively report whether they like or are satisfied with a specific educational program. The second level, learning, determines whether the students have acquired the intended knowledge, skill or judgement. Level three, behavior, sets out to determine whether the program has influenced or changed a student's future method of practice by applying what was learned. Level four, results, evaluates whether the program has achieved the desired outcomes.[5] The anticipated result of implementing the outreach experience is improved quality of life for underserved populations through better healthcare provision.

The Outreach Experiential Program at WOVS

Optometry students at WOVS are first introduced to direct patient care one day per week in the third year of the educational program. Students are scheduled in external clinics (geriatric and pediatric) three to four days in the third year clinical curriculum and one to three days (geriatric only) in the fourth year. The eye examinations are conducted by the students under the direct supervision of a registered (licensed) optometrist. The external geriatric service provides routine and focused optometric care that includes therapeutic management of disease and low vision rehabilitation to 20 long-term-care and retirement facilities in the Kitchener-Waterloo and surrounding region. The external pediatric service provides full eye examinations with an emphasis on binocular vision to approximately 12 facilities and schools. The eye examinations are conducted for both clinics utilizing portable and handheld equipment.

The outreach clinics have continually grown since their inception in 2004. This research is intended to evaluate these services at the level of learner reaction in order to obtain useful information to improve the program.

Methods

TABLE 1
Learner's Satisfaction Survey with Raw Data

Click to enlarge

The study received clearance from the University of Waterloo Office of Research Ethics, which follows the principles of the Declaration of Helsinki. A questionnaire was derived from a validated survey developed by the Veterans Affairs Learners' Perceptions Survey Steering Committee from 1999-2001.[6] This particular survey was chosen because it was created specifically to evaluate the satisfaction of students with their medical education, which is similar to the intent of this study. Demographic information, including the gender of the respondents and the number of external clinic days experienced, was collected. The survey was divided into specific questions related to satisfaction with four domains: faculty/preceptors, learning environment, working environment, and physical environment. The responses were obtained using a five-point Likert scale (very satisfied, somewhat satisfied, neither, dissatisfied, very dissatisfied). The survey concluded with a global measurement of overall satisfaction with the training program graded on a scale from 0-100.

The survey was adapted for the outreach program study. Two demographic-type questions were added regarding student gender and total days assigned to external clinics. A sixth point (not applicable) was added to the Likert scale for the outreach program survey as there were several questions that pertained particularly to medical education and had the potential to falsely increase the numbers of those dissatisfied with the optometric program. **Table 1** shows the survey.

The paper survey was given to 90 optometry students at the end of the third year of their program (April 2013) after eight months of clinical education experience. It was administered anonymously by an independent individual who was a Vision Science Master's candidate and neither a member of the research team nor a supervisor in outreach clinics. The students were familiar with the individual through previous laboratory teaching. The survey was administered during regularly scheduled classroom activity for 10 minutes. Participation was voluntary. Students left completed or uncompleted surveys on a table as they left the classroom.

The overall satisfaction responses were tabulated and percentages were calculated. The data retrieved for overall satisfaction for each domain were calculated in the same manner. The responses to specific questions in each domain were also reviewed. Percentages of those satisfied were calculated based on the sum of "very satisfied" and "somewhat satisfied" responses. Not applicable (N/A) responses were removed from the total count.

Results

TABLE 2
Learner's Satisfaction Survey with Tabulated Results

CLINICAL SUPERVISORS		LEARNING ENVIRONMENT		WORKING ENVIRONMENT		PHYSICAL ENVIRONMENT	
	#/n (%)		#/n (%)		#/n (%)		#/n (%)
Clinical skills	79/83 (95)	Degree of autonomy	68/81 (84)	Faculty/preceptor morale	72/84 (86)	Availability of phones	13/28 (46)
Approachability/ openness	73/83 (88)	Time working with patients	68/82 (83)	Patient record system	37/84 (44)	Convenience of location	34/80 (43)
Teaching ability	75/82 (90)	Degree of supervision	77/83 (93)	Computer access	6/21 (13)	Lighting	22/63 (35)
Patient-oriented	72/83 (84)	Preparation for future training	48/82 (59)	Call schedule	12/32 (38)	Personal safety	72/84 (82)
Interest in teaching	71/84 (85)	Preparation for clinical practice	51/82 (62)	Peer group morale	62/76 (82)	Heating and air conditioning	54/80 (68)
Accessibility/ availability	75/82 (92)	Spectrum of patient problems	61/81 (75)	Workspace	42/82 (52)	Facility maintenance/ upkeep	58/79 (73)
Fairness in evaluation	59/84 (82)	Access to specialty expertise	39/77 (51)	Internet access	8/36 (20)	Facility cleanliness/ housekeeping	60/80 (75)
Being role models	71/84 (85)	Quality of care	46/82 (56)	Orientation program	14/60 (23)	Parking	66/80 (82)
Timeliness of feedback	70/84 (83)	Patient safety	65/80 (79)	Laboratory services	5/16 (33)	Maintenance of equipment	36/75 (51)
		Amount of scut work	13/26 (48)	Radiology services	1/9 (11)	Availability of needed equipment	50/77 (65)
		Interdisciplinary approach	34/72 (47)	Ancillary/support staff: morale	28/56 (50)	Call rooms	3/17 (18)
				Ancillary/support staff	27/61 (53)	Food on call	1/15 (7)
				Library services	18/33 (55)		
Overall satisfaction	71/77 (92)	Overall satisfaction	55/75 (73)	Overall satisfaction	44/73 (60)	Overall satisfaction	59/74 (80)

 # = number satisfied
n = total respondents with 'not applicable' responses removed
% = percent satisfied tabulated from combined 'very satisfied' and 'somewhat satisfied' responses

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The response rate for the survey was 97%. Approximately 68% of respondents were females, and 68% of those who participated were scheduled in outreach clinics three to four days within the last academic year. Overall, students were satisfied with the outreach program, which received an average rating of 76 out of 100 (range of 40-95). The remaining results of the survey are presented in **Tables 1 and 2**. Students were most satisfied with the clinical supervisors assigned to the outreach program with an overall satisfaction score of 92%. They were not as satisfied with the remaining domains with overall satisfaction scores of 73% for learning environment, 60% for working environment, and 68% for physical environment. Within the clinical supervisor domain, students were most appreciative of the supervisors' clinical skills (95%) and teaching ability (90%), but were less satisfied with the evaluation received (82%). In the learning environment section, students were satisfied with the degree of supervision (93%), but less than half were satisfied with the interdisciplinary approach and the amount of scut work such as preparing the room (47% and 48% respectively). Approximately two-thirds were satisfied with the preparation for future training and clinical practice. In the working environment section, students were satisfied with faculty/preceptor morale (86%), but the vast majority of the remaining components were considered to be not applicable to the optometry experience as is evident from the lack of response to these categories. Many were not satisfied with the access to computers or the internet (13% and 20% satisfied respectively). Only 52% were satisfied with the workspace available, and 23% were satisfied with the orientation program. In the physical environment component, students were most satisfied with personal safety and parking but felt that call rooms and food on call were not applicable to the program. Only 39% of the students were satisfied with the lighting available and 51% were satisfied with maintenance of optometric equipment.

Discussion

The intended outcome of the outreach program is to positively impact the quality of life of those served through better healthcare provision achieved by graduating students with the competencies necessary to continue this service provision. Seniors residing in collective dwellings have significantly higher rates of ocular disease (3-15 times) than those living in community.[7] They are also likely to have uncorrected refractive error.[8] Visual impairment has been associated with increased falls, social isolation and depression.[9,10] While there is an increased demand for care due to an aging population,[11] providers have varying opinions about the elderly and a low interest in caring for them.[12] The solution, however, may be increased exposure to positive experiences with caring for the elderly[12] and interaction with satisfied optometrists and mentors who practice geriatric optometry.[13] Similarly, vision disorders are common among the pediatric population in Canada, with an estimated 25% of children between the ages of 0-18 years affected. At six months of age, manifestations of strabismus, high refractive error, and anisometropia can be detected.[14] While treatment varies depending on the severity of the condition, early diagnosis is preferred.[15] Providing timely access to care may contribute to an improved quality of life and, in some cases, help alleviate the need to utilize the social and healthcare resources within the Canadian healthcare system.

This study demonstrated that optometry students are satisfied overall with the outreach clinic program; however, several areas needing improvement were highlighted. The response rate was quite high, possibly as a result of the convenience of completing the survey during the last 10 minutes of regularly scheduled class time. In the clinical supervisors section, students were most content with the clinical skills and teaching ability of the supervising optometrists, who was seen as role models. The overall satisfaction rate for clinical supervision was high. Satisfaction with supervisors to the extent that they are viewed

as worthy role models has been demonstrated as a key component to continued provision of services.[13]

Students were least satisfied with the fairness in evaluation and timeliness of feedback. It is suspected that this lack of satisfaction may have been a significant contributor to the overall satisfaction rating of the outreach program.[16] This is likely from a misalignment of the learning objectives, learning opportunities and evaluation methods. Students are evaluated with a global rating scale on five components of the oculo-visual examination. The scale range is from 40-100 with 70 set as the pass score. Students are evaluated separately on case history and counseling; technical ability; diagnosis and management; record-keeping; and efficiency. The benchmark is the examination of a normal adult patient. At the outset of the third-year optometry training, students have demonstrated the ability to assess normal adult populations, but have not yet acquired the skills needed to assess children and the elderly. They have not been taught many of the techniques required to conduct an examination with only portable equipment such as Perkins tonometry, direct ophthalmoscopy, handheld biomicroscopy, trial-frame refraction, and Mohindra retinoscopy nor have they had didactic teaching in geriatrics and pediatrics. A sufficient knowledge base is necessary for the development of clinical reasoning.[17] It is necessary to provide learning opportunities situated at the level of the student's education to have an effective program. Interaction with patients leads to further competence development and greater self-confidence, which, in turn, promotes greater competency,[18] but conducting examinations without adequate preparation leads to defeat and lack of confidence in abilities. These factors make evaluation difficult and frustrating for both students and supervising clinicians. Students were scheduled into these external programs as a result of curriculum scheduling challenges rather than optimum educational experience. In addition to fairness in evaluation, just more than half of the students were satisfied with the program's ability to assist in preparation for future training or clinical practice. This may also be due to an insufficient number of exposures to practice.

Although the care provided in an external setting often involves extensive interaction with multiple individuals (personal support workers, doctors and nurses in geriatrics; and parents, social workers and teachers in pediatrics) students reported low levels of satisfaction with the interdisciplinary approach to care.[19,20,21] Students may be unaware of the interprofessional collaborations that occur because most take place before or after the actual examination and may not directly involve the student. Attention to actively involving the student in these discussions is warranted.

Many students were not satisfied with the working environment or physical environment of the external clinical program. This is likely tied to the dissatisfaction reported (23% satisfied) with the orientation program. The workspace is often limited to what the facility (elementary school, long-term-care facility, etc.) can provide and varies greatly from what students are familiar with. The optometry program representatives have limited control over workspace provided beyond discussing ideal conditions for adequate assessment (size, lighting, access to sink, etc.). In order to address these issues, all students are provided with a handbook outlining the administrative processes, recommended techniques to review, and clinical pearls for conducting the external examination. In addition, one day at Waterloo Optometry and Vision Science at the beginning of third year is set aside to introduce students to the techniques they will be using. This does not provide sufficient preparation for the outreach clinic setting. Lack of satisfaction with maintenance of handheld optometric equipment is often a result of an inability to conduct timely maintenance due to limited supply of equipment available.

In order to address these issues, the learning objectives need to be revised, the timing and expectations of participation in the external programs within the clinical experience needs to be changed, the number of clinical encounters needs to be increased, and the student evaluation method needs to be improved to align with the actual expectations of student performance. A full discussion of student evaluation methods is beyond the scope of this paper.[22] It is recommended that introduction to participation in external clinics should begin with observation (legitimate peripheral participation) and progress to full patient care by the end of the final year of training. To recognize the nature of the multidisciplinary approach within an outreach clinic, students should be encouraged to participate in the collaborations with other disciplines or asked to reflect on how these collaborations occur to help the patient. Laptop computers should be provided to allow access to electronic medical record forms as well as the internet. Additional equipment should be acquired to allow for timely maintenance.

Two drawbacks to this study have been identified. First, the survey grouped together both the external pediatric and geriatric clinical experience. Separation of the clinics for this evaluation would allow for further analysis and potentially more targeted improvements. The second drawback was the chosen program evaluation method. Educational programs are closely equated to a social system where there are interactions between the various components (including students and supervising optometrists) and with the environment.[4] These interactions are not necessarily linear wherein satisfaction with a program leads to better learning which leads to more change in behavior.[23] The Kirkpatrick Model is ideal for evaluating educational program outcomes, which was the intent of this study.

This study has shown that students are satisfied with the outreach experience. Further evaluation is needed to fully appreciate the program's effectiveness and to determine whether the intended outcomes are achieved. Future studies are planned with the same group of students and the second and third levels of the Kirkpatrick Model of training evaluation.

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Coming in August

| Optometric Education: Volume 41 Number 3 (Summer 2016)

PDF of Article

Stay tuned to your Inbox for the announcement that the Summer 2016 issue of *Eye on Education* — the online newsletter from the Association of Schools and Colleges of Optometry (ASCO) — is available.

The issue will include an interview with **ASCO's new President Karla Zadnik, OD, PhD,** the Glenn A. Fry Professor of Optometry and Physiological Optics and Dean at The Ohio State University College of Optometry. The issue will also include the latest news about ASCO initiatives and activities as well as items of interest from the schools and colleges of optometry and the Association's corporate partners.

Also: Visit ASCO's website to take advantage of a variety of resources, including "Career Opportunities for ODs in Academia: Teaching & Research Needs," a PowerPoint module that explores the need for increasing the faculty ranks at optometric institutions.

Perceived Enhanced Clinical Readiness for Second-Year Optometry Interns

Fuensanta A. Vera-Diaz, OD, PhD, FAAO, and Catherine Johnson, OD, FAAO | Optometric Education: Volume 41 Number 3 (Summer 2016)

PDF of Article

Introduction

Healthcare educators increasingly recognize the benefits of early, direct exposure to patient care,[1,2] defined as authentic patient contact in a clinical setting that enhances learning.[3] Benefits of early exposure to patient care include developing comfort with patients, developing efficient clinical skills, encouraging active learning, making learning more relevant, and reducing difficulty with transition to clinical practice.[1,3-6] However, increasing demands on clinicians and clinical settings pose barriers to training through direct patient care.[7] The attention and time dedicated to on-site clinical teaching has been eroded by the need for clinicians to take on more administrative tasks while simultaneously being more productive. This leaves clinical preceptors less time to dedicate to teaching basic clinical skills and concepts. At the same time, advances in knowledge and technology have expanded the skills required of optometrists.[7,8] In order for optometry students to acquire these skills by the time they graduate, they must become clinically proficient earlier in their student career so they can take most advantage of their clinical experiences as they progress through the curriculum.[4,9]

During the first year at New England College of Optometry (NECO), students receive the majority of their didactic training on clinical topics in the Principles and Practices of Optometry (PPO) course series. Historically, this course series had included weekly lectures and laboratories throughout the fall and spring semesters of the first year. After a three-month break during the first summer, clinical preceptors noted a significant attrition of clinical skills and knowledge when students returned for the fall semester of second year. Students required a significant "ramp up" refresher period to reach the level they had attained at the end of the first year spring semester. Moreover, internal discussion and anecdotal observations indicated that students needed to be proficient in additional skills prior to entering second year if they were to meet the clinical sites' demands and play an active role in the clinical setting (e.g., slit lamp evaluation, Goldmann tonometry). These additional skills were not included in the old PPO curriculum.

In response to these needs, the first year PPO curriculum was modified significantly to include a more concentrated delivery of didactic and laboratory material and the addition of a summer term that included practice patient experiences. The purpose of this study was to evaluate the impact of these changes in NECO's first-year PPO course series on students' perceived clinical readiness as they entered second-year patient care clinical assignments (Patient Care II). Based on clinical goals identified by NECO's clinical educators, we defined "clinical readiness" as competence and confidence in performing clinical skills necessary to play an active role in clinic[1,2,5,6,9] with the specific goal of completing a routine eye exam up to the point of dilation in an efficient manner in Patient Care II assignments.

Methods

NECO's optometry doctorate program

NECO's primary educational program is a four-year Doctorate of Optometry program. Pre-admission requirements include the completion of at least three years of undergraduate preparation with specific coursework. The class size is typically 120-130 students, and students in each class progress through each component of the curriculum at the same time. Students participate in the didactic curriculum during the first three years, with a greater emphasis on general optometric clinical courses (PPO) and basic science courses during the first year and increasing emphasis on more specialized and clinical courses in the second and third years.

NECO's clinical curriculum begins in first year with an active role in vision screening assignments in addition to observations in various optometry settings (Patient Care I). Students are assigned to clinic at least eight hours per week during their second year (Patient Care II) and at least 12 hours per week during third year (Patient Care III). NECO does not have a large, central clinic dedicated to clinical education. Rather, NECO's sites for clinical education include a number of smaller affiliated

satellites, as well as community health centers, hospitals, private practices and commercial settings.

Study protocol and procedures

Survey instruments (Appendix I; delivered using online tool surverymonkey.com) were developed to evaluate the impact of the PPO track curricular changes, the intervention, on students' clinical readiness as they entered Patient Care II. The surveys were delivered to all entering Patient Care II students and preceptors during the fall semester in 2014 (old curriculum) and 2015 (new curriculum) by NECO's Office of Clinical Education. No incentives were provided. Students had participated in Patient Care II clinics for three to four weeks at the point of receiving and answering the survey.

The impact of the intervention was evaluated using three outcome measures that were compared between students enrolled in the old curriculum (Patient Care II in 2014 – OD'17), as controls, and students enrolled in the new curriculum (entered Patient Care in 2015 – OD'18). The specific outcome measures were:

1. Level of active participation in patient care in clinic. **Table 3** provides a detailed summary of the skills students were expected to be able to perform
2. Preceptor and student perception of confidence in clinic
3. Preceptor and student perception of competency in clinic

Intervention: specific curriculum changes implemented

The intervention was comprised of significant changes to the first-year optometric curriculum. These changes included expansion of the learning objectives to emphasize clinical readiness, a concentrated delivery of didactic and laboratory material, introduction of skills that previously were not introduced until second year, and the addition of a summer term that included practice patient experiences.

TABLE 1
Learning Objectives for the Old and New PPO Course Series

OD'17 (Old Curriculum)	OD'18 (New Curriculum)
1. Acquire the knowledge, technical skills, professional attitudes and ethics needed to participate in patient care	1. Demonstrate scientific and theoretical foundations that foster critical and clinical thinking through didactic evaluation 2. Complete a primary eyecare examination up to the point of dilation; students will be expected to be efficient and accurate in their clinical techniques, recording and case presentation to the preceptor 3. Diagnose and prescribe for common refractive errors, including writing an assessment and plan for refractive conditions 4. Accurately describe normal and abnormal findings using clinical terminology 5. Complete contact lens training for soft and rigid gas permeable contact lenses 6. Accurately perform automated pre-testing and diagnostic testing 7. Use topical diagnostic agents in a safe and appropriate manner, including proper installation, with understanding of indications and contraindications and how to educate patients about the effects of these agents 8. Upon entering Patient Care II, apply professional skills that are essential to clinic flow and positive interactions with patients, preceptors and staff 9. Demonstrate effective communications with patients and preceptors 10. Demonstrate cultural competence

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The curriculum changes were made in accordance with NECO's policies and procedures; a curriculum need was identified, feedback was gathered from didactic and clinical faculty and administration, and a proposal for curriculum change was developed. This proposal was presented to NECO's Curriculum Committee, comprised of faculty from each department and student representatives. Once vetted and approved by the Curriculum Committee and subsequently the Dean of Academic Affairs, the curriculum changes were implemented. While some of the surveyed preceptors provided input during the curriculum redesign and participated in aspects of implementation, none of the surveyed preceptors was responsible for the development of the new curriculum.

The learning objectives, course structure and content for the old and new PPO course series are summarized in **Tables 1 and 2**, respectively. In both the old and new curricula, the first-year PPO courses were associated with the clinical course Patient Care I: vision screenings and observations.

TABLE 2
Structure and Content of the PPO Course Series

Course Structure	OD'17 (Old Curriculum)		OD'18 (New Curriculum)		
	Fall (PPO1)	Spring (PPO2)	Fall (PPO1)	Spring (PPO2)	Summer (PPO3)
Time frame	Sept-Dec 2013	Jan-May 2014	Sept-Dec 2014	Jan-May 2015	July-August 2015
Number of weeks	12	15	12	15	7
Lecture (hrs/week)	3	3.25	**3.25**	3.25	**3.25**
Laboratory (hrs/week)	2	2	2	2	**3.25**
Clinical simulations (hrs/week)	N/A	N/A	N/A	N/A	**3.25**
Self-study	Paper homework		**Online pre- and post-lecture homework** **Clinical skills demonstration videos**		
Examinations	Midterm Exam Final Exam Clinical Skills Exam	Midterm Exam Final Exam Clinical Skills Exam	Quizzes (2) Midterm Exam Final Exam Clinical Skills Exam	Quizzes (2) Midterm Exam Final Exam Clinical Skills Exam	Quizzes (2) **Clinical Skills Exam**
Course Content	**OD'17 (Old Curriculum)**		**OD'18 (New Curriculum)**		
	Fall (PPO1)	Spring (PPO2)	Fall (PPO1)	Spring (PPO2)	Summer (PPO3)
Lectures topics	Entrance Tests, HIPAA, Record Keeping, Communication, Screenings, Theory of Refraction, Keratometry, Lensometry, Ophthalmoscopy	Basic Science & Management of RE, Subjective Refraction, Case History, CL, Slit Lamp, Tonometry, Common Eye Diseases, BV, Introduction to LV	**Introduction to Visual System, Entrance Tests, HIPAA, Communication, Screenings, Principles of Refraction, Lensometry, Subjective Refraction, Case History, Record-Keeping**	**Slit Lamp, Normal Variations, Topical Diagnostics, Exam Flow, Epidemiology, Development & Management of RE, Keratometry & Topography, BV, Ophthalmoscopy & Optic Nerve, Tonometry, VF, EHR, Introduction to LV, Case Discussion**	**Communication (Doctor/Patient, Preceptors, Cultural and Social Differences, Sensitive Issues), CL (solutions, I & R, education, over-refraction), Trial Frame, Social Responsibility, Teller Your Exam, Common Pitfalls & Clinical Pearls**
Laboratories topics	Orientation, Entrance Tests, Lensometry, Keratometry	Retinoscopy (+/-), Subjective Refraction (+/-), Ophthalmoscopy, Case History, Near Acts, CL, Slit Lamp (+/-), BV (+/-)	**Hygiene and Policies, Entrance Tests, Screenings, Trial Frame, Lensometry, Retinoscopy (+/-)**	**Case History, Rationale, Lensometry, Entrance Tests, Retinoscopy and Refraction with Phoropter (+/-), Slit Lamp (+/-), BV Tests (+/-), Near Add, Ophthalmoscopy**	**Slit Lamp, Tonometry, VF, CL (I & R), CL Education, EHR, Trial Frame Refraction, Lensometry**
Clinical simulations topics	N/A	N/A	N/A	N/A	**Timed Exams in Classrooms, Simulated Case Histories, Practice Patients, Case Presentation, Clinical Readiness**
Clinical skills exam	Vision Screening Tests (student patient)	Entrance Tests and Refraction (student patient)	Vision Screening Tests (student patient)	Entrance Tests, Refraction, Slit Lamp (student patient)	Entrance Tests, Refraction, Slit Lamp, GAT (peer-student pair/preceptor)

Additional details regarding curricular changes are provided in the text.
Topics and skills added to the new curriculum (the intervention) are indicated in bold font.
RE = refractive error; BV = binocular vision; VF = visual field; CL = contact lenses; LV = low vision; EHR = electronic health records; I & R = insertion & removal; GAT = Goldmann applanation tonometry

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The overall emphasis of the new PPO course series was clinical readiness. For this purpose, a significant amount of lecture time was allotted to case-based discussion with common clinical scenarios relevant to topics taught in each course of the sequence (e.g., screening scenarios in PPO1).[11] These case-based discussions were team-taught, with participation of didactic and clinical faculty. Laboratories were redesigned to be additive, with each skill reinforced in several laboratories throughout the year, increasingly integrated into a typical clinical sequence. These new laboratories also emphasized correlation of findings as well as accurate and efficient performance of procedures and recording. Specific objectives and metrics to monitor student performance were included in each laboratory. In the old curriculum, there was less emphasis on case-based discussion and correlation of findings, and less integration of skills into a typical clinical sequence. No major content topics where removed following these curricular changes. The additions were possible due to reorganization and streamlining of these courses and the addition of the Principles and Practice of Optometry 3 (PPO3) course.

One major change in the new PPO curriculum was the addition of the summer course (PPO3). This course was comprised of seven teaching weeks and was primarily laboratory and clinically based. **(Table 2)** The PPO3 course included practice patient experience with direct supervision and feedback from clinical preceptors. The purpose of the practice patient experience was to expose student clinicians to naïve patients who are more likely to respond as real patients to the student's demeanor, instructional sets and test, rather than classmates who are familiar with the testing being performed. Practice patients were also introduced to reduce the "shock value" of seeing real patients in a busy clinical setting.[5,6,12]

Volunteers were recruited by the students to serve as practice patients for the PPO3 clinical simulations sessions. Each student recruited one patient for week four and one patient for week six of the course. These patients were examined by students other than those who recruited them. Students were provided with specific criteria for the recruitment of practice patients, such as age between 18 to 80 years, corrected vision of 20/40 or better in the best eye, and no relation to optometry (e.g., not an optometrist, optician, technician, optometry student, faculty member). Each student examined a total of five practice patients during his or her clinical simulations sessions. The practice patients were compensated $25 for each two-hour session. Other resources associated to the implementation of this course were exam lanes (one per student), additional clinical preceptors (preceptor:student ratio 3:19) and additional equipment.

In both the old and new curricula, one clinical skills practical exam was administered during the fall (PPO1) and during the spring (PPO2) of first year. A comprehensive clinical skills practical exam with non-optometry presbyopic patients was added during the summer between the first and second year. **Table 2** shows details on the topics for each clinical skills exam. Students were required to pass the skills exam in order to progress through the clinical curriculum.

Strong collaboration between the clinical and didactic faculty was key to integrating the PPO courses with the clinical programs. Clinical faculty were integrated as screening preceptors (Patient Care I) and PPO laboratory instructors, with distinct and planned roles. Additionally, tools for student self-learning and opportunities for self-evaluation such as pre-lecture videos, hands-on homework assignments, case assignments, and quizzes were implemented. Alternative teaching approaches utilizing new technology and hybrid teaching were incorporated.

Subjects

All students enrolled in the NECO Patient Care II program in the fall of 2014 (OD'17; n=134; 90 female, 44 male) and fall of 2015 (OD'18; n=125; 90 female, 35 male) were surveyed. All clinical preceptors for the NECO Patient Care II program were surveyed (n=60 in 2014 and n=61 in 2015). A total n=49 preceptors were surveyed both years.

Patient Care II students were assigned to a wide range of clinical settings: NECO affiliated clinics, community health centers, hospitals, private practices and commercial practices. The clinical focus of the majority of these sites was primary eye care, while approximately one third of these sites provided specialized eye care such as low vision, pediatrics or advanced contact lenses. The ratio of clinical preceptors to students was very similar across the settings, with a trend towards a lower ratio of students per preceptor in private practice and commercial settings.

This research followed the tenets of the Declaration of Helsinki. NECO's Institutional Review Board reviewed and approved this study. Informed consent was not required as participation in the surveys was anonymous.

Data analyses

Statistical analyses were performed using JMP 10.0 (http://www.jmp.com/). Group data for student and preceptor perception of students' expectations for Patient Care II clinics (Question 1) before (OD'17, fall 2014) and after (OD'18, fall 2015) the implementation of the new curriculum were compared using Wilcoxon signed-rank non-parametric tests (0.05 significance level). Expectations for individual skills for each year were evaluated using Chi Square test for each item (0.05 significance level). Group data for student and preceptor perception of students' confidence, professionalism and communication skills (Question 2a) and perception of students' clinical competence (Question 2b) were evaluated using Wilcoxon Rank Sum non-paired, non-parametric tests (0.05 significance level).

Student and preceptor answers to open-ended Question 3 were grouped into the major response categories described in **Table 5**. Each verbatim comment provided by the subjects was independently coded by the authors and included in one of the major response categories. A subsequent qualitative code analysis was conducted.

Results

The response rate for students was 91/134 (68%) in the fall of 2014 and 112/125 (73%) in the fall of 2015. The response rate for the Patient Care II clinical preceptors online survey was 30/60 (50%) in the fall of 2014 and 35/61 (57%) in the fall of 2015.

TABLE 3

Students and Preceptor Answers to Survey Question 1

[Expectations about what skills OD students were going to perform in Patient Care I before (2014) and after (2015) curriculum changes]

	2014 (OD'17)		2015 (OD'18)	
	Students	Preceptors	Students	Preceptors
Observe OD3 or OD4 students	60.47	48.00	50.77	58.00
Observe preceptors	78.90	70.00	62.26	91.76
Welcome patients	83.72	83.33	86.79	79.41
Automated pre-testing	52.33	46.00	51.89	58.00
Manual tonometry	87.44	70.00	71.70	79.41
Case history	87.21	80.00	86.81	88.24
Entrance tests	95.35	96.67	89.62	91.18
Static retinoscopy	88.60	73.33	88.81	79.47
Subjective distance refraction	88.23	80.00	90.62	79.41
Near refraction	**83.48***	**73.33**	**74.53***	73.53
Undilated anterior segment slit lamp exam	**83.72***	**86.67***	**74.53***	**76.47***
Undilated fundus examination using ophthalmoscope	**12.79***	**36.66***	**33.96***	**47.06***
Undilated fundus examination using slit lamp	**6.98***	**26.66***	**22.64***	**32.35**
Drops instillation	82.33	83.33	74.53	73.53
Dilated fundus examination using slit lamp	65.91	23.33	16.04	32.35*
Dilated fundus examination using BIO	69.33*	23.33	14.15*	32.35*
Contact tonometry	**13.95***	**46.66***	**62.26***	**47.06***
Binocular vision testing	10.47*	36.66	19.81	32.35
Vision therapy	8.00	6.67	1.89	8.00
Automated visual field testing	26.74	40.00	37.74	47.06
Soft CL I&R	19.77	46.66	28.47*	44.12*
RGP CL I&R	18.47	10.00	13.21	8.82
Contact lenses filling	4.65*	26.66	14.15	26.47
Patient education	**36.74***	**16.67***	**66.35***	**38.29***
Optical dispensing and optical work	22.09	50.00*	16.04	44.12*
Automated corneal topography	11.63	6.67	19.81	8.82
OCT	23.26	36.67	44.34	41.18
Fundus photography	26.74	36.67	39.62	38.29

Numbers indicate the percentage of respondents who listed that skill as an activity expected to be performed in clinic
*Values with * indicate significant difference between student and preceptor surveys in each year (Chi Square test for each item, 0.05 significance level)*

Values with ♯ indicate significant difference between 2014 and 2015 in the number of students or preceptors who reported to perform this activity (Chi Square test for each item, 0.05 significance level); these skills and percentage values are also indicated with bold font

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Results of the 2014 preceptor survey (Appendix I, Question 4 for preceptors) corroborated initial discussions and anecdotal evidence suggesting that preceptors would be interested in giving second-year students additional patient care responsibilities if they had previously developed those skills. Most preceptors (86% of those who responded) would be interested in giving second-year students additional patient care responsibilities such as performing anterior segment evaluation with slit lamp and Goldmann tonometry. Additionally, preceptors reported a need for students to improve efficiency in conducting a comprehensive exam up to the point of dilation upon entering their second year if they were to be allowed to conduct more independent exams on patients during their Patient Care II assignments. Therefore, the curricular changes described in the methods section were implemented.

The student and preceptor perception of students' expectations for Patient Care II clinics were compared between the class before (OD'17, fall 2014) and after (OD'18, fall 2015) the implementation of the new curriculum. **(Table 3)** These data were obtained from Question 1 of the surveys. **(Appendix I)** A significant improvement in the correlation of preceptors and students expectations for Patient Care II clinical assignments was found for the group of skills surveyed (Wilcoxon Rank, p=0.04).

The specific techniques that were ranked higher in 2015 than 2014 were near refraction in presbyopes, anterior segment evaluation using a slit lamp, undilated fundus evaluation, contact tonometry and patient education. The general expectations of preceptors and students for what activities the students should be able to perform in Patient Care II (Question 1) were higher in 2015 than 2014, **(Table 3)** even for certain techniques that were not emphasized in the new curriculum, e.g., ophthalmoscopy, or techniques that students had not yet learned in the PPO track, e.g., dilated fundus evaluation using a binocular indirect ophthalmoscope. Preceptors had higher expectations than students both years, but their expectations were closer to students' in 2015 (cumulative rating preceptors 2014: 44.4, students 2014: 37.0; preceptors 2015: 50.5, students 2015: 44.4).

Numbers indicate average ranking for each question (1-Strongly Disagree, 2-Disagree, 3-Neither Disagree nor Agree, 4-Agree, 5-Strongly Agree)
A higher number indicates a better ranking; items 1 through 8 are relevant to student confidence and attitude (Question 2a); items 9 through 18 are relevant to student competence in clinic (Question 2b)

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The student and preceptor perception of students' confidence and competence in Patient Care II clinics were compared between the class before (OD'17, fall 2014) and after (OD'18, fall 2015) the implementation of the new curriculum. **(Table 4)**

Items 1 through 8 of Question 2a were related to perception of student confidence and attitudes. Answers to these questions revealed a trend towards student perception of their confidence and attitude being higher than their preceptors' perception, although this difference was not significant (Wilcoxon Rank Sum, S=-1.8, p=0.78) (mean rating for items 1-8 was 4.17 for 2014 and 4.20 for 2015). No significant changes were found from 2014 to 2015 (Wilcoxon Rank Sum, S=-3, p=0.67).

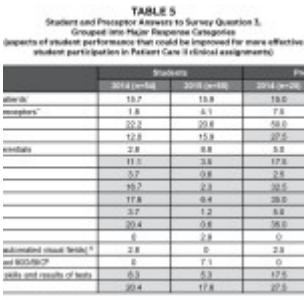

TABLE 5
Student and Preceptor Answers to Survey Question 3,
Grouped into Major Response Categories
(aspects of student performance that could be improved for more effective student participation in Patient Care II clinical assignments)

	Students		
	2014 (n=54)	2015 (n=85)	2014 (n=29)
	13.7	13.9	13.8
	1.8	4.1	7.6
	22.2	20.6	58.0
	12.8	15.9	27.5
	2.8	8.8	3.8
	11.1	3.6	17.6
	5.7	0.6	2.5
	16.7	2.3	20.5
	17.8	0.4	28.0
	3.7	1.2	8.8
	20.4	0.6	36.0
	0	2.8	0
	3.8	0	2.8
	0	7.1	0
	5.3	5.3	17.5
	20.4	17.8	27.5

Numbers indicate the percentage of subjects (students or preceptors) who gave a response that was included in the specific response category (higher numbers indicate that more subjects thought that area or skill needed improvement in order to more effectively participate in Patient Care II clinics)
The categories that improved from 2014 to 2015 are indicated in grey shading
Most technical skills, particularly slit lamp, retinoscopy, subjective refraction and case history, and general confidence in skills and results, improved from 2014 to 2015 based on both student and preceptor perceptions
Note that tonometry was not part of the curriculum in 2014, and fundus evaluation was not part of the curriculum in 2014 or 2015
** Communication with patients refers to general communication, including non-English-speaking patients*
*** Communication with preceptors includes presentation of cases*
§ General exam flow refers to determining order of testing and tests needed for each patient
¶ Refers to technique, accuracy and efficiency
BIO = binocular indirect ophthalmoscope; EMR = electronic medical records

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Items 9 through 16 (Question 2b) were related to perception of competence. Answers to these questions revealed that students' perception of their performance was higher than their preceptors' perception (Wilcoxon Rank Sum, S=18.5, p=0.026) (mean rating for items 9-16 was 3.52 for 2014 and 3.66 for 2015). Students' perception of clinical competence significantly improved from 2014 to 2015 (mean difference 0.21, Wilcoxon Rank Sum, S=22.5, p=0.019), whereas there was no significant change in preceptors' perception of students' clinical competence between the two years (mean difference 0.08, Wilcoxon Rank Sum, S=8.0, p=0.41). Note that preceptors were aware of the curricular changes and their expectations should have been higher in 2015. Overall analyses of items 9-16 for both students and preceptors showed a significant improvement in perception of competence from 2014 to 2015 (Wilcoxon Rank Sum, S=59, p=0.026).

The percentages of students who gave comments to open-ended Question 3 were 59% (n=54) in 2014 and 76% (n=85) in 2015; the percentages of preceptors who gave comments to this open-ended question were 67% in 2014 and 74% in 2015. This open-ended question yielded insight into how students could be better prepared for Patient Care II clinics. **(Table 5)** Verbatim answers were classified into major categories that showed that most technical skills, particularly slit lamp, retinoscopy, subjective refraction and case history, improved from 2014 to 2015, based on both students' and preceptors' perception. General efficiency was the most commonly reported category for both years, and improved only minimally between 2014 and 2015 according to student and preceptor responses.

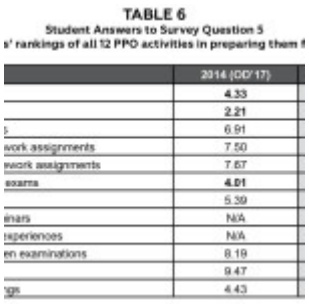

TABLE 6
Student Answers to Survey Question 5
s' rankings of all 12 PPO activities in preparing them f

	2014 (OD'17)
	4.33
	2.21
s	6.91
work assignments	7.50
work assignments	7.67
exams	4.01
	5.39
inars	N/A
xperiences	N/A
en examinations	8.19
	9.47
gs	4.43

Rankings are from most useful (1) to least useful (12)
A lower number indicates a better ranking
The three top-ranked activities are indicated in bold font (laboratories, clinical skills exams and practice patient experiences were ranked as most useful, and written exams were ranked as least useful)

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When asked to rank the usefulness of the various components of the PPO courses in preparing students for clinic (student Question 5), students consistently ranked PPO laboratories as the most useful activity. Clinical skills practical exams, regular lectures and Patient Care I assignments (vision screenings) followed laboratories in the ranking of useful activities. **(Table 6)** In 2015, students had two new activities in the new summer term: practice patient experiences, rated highly, and clinical readiness seminars, rated lower than clinical skills exams, lectures, Patient Care I assignments and seminars where clinical cases were discussed. **(Table 6)**

Discussion

The main changes in the PPO curriculum were a more concentrated delivery of didactic and laboratory material and the addition of a summer term between first year and the fall of second year that included practice patient experiences. These modifications may have contributed to the perceived improvement in clinical readiness of OD'18 students entering their second-year clinical rotations. Studies have shown that early patient encounters with direct supervision from preceptors, one-on-one clinical skills training, and timely feedback provide benefits to clinical skills training and non-analytical reasoning skills,[1,13] as well as increased comfort with clinical settings and patients[1] and motivation.[5] In addition, simulated patient encounters with feedback are known to result in improved student-patient communication.[14]

With implementation of the new curriculum, both the student and preceptor surveys showed that students had begun to take a more active role in patient care during their clinical assignments, including less observation of preceptors and upper-year students and less automated pre-testing. This is likely related to changes in students' skill set. Students were able to acquire basic proficiency in individual clinical techniques required to complete a primary care comprehensive eye exam, up to the point of instilling dilation drops, prior to starting clinical assignments in the fall of their second year. Skills such as slit lamp evaluation and contact tonometry were added earlier in the curriculum. Also, students were able to gain more experience with visual field testing and other supplemental tests, which preceptors had previously identified as being helpful for efficiency in their clinics, prior to entering second-year clinics. Additionally, students were introduced to essential clinical skills related to communication, patient interaction and clinical reasoning.

Student and preceptor expectations also converged after implementation of the new curriculum. Particularly, students' perception of their clinical competence increased after the curriculum changes, which was also reflected in the expectations of their role in the clinic. While preceptors' expectations for students remained stable for some skills from 2014 to 2015, student expectations improved for most skills, notably: near refraction, undilated anterior segment evaluation, drop instillation, contact tonometry, binocular vision testing, automated visual field testing, optical coherence tomography testing and fundus photography. Each new skill that students were expected to perform in clinic promoted their ability to participate in a clinical setting, at a level similar to that that of past students entering their third year rather than their second year. This, in turn, allowed second-year students to be placed in a wider array of clinical settings, and for upper-year students to be placed in settings where they could gain more advanced training.[15]

Of note, many of the skills identified as deficient in 2014 were addressed after the curriculum changes, as shown in open-ended Question 3. In particular, most technical skills (slit lamp, retinoscopy, subjective refraction and case history) were identified by students and preceptors as improved from 2014 to 2015. There was an improvement in student efficiency using electronic medical/health records systems, although this is an area that needs to improve further. Note that tonometry was not part of the curriculum in 2014 and fundus evaluation was not part of the curriculum in 2014 or 2015. These areas do not appear to be deficient, probably because they were not perceived as essential for participation in Patient Care II clinical assignments.

After the implementation of the new curriculum, students and preceptors appeared less concerned about students' skills and more about general exam efficiency, flow and communication, which are more advanced aspects of clinical performance. Interestingly, preceptors' perception of students' communication with patients and exam flow seemed to improve in 2015, but students' perception did not. Preceptors' perception of students' ability to communicate with preceptors was poorer than that of students. General efficiency, the most commonly reported category for both years, improved only minimally between 2014 and 2015 by students and preceptors.

The main challenges encountered in the implementation of the new curriculum were related to the recruitment and scheduling of practice patients. Students requested that future practice patient recruitment be coordinated, recruited and scheduled by the College. Other challenges were related to the student:preceptor ratio in clinical simulations and laboratories, which made implementation of student performance evaluation rubrics and clinical readiness seminars difficult. In spite of these challenges, mostly practice patient experiences were highly ranked in the list of usefulness in preparing students for their clinical assignments. **(Table 6)** Laboratories and clinical skills exams were ranked as the most useful activities.

One limitation of this study was the timing of delivery of the survey, which was administered three weeks into the fall academic semester. Given that most students are assigned to clinic one day per week in their second year, students were still acquiring familiarity with the clinical setting, and preceptors were still acquiring familiarity with their students. Thus, the results reflect perceptions of expectations, competence and confidence rather than an objective assessment of these factors. However, these perceptions are important in designing a curriculum that provides the foundation for a comfortable yet motivating clinical training environment. In the future, surveys or other measures of student performance will be needed to assess the long-term impact of these curricular changes.

Conclusion

A concentrated delivery of didactic and laboratory material during the first year of optometry school, including the addition of a summer term that included practice patient experiences, may have improved student clinical readiness. This enhanced students' confidence and perception of their competence, and it aided their ability to meet the expectations of their preceptors and the needs of the student clinics. As a consequence, a more robust clinical experience could be achieved. Further study is needed to assess the long-term impact of these curricular changes on student performance and perceptions.

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Appendix 1

	Students	Preceptors
	What activities are you expected to perform in your clinicals?	What activities are your Patient Care II students expected to perform in your clinics?
Question 1:	Please check ALL that apply and write any notes in the comments section as needed, e.g. "certainly perform off-hand exam"	
Question 2:	Please answer the following question considering your perception of your own performance and answer as sincerely as possible. Your answers are completely anonymous and in no way will affect your grades or your preceptors' opinion of you, as they will not have access to your answers.	Please rate the following statements on a Likert scale. Please consider your current group of Patient Care II students as a whole, NOT individual students.
	These answers were rated on: Strongly Disagree, Disagree, Neither Disagree Nor Agree, Agree, Strongly Agree or N/A	
2a:		
2b:		
Question 3:	List any aspects of your performance that you think could be improved in order for you to participate more effectively in Patient Care II clinics.	What aspects of Patient Care II students' performance could be improved in order for students to participate more effectively in your clinic?
Question 4: Preceptors ONLY	If second-year students performed at a higher level (holistic, could you allow them to have additional patient care responsibilities? (This was an open question)	
Question 5: Students ONLY	Rank the following first-year activities that were most useful (1) to least useful (10) in preparing you for clinic: 1. Regular lectures 2. Laboratory sessions 3. Pre-lecture/open videos 4. Pre-lecture/open homework assignments 5. Pre-lecture/open assessment assignments 6. Clinical skills-oriented exams 7. Case discussions 8. Clinical rotations-seminars 9. Summer patient care experience 10. Midterm and final written examinations 11. OSCEs 12. Patient Care I screenings	

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Plateau Iris Syndrome and Acute Angle Closure Glaucoma: A Teaching Case Report

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PDF of Article

Background

Primary angle closure glaucoma is characterized by apposition of the peripheral iris to the trabecular meshwork as a result of abnormal size and position of anterior segment structures or posterior segment pressure forces that alter the anterior segment anatomy.[1,2,3] The four most common causes of angle closure glaucoma are: pupillary block, plateau iris, lens-induced angle closure and ciliary block.[2] Plateau iris syndrome (PIS) is the most common etiology of angle closure in relatively young patients, while in the older population, pupillary block accounts for almost all cases.[4] A structural anomaly in which the pars plicata is anteriorly displaced or abnormally large is responsible for the plateau iris.[2]

PIS is also to be differentiated from plateau iris configuration (PIC). Whereas PIC refers to a normal anterior chamber depth, flat iris plane, but narrow angle on gonioscopy before surgical treatment, PIS is a diagnosis that refers to the potential for an angle to occlude in patients with PIC in the presence of a patent iridectomy or iridotomy.[5]

PIS is further classified into two forms: complete and incomplete. They are differentiated by the height of the plateau, which refers to the level of the iris surface in relation to the angle structures. In the complete form, the height of the plateau is such that it closes the anterior and posterior trabecular meshwork, resulting in no drainage and subsequent rise in intraocular pressure (IOP).[2,6,7] In contrast, the incomplete form does not result in IOP rise because partial closure allows for adequate drainage.

It is paramount for the astute clinician to not only identify the mechanism of acute angle closure but also to be proficient in methods of analyzing the iridocorneal angle with gonioscopy, ultrasound biomicroscopy (UBM) and optical coherence tomography (OCT) so that timely treatment and management can be initiated. Furthermore, PIS should be considered as a causative factor in patients with IOP rise following laser peripheral iridectomy or iridotomy.

This teaching case report is intended for optometry students at all levels. For first- and second-year students, emphasis can be placed on the anatomical structures of the iridocorneal angle, mechanisms of acute angle closure, diagnostic testing that can be performed and the mechanisms of action for medications used in treatment. For third- and fourth-year students and residents, emphasis can be placed on treatment and management of cases with persistent angle closure and glaucoma despite laser treatment.

Case Description

A 56-year-old Caucasian male presented for a comprehensive eye exam without any visual complaints. His last eye examination had been 15 months prior, and he reported an unremarkable exam at that time. The patient stated that he had a history of “narrow angle attacks,” which had resolved after bilateral laser peripheral iridotomies (LPIs) 13 years prior. The patient denied any history of glaucoma or being treated with topical medications. Family ocular history revealed that his maternal grandmother had been diagnosed and treated for glaucoma. The patient’s medical history was remarkable for multiple sclerosis (MS) and hyperlipidemia. His current medications included interferon beta-1a (Avonex) and simvastatin daily. At his last visit with neurology, the patient was noted to have clinically stable MS on the current regimem of Avonex. He had no reported allergies to medications. The patient stated that he had never been a smoker, did not drink and did not use recreational drugs. He was oriented to time, person and place and his mood and affect were appropriate.

The patient’s entering best-corrected visual acuity was 20/20 OD and OS at distance and at near. Pupils were equally round and reactive to light without an afferent defect in either eye. Extraocular muscles were unrestricted and full in all fields of gaze. Confrontational visual fields were full to finger counting in both eyes. Color vision was full in each eye as measured with Ishihara plates. Manifest subjective refraction was OD +7.25 -2.25 x 100 OD and OS +5.00-2.25 x 075 with 20/20 visual acuity at distance in each eye. Anterior segment examination by slit lamp revealed bilaterally patent LPIs, a white and quiet

conjunctiva with clear corneal layers OD and trace pigment on the central corneal endothelium OS. The irises were both flat. The anterior chamber was normal depth and without cells or flare. There were early nuclear sclerotic lens changes in both eyes. Intraocular pressures as measured by Goldmann tonometry were 14 mmHg OD and 34 mmHg OS at 10 a.m. Sussman 4-mirror gonioscopy showed the deepest structure seen OD to be posterior trabecular meshwork in all clock hours and anterior trabecular meshwork from 10 o'clock to 2 o'clock. In the left eye, the deepest structure seen was the posterior trabecular meshwork for 240 degrees, except at 10 o'clock where iris-corneal touch was noted. The deepest structure in the remaining 120 degrees was anterior trabecular meshwork. The patient refused a dilated fundus examination despite education on the importance and the need for assessment of sight-threatening disease. Undilated fundus exam was performed using a 78D Volk lens and revealed shallow, healthy pink rim tissue without pallor OU. The cup to disc ratio was assessed as 0.35 round OD and 0.45 round OS. The maculae were clear and flat with no pathology noted.

On that same day, the patient was evaluated by the glaucoma specialist. The specialist concluded that the increase IOP OS was most likely a consequence of damage to the trabecular meshwork from past episodes of acute angle closure prior to having undergone LPI's in each eye. He supported this tentative diagnosis by noting that the patient was asymptomatic, presented with no signs of inflammation, had patent LPIs, and did not have peripheral anterior synechiae on gonioscopy. The specialist recommended having the patient return in one month for an IOP test to establish a diurnal IOP curve, dilated fundus examination, pachymetry and a 24-2 SITA-standard Humphrey visual field test.

Follow-up 1: three weeks after initial presentation

The patient returned to the eye clinic three weeks later to complete the glaucoma workup as recommended by the specialist. At this visit, however, the patient reported an episode of unilateral left eye pain with associated blurred vision. He also stated that the pain lasted for two hours. The patient then admitted that these same symptoms had been occurring over the past year at a frequency of one episode every few weeks. He noted that the visual symptoms were also occasionally accompanied by a headache and had the propensity to occur in the late afternoon or evening. At this exam, presenting visual acuities with glasses were 20/25 OD and OS. Pupils, extraocular muscle testing, confrontational visual fields and slit lamp examination were all stable since the last visit. Intraocular pressures by Goldmann tonometry were recorded as 14 mmHg OD and 19 mmHg OS at 9:10 a.m. Intraocular pressures were retaken at 10:30 a.m. and were noted as 15 mmHg OD and 20 mmHg. Pachymetry revealed central corneal thickness to be 522 microns OD and 558 microns OS. The patient was dilated using 1% tropicamide and 2.5% phenylephrine OU. Dilated fundus examination revealed early nuclear sclerotic lens changes in both eyes. The cup to disc ratio was 0.35 round OD and 0.45H/0.40V OS, without pallor OU. Temporal and inferior-temporal thinning was noted on the optic disc OS. All other aspects of the posterior segment were unremarkable. Humphrey visual field testing showed no defects OD and an early superior arcuate defect OS, which was consistent with the thinning that was previously noted on the neuroretinal rim OS. Post-dilation IOPs by Goldmann tonometry, taken at 11:45 a.m. were 15 mmHg OD and 34 mmHg OS. At that time, one drop of 0.5% apraclonidine hydrochloride (Iopidine) was instilled in the left eye. Post-dilation, Sussman 4-mirror gonioscopy showed the deepest structure in the right eye to be the posterior trabecular meshwork for 270 degrees and anterior trabecular meshwork for the remaining temporal 90 degrees. In the left eye, the deepest structure was anterior trabecular meshwork for 270 degrees with no structures visible in the remaining temporal 90 degrees. Repeat tonometry by the same method used previously was 12 mmHg OD and 18 mmHg OS. At the conclusion of the exam, the assessment was likely narrow angle glaucoma OS and the patient was started on 0.004% travoprost (Travatan) qhs OS only. He was scheduled for a follow-up appointment in six weeks.

Follow-up 2: nine weeks after initial presentation

The patient returned for his second follow-up visit for an IOP check to determine the efficacy of the treatment initiated at the previous visit. He reported good compliance on the current regimen of travoprost 0.004% qhs OS. When questioned about recurrent instances of intermittent blurred and painful vision, the patient noted only having one episode since his last eye exam. He felt that his vision was stable and denied any other ocular complaints. The entrance examination findings were stable with prior exams and tonometry via Goldmann was 16 mmHg OD and 15 mmHg OS at 10 a.m. The patient was instructed to continue with the current regimen and to return to the clinic in two to three months for a follow-up appointment, or sooner if painful or blurry vision occurred.

Follow-up 3: 17 weeks after initial presentation

Figure 1. Ultrasound biomicroscopy of the right eye.
Click to enlarge

The patient returned to clinic two months later reporting more frequent episodes of blurred vision accompanied by periorbital pain OS. He noted that the symptoms were lasting up to three hours and felt that they were now occurring two to three times per week. The patient also realized that these symptoms typically occurred after waking in the morning or after taking a nap. He noticed that these episodes mimicked the symptoms he had experienced prior to having LPIs. The patient reported compliance with the 0.004% travoprost qhs OS. Visual acuities, pupils, extraocular motilities, confrontation fields, color vision and slit lamp examination were again stable. IOPs via Goldmann tonometry were recorded as 11 mmHg OD and 11 mmHg OS at 2 p.m. Gonioscopy was repeated at this exam with careful attention to the iris approach into the angle. Sussman 4-mirror gonioscopy revealed a flat iris approach centrally with a steep approach into the angle OU. The deepest structure visible OD was the scleral spur in all clock hours. The deepest structure visible OS was the anterior trabecular meshwork except from 3-9 o'clock where appositional touch was apparent. Indentation gonioscopy revealed posterior trabecular meshwork. The patient was diagnosed with complete PIS OS and was referred to a tertiary center for UBM.

Figure 2. Ultrasound biomicroscopy of the left eye following argon laser peripheral iridoplasty.
Click to enlarge

UBM confirmed PIC OD and complete PIS OS. The patient was treated with argon laser peripheral iridoplasty (ALPI) OS the same day following UBM. **(Figures 1 and 2)** The patient was scheduled for a follow-up appointment in two weeks and told to continue with the current medication, 0.004% travoprost qhs OS.

Follow-up 4: 19 weeks after initial presentation

The patient presented to this exam reporting one episode of painful, blurry and cloudy vision when he woke from a nap. The symptoms lasted three to four hours before completely resolving. He felt the symptoms were slightly less intense than prior to

having ALPI OS. The patient confirmed good compliance with the current medication, travoprost qhs OS. Again, all entrance testing and slit lamp evaluations yielded normal findings. IOPs via Goldmann tonometry were 15 mmHg OD and 16 mmHg OS at 11:39 a.m. Repeat gonioscopy did not reveal a widening of the angle. The same structures were seen OS as noted prior to ALPI. The patient was scheduled to return to the clinic in two weeks for evaluation with a glaucoma specialist.

Follow-up 5: 21 weeks after initial presentation

The patient returned to the clinic as scheduled but presented to the visit with an injected left eye in conjunction with a mid-dilated pupil. When questioned he reported having four episodes of pain with blurring of vision in that eye since his last visit. The most recent episode lasted 10-12 hours, and his wife noted that his pupil was larger in the left eye. He reported that the symptoms were mitigated after going into the bright sunlight. The patient also noted strict adherence to administering 0.004% travoprost qhs OS. Visual acuity was stable at 20/20 OD and OS. Pupils were not equal. In dim illumination, the pupils were measured at 4.0 mm OD and 6.0 mm OS, and in bright illumination, 3.0 mm OD and 5.5 mm OS. Both eyes were round and reactive to light, but OD was more brisk with a grade 3+ response vs. a grade 1 response OS. No afferent pupillary defect was noted. Extraocular motilities and confrontational visual fields were full OU. Slit lamp examination was stable from last exam OD but revealed perilimbal flush OS. The anterior chamber was without cells and flare and the LPIs remained patent OU. IOPs measured by Goldmann tonometry were recorded as 14 mmHg OD and 51 mmHg OS at 8:43 a.m. Sussman 4-mirror gonioscopy OS showed anterior trabecular meshwork from 4-8 o'clock and no other structures in the remaining clock hours with appositional touch. Indentation gonioscopy again opened the angle to anterior trabecular meshwork. The glaucoma specialist started the patient on a 500 mg tablet of acetazolamide (Diamox) once daily, dorzolamide hydrochloride/timolol maleate (Cosopt) bid OS only, and pilocarpine 2% qid OS only. The 0.004% travoprost qhs OS was discontinued. The patient was followed closely and a repeat IOP check at 1 p.m. revealed that IOP in the left eye had dropped to 6 mmHg. The patient remained on Diamox for four more days and then the acetazolamide was discontinued. The glaucoma specialist recommended the patient remain on the current regimen of dorzolamide hydrochloride/timolol maleate bid OS and pilocarpine 2% qid OS until his next follow-up appointment.

Follow-up 6: 22 weeks after initial presentation

The patient returned to the eye clinic one week later for follow- up. He denied any new episodes of painful, blurry vision OS and reported 100% compliance with the current medication regimen of dorzolamide hydrochloride/timolol maleate bid OS and 2% pilocarpine qid OS. Visual acuity was stable at 20/20 OD and OS. Pupils were not equal secondary to induced miosis OS from the pilocarpine. All other entrance tests as well as slit lamp evaluation were unremarkable. IOP was measured at 17 mmHg OD and 11 mmHg OS at 11:08 am with Goldmann tonometry. Sussman 4-mirror gonioscopy was performed OS and no structures were seen in the nasal clock hours. With compression technique, the deepest structure seen was posterior trabecular meshwork in that quadrant. In the remaining quadrants, the deepest structure seen was the anterior trabecular meshwork. The patient was told to continue his current regimen of dorzolamide hydrochloride/timolol maleate bid OS and 2% pilocarpine qid OS and was scheduled to return to the glaucoma specialist in two weeks.

Follow-up 7: 24 weeks after initial presentation

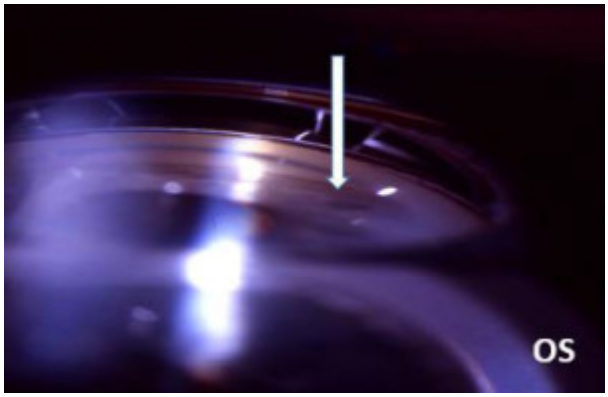

Figure 3. Gonioscopy following argon laser peripheral iridoplasty in our patient. The white arrow denotes the incorrectly placed mid-peripheral laser burn.
Click to enlarge

The patient was seen two weeks later by the glaucoma specialist. The patient reported compliance with the current regimen of dorzolamide hydrochloride/timolol maleate bid OS and 2% pilocarpine qid OS and denied any episodes of painful, blurry vision.

At this visit, visual acuity was stable at 20/20 OD and OS. Pupil findings were stable; however, the pupils again were not equal secondary to the effects of pilocarpine. All other findings were also stable. IOP by Goldmann tonometry was measured at 14 mmHg OD and 12 mmHg OS at 11:15 a.m. Gonioscopy was repeated and graded the same as during the previous exam. The glaucoma specialist recommended that the patient remain on the current medical regimen of dorzolamide hydrochloride/timolol maleate bid OS and 2% pilocarpine qid OS. The specialist noted that if episodes were to recur, ALPI would be repeated. Furthermore, he noted that the recent ALPI was not successful because the placement of the laser was not as peripheral as recommended **(Figure 3)** and the burns were not sufficiently intense to render effective contraction and subsequent opening of the angle. He recommended that the patient be monitored closely with repeated gonioscopy, and ultimately cataract extraction, when there was a secondary decrease in visual acuity. The patient remained on dorzolamide hydrochloride/timolol maleate bid OS and 2% pilocarpine qid OS and denied any episodes of painful, blurry vision at his three- and six-month follow-up appointments.

Key Concepts

1. Recognizing the importance of probing further into a patient's past ocular history to help guide the clinician to the correct diagnosis
2. Recognition of the signs and symptoms of angle closure glaucoma and plateau iris syndrome
3. Recognition of available ancillary testing that may lead to the correct diagnosis
4. Understanding that treatment is not based solely on the identification of acute angle closure glaucoma, rather, it is driven by mechanisms responsible for angle closure
5. The importance of post-treatment and management of patients with acute angle closure

Learning Objectives

1. To understand the signs and symptoms of acute angle closure glaucoma
2. To understand the ocular anatomy and the mechanisms of acute angle closure glaucoma
3. To gain knowledge with regard to the differential diagnosis in patients with persistent angle closure
4. To understand the condition of angle closure glaucoma, specifically plateau iris syndrome, and recognize when appropriate ancillary diagnostic testing is necessary
5. To understand the typical patient demographic of the disease profile
6. To provide proper patient education with regard to expectations, treatment options, importance of ancillary testing and follow-up appointments
7. To understand the optometrist's role in the workup, management and co-management of a patient with this condition
8. To understand the treatment options for a patient with this condition and refer for treatment in a timely manner in order to prevent ocular morbidity

Discussion Questions

1. Knowledge and concepts required for critical review of the case

    a. What are the anatomical differences between normal ocular structures, PIS and PIC?

    b. What is the difference between complete and incomplete PIS?

    c. What tests during the examination would be helpful in the diagnosis of the case?

    d. What ancillary testing would be helpful in the diagnosis of the case?

2. Differential diagnosis

    a. What are the ocular differential diagnoses in a patient with persistent symptoms despite treatment?

    b. How can the list of differentials be narrowed?

    c. Which of the differentials made the most sense with this history?

3. Disease management

    a. How do we treat this condition in order to minimize ocular morbidity?

    b. How is a patient like this managed after treatment has been initiated?

c. When is treatment usually initiated?

d. What topical medications are used in the treatment of angle closure glaucoma?

e. What is the mechanism of action for each class of these topical medications?

f. What ancillary surgical treatment can be used in the treatment of angle closure glaucoma and what is the mechanism of action?

4. Patient education

a. What do we tell the patient about his or her disease and long-term prognosis?

b. What symptoms do we tell the patient to look out for?

c. How do we properly educate this patient to understand the importance of regular follow-up care?

5. Critical thinking

a. What were the complicating factors in this case?

b. How would you have managed this case differently?

Learning Assessment

1. Clinical skills such as gonioscopy, tonometry, anterior segment OCT and UBM may be tested in a proficiency clinical exam
2. Knowledge base of the condition can be tested via diagrams and photos of normal and abnormal gonioscopy findings
3. Knowledge base of the condition can be tested via anterior segment OCT test results of normal vs. PIC
4. Knowledge base of the condition can be tested using normal vs. PIC UBM findings
5. Clinical thinking skills can be assessed by case reports that are either hypothetical examples or from a review of the literature

Discussion

Epidemiology

Angle closure glaucoma is a relatively rare occurrence in Caucasians and is found in approximately 2% of this population.[8] The occurrence of angle closure in young Caucasians is even more infrequent. PIS is the most common etiology of angle closure in relatively young patients, while in the older population pupillary block accounts for almost all cases.[4] Ritch et al. studied the prevalence of PIS in patients 40 years or younger with angle closure and found that 54% of this population had PIS.[9] Similarly, Stieger et al. found the occurrence of PIS in their studied population of patients 60 years or younger with angle closure to be 47%.[1] Another large retrospective study showed that the mean age of diagnosis for patients with PIS was 35.[9] Evidence also suggests that this anatomical phenomenon is familial following an autosomal dominant inheritance pattern.[10]

Pathophysiology and mechanisms of angle closure

The four mechanisms of angle closure are pupillary block, plateau iris, lens-induced, and angle closure originating posteriorly to the lens/iris diaphragm. The latter includes ciliary or malignant block from aqueous misdirection. Pupillary block occurs when aqueous humor cannot pass from the posterior to the anterior chamber because of iridolenticular apposition. Plateau iris occurs when an anteriorly rotated or abnormally large ciliary body occludes the ciliary sulcus, blocking access to the trabecular meshwork and resulting in elevated IOP. Angle closure can also occur if a cataractous lens pushes the central and posterior lens forward, causing iridotrabecular apposition. Similarly, ciliary block or aqueous misdirection also causes iridotrabecular apposition where interaction between the lens capsule and the anterior vitreous obstructs aqueous flow from the ciliary processes to the anterior chamber.[11]

Differentials for persistent angle closure and PIS in our patient

Given the persistence of self-reported, recurrent episodes of intermittent, painful and blurry vision with concurrent moderate rises in IOP measured in-office, the differential diagnoses were revisited. The initial diagnosis considered at the patient's first visit was prior damage to the trabecular meshwork secondary to past episodes of acute angle closure attacks prior to LPIs. This mechanism, however, would lead to a chronic elevation without the large fluctuations in IOP seen at follow-up visits. Another

differential considered was pigment liberation, post-dilation, given the rise in IOP recorded after the patient was dilated at his second visit. Meticulous gonioscopy and slit lamp evaluation of the anterior chamber post-dilation did not support this theory. Two other differential diagnoses that warrant exclusion in a patient with narrow angles status post-LPIs are re-closure of the LPIs and persistent peripheral anterior synechiae. Slit Lamp evaluation confirmed patency of the apertures and gonioscopy verified the absence of synechiae, ruling these out as potential causes. The patient's past history of acute angle closure and subsequent bilaterally patent LPIs removed all question of pupillary block as the mechanism of angle closure. Furthermore, slit lamp exam revealed an incipient cataract, noncontributory to angle closure. Likewise, the lack of recent intraocular surgery without evidence of consistent elevated IOP and no signs of a shallow central anterior chamber on slit lamp exam provided low suspicion for ciliary block as the mechanism of angle closure. A last differential is pseudo plateau iris caused by iris or ciliary body cysts, but this was not consistent with the patient's UBM or gonioscopy findings. Thus, complete PIS was the most likely cause of angle closure in this patient.

Diagnosis of acute angle closure and PIS

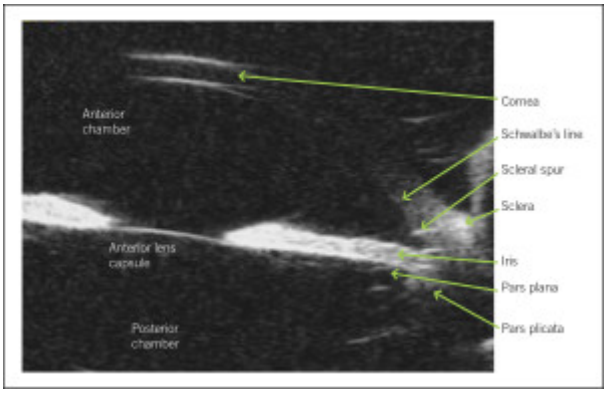

Figure 4. Ultrasound biomicroscopy (UBM) of a normal eye. This is a typical cross-sectional, in vivo image that can be obtained using UBM. The anatomic relationships between the structures can be evaluated easily.
Click to enlarge

The method of choice for diagnosing PIS is UBM **(Figure 4)** because of its high resolution images of the region, including the ciliary body and the posterior chamber.[12] Anterior segment OCT is useful in identifying characteristics of narrow angles and can also quantitatively measure the anterior chamber angle. It is less invasive than UBM as it does not require topical anesthesia or direct contact with the ocular surface. However, OCT is inferior to UBM as it does not detail the ciliary body positioning and the iridociliary relationship. Lastly, it goes without saying that gonioscopy is a very important test. In our patient, it was used to determine angle closure and to rule out pigment liberation post-dilation and peripheral anterior synechiae. On gonioscopy, the angle is found to be narrow, and there is a drop-off of the peripheral iris. Furthermore, investigators found that the "double hump" or "sine wave" sign detected by indentation gonioscopy can indicate the presence of plateau iris, even in the presence of a patent iridotomy.[13] On the iris, the peripheral hump is caused by the ciliary body propping up the iris root, whereas the central hump represents the central third of the iris resting over the surface of the lens.[4] It is thought that compression forces the aqueous humor behind the iris, causing the double hump sign pre- and post-laser treatment.[13] Performing gonioscopy in the fellow eye can also provide useful clues because angle closure glaucoma is often bilateral and asymmetric.[11]

Treatment and management of PIS

For cases of acute angle closure glaucoma, treatment is often initiated before cause is determined because of the detrimental effects of prolonged IOP elevation on ocular structures. Typically, topical aqueous suppressants including beta- blockers, alpha-agonists and carbonic anhydrase inhibitors are used. Prostaglandin analogs can be used despite a common perception that this class of medication takes longer to work.[11] Pilocarpine, a direct-acting cholinergic, can also be used. In addition to its miotic effects, mechanically pulling the iris away from the trabecular meshwork, it also stimulates contraction of the ciliary muscle, thereby increasing trabecular outflow of aqueous humor. Pilocarpine is also effective at lowering IOP as it promotes peripheral iris thinning, opening the anterior chamber angle.[14] Pupillary constriction, induced myopia, brow ache and retinal detachment are potential side effects of this medication. Oral or intravenous acetazolamide 500 mg can be used for IOP greater than 40 mmHg. Intravenous mannitol can be used in cases where IOP is greater than 50-60 mmHg or if the earlier treatments are ineffective after two hours.[11] Following control of acute IOP elevation, the next step is to perform iridectomy or iridotomy to eliminate pupillary block as the cause. The next treatment option to consider is APLI, which has also been

proposed as a definitive treatment for PIS.[15,16] During this procedure, large-diameter contraction burns tighten the peripheral iris and cause thinning to the peripheral iris stroma, preventing angle closure upon dilation. In a few studies, APLI has been shown to be effective and safe.[15,16] In the case described here, APLI was not effective for two reasons. First, the burns created by the laser were not of adequate intensity to cause effective contraction. Second, it was also proposed that the location of the burns was not peripheral enough to cause effective contraction. Similarly, one review did not find strong evidence for the use of APLI in this subset of angle closure patients.[17]

Lens extraction is not a standard treatment for PIS; however, it can be an option when the lens plays a role in obstruction of the angle. Anterior displacement of the anterior lens capsule with age can cause changes in the central or axial anterior chamber depth and raise the height of the plateau and narrow the angle. In the current case, although the mechanism of angle closure was PIS, cataract extraction was considered after ineffective APLI treatment because it lowers the overall iris plateau height. Ultimately, when surgical intervention is refused or surgical treatment has failed, patients are placed on maintenance doses of pilocarpine. Unfortunately, very few studies have evaluated the exact dose and duration necessary to mitigate acute attacks.

In our case, visual field testing showed no defects OD and an early superior arcuate defect OS, which was consistent with the thinning that was previously noted on the neuroretinal rim OS. Of course it is paramount that management of these patients include regular visual field testing to asses functional damage and adjust intraocular target pressures as necessary.

Conclusion

This teaching case report discusses the treatment and management of a patient with acute angle closure glaucoma secondary to complete PIS. Recognition of PIS as a cause in the development of primary angle closure is critical. Following laser peripheral iridotomy, the patient must continue to be monitored for recurrent angle closure with careful gonioscopy as well as regular visual fields. The eyecare provider should be able to identify the clinical characteristics of plateau iris syndrome in order to prevent incorrect diagnosis, which can lead to the development of peripheral anterior synechiae, chronic angle closure or acute angle closure.

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