Association of Schools and Colleges of Optometry

The Association of Schools and Colleges of Optometry (ASCO) represents the professional programs of optometric education in the United States. ASCO is a non-profit, tax-exempt professional educational association with national headquarters in Rockville, MD.

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The Journal of the Association of Schools and Colleges of Optometry

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Elizabeth Hoppe, O.D., M.P.H., Dr. P.H., F.A.A.O.
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David Damari, O.D., F.A.A.O., ed.
How does a program define "success"? Once success is defined, how does a program measure its attainment? For many reasons, some internal and some external, the schools and colleges of optometry have seen an increase in the need to ask and answer these important questions.

Both professional and regional accrediting institutions have shifted their focus to emphasize the measurement of various educational outcomes. Recent updates to the Accreditation Council on Optometric Education’s Professional Degree Program Standards include many important references to program outcomes. They also suggest examples of evidence that can be used to demonstrate outcome evaluation and subsequent actions. Standard 1.3 reads:

“The program must identify and use outcomes measures to evaluate its effectiveness by documenting the extent to which its goals and objectives have been met, and use such assessment to improve its performance. Such measures should include but not be limited to graduation rates, National Board of Examiners in Optometry scores, licensing examination results and career placement.”

This issue of Optometric Education highlights three examples of educational research that strive to define and measure a different aspect of "success." The three different studies have taken various approaches. In combination, they span the entire continuum of the educational experience from admissions to the didactic and clinical educational processes. Eventually they include implications for success in patient care and life long learning.

Some experts suggest that the best way to attain success is to prevent negative outcomes from occurring in the first place. Goodwin, et al. have conducted an important research study that delves into admissions and success in the first two years of the optometric program. They offer insights into factors that can be evaluated during the admissions process to optimize the likelihood of successful program completion. The results of this study offer important suggestions that can be used to maintain and enhance optometric programs' relatively high graduation rates.

Passage of all three parts of the National Boards remains the key to licensure for optometric practice, and therefore a key indicator of program success. Understanding how the educational process may relate to NBEO performance can help schools and colleges design and assess various clinical education programs. Register and Hoppe present another definition and another measure of success that occurs later in the four-year curriculum.

Many optometric leaders believe that the most important measure of success comes long after graduation, when alumni provide the highest quality patient care. Much has been written about doctors’ decision-making and the importance that critical thinking plays in making the correct diagnosis and selecting the optimal management choice. Denial and Pitcher offer insights to help institutions determine which factors may be related to students’ critical thinking ability.

This issue also includes a provocative 20/20 Think Tank feature in which optometric leaders share their thoughts about what makes today’s graduates successful, and how “success” has changed over the past 20 years.


Want to predict success in optometry school? Maybe the secret lies in the applicant’s use of video games. Much to the chagrin of parents and teachers everywhere, research keeps popping up that shows that video games may hold some educational benefits.

Reuter’s recently reported that adults who trained their brains with a computer workout program showed significant improvement in spatial short-term memory, spatial learning, and focused attention. Similar reports showed how researchers used a computerized dance program to stimulate neural pathways, leading to increased attention and improved reading comprehension.

In a study at the University of Rochester, it was noted that video games containing high levels of action may substantially increase spatial resolution abilities. This resulted in improved visual acuity and other visual skills. Research has also suggested that video game users appear to have better eye-hand motor coordination on pursuit type tasks.

In a recent issue of Optometry & Vision Development three articles were featured that may have a profound effect on optometry and the care of children with reading or academic problems. In the first article, “The Effect of HTS Vision Therapy Conducted in a School Setting on Reading Skills in Third and Fourth Grade Students,” Indiana University Professor Dr. David Goss (and colleagues) demonstrated that if a patient completes the HTS (Home Therapy System) computer program, improvements in reading can be achieved. In another article, Helms and Sawtelle showed substantial cognitive skills improvements for their subjects by using therapy delivered in a video game format (“A Study of the Effectiveness of Cognitive Skill Therapy Delivered in a Video-Game Format”). They found that by using a program called BrainWare Safari, the study group demonstrated an average of 4 years, 3 month improvement on tests of cognitive skills (control group showed a 4 month improvement) and 1 year, 11 month advancement on tests of achievement compared to 1 month improvement for the control group. And finally, Teri Lawton, PhD, in her paper, “Training Direction-Discrimination Sensitivity Remediates a Wide Spectrum of Reading Skills,” found impressive improvements in reading for 2nd and 3rd graders upon completion of her MovingToRead TM computer program. These programs may modify how we manage children diagnosed with learning related vision problems.

Of course, there are the more familiar studies that reveal how violent video games increase aggressive behavior in children and young adults. Most authorities are still recommending no more than one hour of TV or video game viewing per day. Perhaps not so much because the games themselves are so bad, but because excessive video game play takes time away from other productive activities such as reading, exercising, socializing, etc.

You never know; perhaps the inquiry “how much time do you spend playing video games?” may some day be added to the list of questions asked during optometry school admission interviews.

References
8. Lawton T. Training Direction-Discrimination Sensitivity Remediates a Wide Spectrum of Reading Skills Optom Vis Dev. 2007; 38(1);33-47.
Think Tank . . .

Successful graduates will continue to be those people who are impassioned about their profession. Those who always put the patient’s needs ahead of their own will find that success follows.

Dedication to the needs of their family, their patients, and their profession must be balanced to achieve success and personal fulfillment. The times may be different, but the keys to success are unchanged.

Carol L. Alexander, O.D.
Director, Professional Affairs, Vistakon
Ohio State University College of Optometry, 1987

Most graduates in the class of 2007 are part of the millennial generation; 1987 grads are largely Baby Boomers. Millennials are more “hands-on” learners than previous generations (they may have learned more in lab and clinic than in the lecture hall); they expect the speed, flexibility, interaction, and convenience provided by digitally delivered information; they are time-conscious; and they multi-task (they can simultaneously attend a lecture, check email, and hold a whispered discussion about a pediatrics case during ocular disease class).

At the same time, they are generally warmer and outgoing, more dutiful, and more organized and self-disciplined than previous generations. These characteristics might predict that this generation of new optometrists will be different from their predecessors in many ways.

I anxiously await the impact of these graduates on the profession.

Kimberly Reed, O.D.
Associate Professor of Optometry
Nova Southeastern University College of Optometry

The past twenty-five years have brought challenges to today’s graduates that simply did not exist in 1987. With emergence of new technologies in both patient care and in information management systems, the 2007 graduate needs to embrace change and be receptive to the interdependence of new knowledge, patient care, health care policy and practice management.

David A. Heath, O.D., Ed.M.
President, SUNY State College of Optometry

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Optometric Education
My Best Day in Optometric Education

William E. Cochran, O.D.

A fter serving twenty-four years as president of Southern College of Optometry, I can without doubt say that my best day in optometric education was experienced twenty-four times. Obviously that day is the day of Commencement. The pomp and circumstance of the very first graduation day has carried over during these many years. Somewhat sadly May 11, 2007, will be the last graduation at which I will pronounce the words, "...by virtue of the authority vested in the Southern College of Optometry by the State of Tennessee I hereby bestow the degree, Doctor of Optometry, upon those recommended with all of the rights, privileges and responsibilities appertaining thereto."

Besides graduation, there has recently been a “happening” that I believe will help address a nagging problem perceived by many to be a failure of optometric education. All of the deans and presidents of the schools and colleges of optometry have experienced the complaint, “You are not teaching students/graduates to be good business men and women.” And, “If you taught the students practice management skills they would not go commercial.”

The fact of the matter is that the curriculum of all optometry schools includes practice management courses. ASCO’s Practice Management Educators Special Interest Group is dedicated to enhancing and emphasizing the practice management curriculum. Nevertheless, today’s practice of optometry requires a greatly expanded scientific curriculum that tends to overshadow the practice management curriculum. Additionally, there are no practice management questions on national or state boards. With students, practice management is not a priority.

As to the perception that a lack of practice management skill leads to commercial practice, I say “hogwash!” That is a red herring. Optometrists, new graduates as well as established graduates, practice in retail settings for a variety of reasons. But those reasons are for another discussion.

Yet perception is sometimes called reality. There is no question that young graduates need to develop and hone their business skills. After graduation and after passing boards, practice management/development suddenly looms dauntingly on the radar screen. So, what is a new graduate to do with thousands of dollars of debt, possibly a new family and the expense of developing a practice?

Well, the recent “happening” I mentioned earlier is the establishment of the Hayes Center for Practice Excellence (HCPE) at Southern College of Optometry. Established in 2006, the mission of the Hayes Center is to teach present and future optometrists how to better manage the business aspects of optometric practice. The HCPE is being supported by an endowment fund through the generosity of Dr. and Mrs. Jerry Hayes and the Hayes Family Foundation.

In January 2007, Southern College of Optometry and the Hayes Center for Practice Excellence offered the first course aimed at SCO graduates one to five years after graduation. The program also received generous support from VSP. The program is designed to offer recent graduates a high quality course in the business of optometry at a very modest cost. The excitement generated among the first HCPE class can be experienced by logging on to sco.edu and clicking on the Hayes Center link.

So, another of my best days in optometric education is the day that Jerry and Cris Hayes made a generous financial commitment to fund a special need in optometric education. It is extremely rewarding to experience the generosity of dedicated alumni. Hopefully, all schools and colleges of optometry will continue to benefit from the generosity of their alumni.
The following companies support ASCO's national programs and activities benefiting all 17 schools and colleges of optometry in the U.S. and Puerto Rico:

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Transitions Optical
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Coopervision
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Rapid Pathogen Screening
Volk Optical, Inc.

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Nidek Incorporated
Ophthonix, Inc.
Safilo Group
Vision Care Institute™of Johnson & Johnson Vision Care, Inc.

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**Nidek and Rapid Pathogen Screening Join Corporate Contributors Program**

ASCO welcomes two companies - Nidek and Rapid Pathogen Screening - as the latest additions to its Corporate Contributors Program. Nidek is a global leader in eye care products for ophthalmology and optometry. With diversified clinical research and continual development, an array of laser and diagnostic products are offered that lead the way for improved diagnosis and treatments. Frank Wood, Nidek's marketing manager, said that "the relentless commitment to customer satisfaction means Nidek will do whatever it takes to continually exceed expectations."

Nidek's newest innovation is its auto-focus Non-Mydriatic fundus camera. With its true 45° images (large sensor size) and unsurpassed resolution, the AFC-210 delivers superior diagnostic accuracy, meeting reading center criteria for diabetic screening. The highly automated design is so simple to use that even someone with limited experience can take professional quality retinal images after just a few minutes of training. The 12.8 mega pixel resolution is one of the highest of any Non-Mydriatic desktop cameras on the market, and has automatic focus and auto alignment features.

**Rapid Pathogen Screening Inc.**

(RPS) develops, manufactures and markets easy-to-use, point-of-care (POC) diagnostic detectors for the rapid diagnosis of human infections across a wide range of pathogens.

RPS Inc. was founded in March 2004 as a joint venture between Sambursky LLC, Binghamton, NY, and Securetec Detektions-Systeme AG, Munich, Germany.

RPS Conjunctivitis Detectors make it easy to distinguish viral from bacterial or allergic conjunctivitis. Our products lead to reduced use of antibiotics and provide a prophylactic counter measure against the growing problem of antibiotic resistance. In some regions, nearly half of all patients with acute infectious conjunctivitis presenting to a primary care provider or emergency room physician may receive unnecessary antibiotic treatment.

**Vision Service Plan (VSP)**

Students are the future of private practice, and VSP has developed several programs to make those goals easier to reach.

**EyeSeek**

Launched nationally in November 2006, EyeSeek.vsp.com is available to students, recent graduates, and interested optometrists searching for private-practice opportunities.

**Student Outreach**

To help students achieve their career goals, VSP has created a new, dedicated position to connect with students. "Think of me as the students' direct link to private-practice resources," says VSP University Outreach Coordinator Dana Beards. "I'm here to ensure that VSP has a thriving relationship with each of the schools and with the students, who are the future of our profession."

For more information, contact Dana Beards at (800) 852-7600, ext. 5717, or by e-mail at danabe@vsp.com.

**Vision Loans**

Nearly one-quarter of practicing optometrists are approaching retirement age. For optometrists considering purchasing an existing practice, moving into a partnership role or starting as an associate, many possibilities exist and Vision Loans can help. Vision Loans, an innovative loan program by VSP and Vision One Credit Union, provides funds to qualified doctors for: new associate salary loans, partnership buy-ins, practice purchases and down payments. Since its inception in 2003, Vision Loans has issued loans totaling more than $14 million.

For more information, contact Vision One's Lending Division at (800) 327-2628.

**Transitions Optical**

As a complement to the clinical review paper it recently sponsored, Ocular Effects Associated with Medications, Transitions Optical, Inc. has created a new medications database that will enable the optical

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industry to easily access information on the types of medications that may cause adverse ocular effects. To further emphasize the potential impact of common medications on healthy sight, Transitions has also launched several other tools to aid eyecare professionals in discussing this important topic with patients.

"While patients might know that their medications carry a possibility of side effects, they may not realize that there could also be vision-and eye-related health consequences," said Carole Bratteig, manager, training and education, Transitions. "Awareness is the first step in reducing risk, which is why we have developed these tools and suggestions for eyecare professionals on how to effectively discuss side effects of medications on the eyes with patients and counsel them on UV protection and healthy sight."

Developed by ocular pharmacologist and textbook author, Siret D. Janus, Ph.D., as part of the Transitions Partners In Education program, Ocular Effects Associated with Medications provides a reference guide for eyecare practitioners of drugs and drug classes that might affect the eyes. As a next step in this effort, Transitions has created a free online Ocular Side Effects Database that will enable eyecare professionals to quickly search drugs by name and determine which medications affect vision. The database includes a listing of brand drug names and details on the quantity and quality of vision affected by each drug. The medications database is available on the Transitions Web site, www.transitions.com/medications, with accessibility through additional avenues planned for upcoming months. As part of its commitment to advocate the highest standards for international optometric education, the World Council of Optometry (WCO) has announced that it accepts the principles of Transitions’ Partners In Education Healthy Sight Counseling program and recommends the integration of such subject matter into the curricula of optometry schools worldwide. The Healthy Sight Counseling student curriculum introduces an integrated approach to healthy sight that promotes customized vision correction, maintenance and preventive eyecare, and increased professional and patient awareness of eye health through education.

**Volk Optical**

Viewing the anterior segment and observing the fine structural details is challenging. An increased magnification (1.5x) Gonio lens introduced by Volk Optical will enable more details to be seen more easily. The four-mirror lens is the industry-preferred standard lens for static and dynamic gonioscopy and delivers the crispest, clearest 360° views of the anterior chamber angle, with high magnification to appreciate details previously unattainable with Gonio lenses.

It is available in small or large ring options or versatile 2 in 1 handle that can be angled in two positions. Its no-flange design does not require interface solution allowing quick eye contact, reducing patient discomfort and facilitating the examination.

Volk Optical is an innovator in the design and manufacture of diagnostic and therapeutic ophthalmic lenses, equipment, and accessories. The company is based in Mentor, Ohio, USA, and has representatives and distributors around the world.

To order or obtain more information about Volk products, visit www.volk.com, phone Volk at 1-800-345-8655 (toll free) or 440-942-6161, or contact your Authorized Volk Distributor.
Correlation Between Quantity of Clinical Experiences and NBEO Clinical Skills Performance

Shilpa J. Register, O.D., M.S. F.A.A.O., Elizabeth Hoppe, O.D., M.P.H., Dr. P.H., F.A.A.O.

Abstract

**Purpose:** Part III of the NBEO assesses a student’s ability to examine patients and evaluate patient care decisions. There is some evidence that more hands-on patient care experience in optometric clinical education may result in improved clinical skills and clinical thinking. Our objective is to evaluate the correlation between the quantity of clinical patient encounters and performance score on the NBEO Part III.

**Methods:** Data from the 2004 and 2005 New England College of Optometry graduating classes were evaluated. The total number of fourth year patient encounters as reported by student patient logs was compared with the reported total NBEO Part III score.

**Results:** Data from 156 students were included. Total patient encounters in the final year ranged from 313 to 2533 with a mean of 1143.9 and standard deviation of 362.4 representing a skewed distribution. NBEO scores ranged from 267 to 723 with a mean of 457.7 and a standard deviation of 110.5. Correlation with NBEO Part III total scores was calculated as $r^2 = 0.00$.

**Conclusions:** The data showed no significant correlation, indicating that other factors may better determine performance on NBEO Part III examination. This analysis suggests that further studies are needed to determine other factors that may better predict NBEO Part III performance. This study may be used to plan clinical programs and clinical goals for optometry students and to predict optometric success within the application process.

**Key Words:** Clinical education, National Board Examination Performance

Introduction

Optometric educators face the dual challenge of predicting likely success within the educational curriculum, and success as a practicing optometrist after graduation. A variety of preadmissions variables such as undergraduate grade point average, performance on the Optometry Admission Test (OAT), and personal characteristics have been evaluated to determine which factors are correlated with overall academic performance and academic success during the doctor of optometry professional degree program. Further research has identified significant factors that enable the prediction of performance on the National Board of Examiners in Optometry (NBEO) Part I examination. Yet, little research has been published predicting performance of optometry students in the clinical setting.

In the field of medicine, there have been numerous publications on the prediction of academic performance and residency success after medical school. Murden, et al. found that personal characteristics such as level of maturity, nonacademic achievement motivation, and rapport were predictors of clinical success in medical school. According to Taylor, et al., there is a need for an objective measure of clinical skills. The National Board of Medical Examiners (NBME) implemented a clinical skills exam as part of the USMLE Step 2 in mid 2004. Their study compared the relationship between the USMLE Step 2 prototype and intern’s performance using grade point average (GPA), and USMLE scores. Their results showed that GPA and interpersonal score were the best predictor for USMLE success. Other studies have assessed the correlation between the global assessment of an intern selection committee with the clinical and cognitive performance of a resident.

In 1993 the National Board of Examiners in Optometry added the Patient Care (PC) examination as the third part of the National Board Sequence. Part III of the NBEO is designed to assess a student’s ability to examine patients and evaluate patient care decisions. This examination is usually taken during the spring semester of the fourth year for all optometric students, and is a requirement for optometric licensure in the United States. The examination consists of two distinct sections: Clinical Skills Examination (CSE) and Patient Assessment and Management (PAM).


The Patient Assessment and Management consists of 40 patient scenarios in the following categories: Ocular Disease/Trauma Diagnosis, Data Interpretation, Clinical...
Part III is a critical step in the examination and licensure process. Not only does it serve as an indicator of clinical skills and clinical thought processes, because of the timing of the examination it could serve as a barrier to timely licensure and entry into practice. Part III is administered in the spring of the last year of the 4-year educational program and the examination is limited to one administration prior to graduation. If a student is not successful in his or her first attempt, he or she must retake the test after graduation and delay licensure until that score is reported to the respective state boards of choice. While Part III has the highest initial pass rate, it exhibits the lowest ultimate pass rate because there is only one opportunity to take this examination prior to graduation. Educational theory suggests that more hands-on patient care experience in optometric clinical education may result in improved clinical skills and clinical thinking which is currently evaluated and standardized using the NBEO Part III. The objective of this study is to evaluate the correlation between the quantity of clinical patient encounters of fourth year students and performance score on the NBEO Part III.

### Methods

Data from the New England College of Optometry (NECO) graduating classes of 2004 and 2005 were evaluated. This data represents a compilation of student patient encounter logs reported by our students each clinical rotation. The patient encounters include a variety of experiences such as comprehensive eye examinations, intermediate eye examinations, vision screenings, observations, and problem focused examinations that occurred during their rotations. NECO final year students have four clinical rotations of approximately 12 weeks duration. Clinical assignments are made within the College-affiliated, New England Eye Institute, community health centers, the Department of Veterans Affairs, and a variety of other locations that extend nationally as well as internationally.

### Results

Results from 156 students were included for both patient encounter analysis and NBEO Part III analysis. Figure 1 shows the distribution of

![Figure 1: Distribution of Total Patient Encounters By Student](image1)

![Figure 2: Distribution of Students by Overall Part III Scores](image2)

### Table 1

<table>
<thead>
<tr>
<th>Data Compilation of NBEO Scores and Patient Encounters</th>
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<tr>
<td>Range</td>
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<tr>
<td>NBEO Part III Overall Score</td>
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<tr>
<td>CSE Score</td>
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<td>PAM Score</td>
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<td>Total Patient Encounters</td>
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The self-reported patient encounters were compared with the NBEO Part III score reports. The NBEO scores were compiled from the official score reports sent by NBEO from those students who released their score reports to the college. The official scores are reported as the Part III Overall Score, Clinical Skills Exam (CSE) Score, and Patient Assessment and Management (PAM) Score. Kruskal-Wallis H and Pearson's correlations were calculated.
As shown, the total patient encounters in the final year ranged from 313 patient encounters to 2533 patient encounters with mean of 1143.9 patient encounters and standard deviation of 362.4 patient encounters representing a skewed distribution. The total number of patient encounters per student varied greatly and could be due to self reported scores, variance in clinical rotations, and timing of clinical rotations. Figure 2 shows the distribution of the overall Part III NBEO scores with the majority of students scoring between 351 and 550. Table 1 shows the raw data that can be used to compare the total NBEO scores, CSE scores, PAM scores, and patient encounters using their range, mean, and standard deviation. Correlations were calculated using the total number of patient encounters as a predictor variable for the outcomes of CSE score, PAM score, and total Part III score. In each case, the correlation was non-existent with $r^2$ values equal to 0.00, 0.01 and 0.00 respectively. Scatter plots in figures 3 through 5 show a non-structured appearance, which shows no significant correlation between NBEO Part III scores, CSE scores, and PAM scores with the number of patient encounters. For example, there were many students who saw the same number of patients during their clinical rotations but had a range of 275 to 725 on their NBEO Part III examination.

Total patient encounters were also compared with the pass/fail performance on Part III. Using a cut-off score of 300, there were 19 students in this sample who did not pass Part III on their first attempt. The mean number of patient encounters for these 19 students was 1,103 compared with a mean of 1,155 patient encounters for students who passed the exam on their first attempt. Because the variance of the data was not homogenous, a non-parametric test, the Kruskal-Wallis N, was used to compare the two groups. The mean number of patient encounters was found to be not statistically significantly different ($p=0.3949$).

**Discussion**

Initial data analysis showed no significant correlation between NBEO Part III performance and clinical patient encounters, indicating that other factors may better determine performance on NBEO Part III exami-
nation and further studies are needed to determine these factors and their relationship to NBEO success. The NBEO Part III examination assesses clinical skills, but also considers other factors such as the clinician's efficiency, accuracy, and confidence. Because of the many facets that encompass the NBEO Part III examination, clinical experience alone cannot fully determine a student's ability to succeed in passing this exam.

In addition, other factors may also better predict the student's performance on NBEO including GPA, clinical evaluations, order of clinical experiences, types of clinical experiences and/or other measures of cognitive performance. According to De Wald et al., there was a strong correlation between National Board Scores for the National Board Dental Hygiene Examination and student GPA exiting the dental hygiene program when comparing students who took a board review course and those that did not. In this study, students from the same class were compared and separated by entering GPA, exiting GPA, and participation in an external board review course. Their results show that participation in the external board review course did not significantly affect student performance when compared to students who did not participate in the external board review course. However, exiting dental hygiene GPA's were shown to be a strong predictor on performance on the National Board Dental Hygiene Examination. Therefore, it may be worthwhile to analyze entering and exiting optometric GPA to determine if a significant relationship exists to predict NBEO Part III performance.

Another study investigated the timing and order of clinical experiences in relation to performance on specific sections of the National Board of Medical Examiners (NBME) Examination. They hypothesized that students taking the examinations later may do better because of increased clinical experiences, clinical knowledge, clinical skills, and problem-solving abilities. They refer to this phenomenon as "the clerkship timing effect." Because medical clerkships are significantly different in content, the timing of the clerkship was a factor in determining success on different parts of the NBME subject examinations. The authors also suggested that exam performance may vary due to familiarity of the examination format. This shows the need for further analysis in optometry as to the type of clinical experience and the timing of the clinical experience in relation to board examination administration and sequence. Others in the medical field have looked at correlations between clinical evaluations, NBME scores, and clinical performance and have shown that NBME Part I scores are minimally predictive of clinical performance.

There are some limitations to this study. First of all, the students were not randomly chosen from the population of all optometric students taking the NBEO Part III examination. Therefore, our results may not be universal and applicable to other schools and colleges of optometry. Furthermore, because the patient encounters are an objective measurement, our data may not represent the true patient encounters for each student. It is possible that there were more or less patient encounters than actually reported. Therefore, we want to stress the importance of monitoring and accurately documenting the number and type of clinical patient encounter for each optometric student. Other forms of data input should be considered to enable optometric educators to obtain and interpret needed data containing types of problems and diagnoses that students encounter. Denton et al. showed that CWeblog, a web and palm OS-based system, has been used by medical students to record data on problems and diagnoses encountered in the clinical setting. This data is immediately available to clerkship directors and can be easily evaluated. It has made it much easier for both directors and students. Therefore, optometric educators may need to consider other forms of data entry that will lessen the chance of student and transcription errors. We also need to consider studying and compiling a list of core problems that all third year students should encounter on a clinical basis. This will help in assessment and prediction of success on NBEO.

The data and analysis from future studies may be used to plan clinical programs and clinical goals for optometry students to improve NBEO performance in fourth year optometric students. It can also be used to predict success in optometry school and NBEO performance for use in the admissions process.

References

Optometric GPA, NBEO and Clinical Performance Compared To Critical Thinking Skill And Disposition

Aurora Denial, O.D., F.A.A.O.
Maria Pitcher, M.A.

Abstract

Purpose: Over the past decade, the topic of critical thinking has been brought to the forefront of health care education. The purpose of this study is to determine if critical thinking skill and disposition are correlated to cumulative optometric GPAs, national board scores (NBEO part 1), and clinical performance.

Methods: Seventy-eight students from the New England College of Optometry were assessed at the end of their third year with the California Critical Thinking Skills Test (CCTST) and Disposition Inventory (CCTDI).

Results: Total critical thinking skills were found to have a moderate to high correlation with GPA (r=0.45) and NBEO (r=0.42). Total critical thinking disposition demonstrated very low associations with GPA (r=0.06) and NBEO (r=0.18). The clinical groupings were not statistically associated with total disposition ANOVA (p=0.9249) but were associated with total skills (Kruskal-Wallis test p=0.0040).

Conclusion: This study suggests that there is a moderate to high correlation between a standardized test score evaluating critical thinking skills, GPA and NBEO (part 1) scores. Students who demonstrated the lowest clinical ability demonstrated low scores in critical thinking skills. The identification of this trend may be important in the early identification of students and the remediation of students in the clinical and academic setting.

Key words: critical thinking, optometric education, remediation

Introduction

The practice of optometry requires the processing of information about a patient’s symptoms and conditions, conducting an appropriate examination, arriving at a diagnosis, initiating a treatment plan and evaluating the outcome of a decision plan. Optometrists are often called upon to manage complex clinical scenarios, which involve a high level of decision-making skills. Good decision-making skills have been linked to good critical thinking skills. The Delphi report, which represents the collective thinking of several hundred experts in a variety of disciplines, defines critical thinking as purposeful, self-regulatory judgment that results in high level of decision-making skills. Good decision-making skills have been linked to good critical thinking skills.

The Delphi report, which represents the collective thinking of several hundred experts in a variety of disciplines, defines critical thinking as purposeful, self-regulatory judgment that results in good decision-making skills. Good decision-making skills have been linked to good critical thinking skills.

Over the past decade, the topic of critical thinking has been brought to the forefront of optometric and health care education. As more health care educators have realized the importance of critical thinking in patient care, more emphasis has been placed on researching and teaching critical thinking. The critical thinking skills of medical students have been assessed in several studies. Miller found that first year medical exam scores, medical GPAs, and MCAT scores had significant positive correlations to critical thinking. Likewise, Scott found that critical thinking scores were moderately predictive of academic success in the preclinical years of medical school. Mishoe and Shelledy reported significant relationships between critical thinking skills and decision making skills in respiratory care students. Facione reports that a study of over 1100 college students shows that scores on critical thinking skills tests are significantly correlated with college GPA and reading comprehension skills. The field of optometry has also shown an interest in the critical thinking skills of its students. In 1999, a task force was assembled by the Association of Schools and Colleges of Optometry to evaluate the critical thinking content of the OAT (Optometry Admission Test).

However, despite the interest of the optometry field in critical thinking, there is a paucity of research on this subject. A literature search of Pubmed, ERIC, Visionet, and VisionCite revealed only one research article and two editorials discussing this issue. The article revealed that, in 2002, the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI) were given to first and third year students to assess their critical thinking skills and dispositions. These results were then correlated with OAT scores, gender, and other demographics. There did not seem to be a significant difference between the scores of the two classes or between the genders. The only significant result was that the critical thinking skills tended to correlate with OAT scores. Total critical thinking skills scores were significantly correlated with seven of eight OAT scores, which included Quantitative Reasoning (r=0.26), Reading Comprehension (r=0.34), Biology (r=0.17), General Chemistry (r=0.19), Physics (r=0.26), Total

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tested by the CCTST are: analysis, five areas assessed. The five areas and separate scores for each of the total score for critical thinking skills Assessment which reported both a CCTST was scored by Insight involved with critical thinking. The designed to measure the skills psychological tests. The CCTST is clinical rotations. The tests were administered using the recommended guidelines from Insight Assessment.

The desired endpoint of optometric education is a student who is able to provide a high level of patient care and manage complex patient care scenarios. Optometric educators strive to design and implement innovative strategies that effectively assist students in their journey to becoming professionals. The portfolio of a successful optometric student includes: graduation from an accredited college of optometry, which implies maintaining a satisfactory grade point average, passing the National Board Examination in Optometry (NBEO parts 1, 2 and 3) and success in the clinical environment.

The purpose of this study is to determine if critical thinking skills and disposition toward critical thinking are correlated to cumulative optometric GPAs, NBEO (part 1), and clinical performance. If these measures correlate, then potentially students with weaknesses in critical thinking skills/disposition can be offered a more effective remediation strategy. Additionally, students at risk for academic and/or clinical difficulty may be identified early in the educational process and with intervention, remediation may not be needed.

Methods

Seventy-eight students from the New England College of Optometry were given the California Critical Thinking Skill Test (CCTST) and California Critical Thinking Disposition Inventory (CCTDI) at the end of their third year of optometric education. At this point in the curriculum, the students have completed all of the didactic curriculum and three clinical rotations. The tests were administered using the recommended guidelines from Insight Assessment. The California Critical Thinking Skills Test (CCTST) and California Critical Thinking Disposition Inventory (CCTDI) are both standardized psychological tests. The CCTST is designed to measure the skills involved with critical thinking. The CCTST was scored by Insight Assessment which reported both a total score for critical thinking skills and separate scores for each of the five areas assessed. The five areas tested by the CCTST are: analysis, evaluation, inference, deductive reasoning and inductive reasoning. The CCTDI is designed to measure the disposition toward critical thinking. The CCTDI was scored by Insight Assessment which reported both a total score for disposition and separate scores for each of the seven areas assessed. The seven areas tested are: truth-seeking, open-mindedness, analyticity, systematicity, confidence in reasoning, inquisitiveness and maturity. The total scores for skills and disposition were compared with cumulative GPA at the conclusion of the third year (encompassing the entire didactic curriculum) and NBEO (part 1) scores. The NBEO (part 1) consists of basic science questions which formulate the foundation of optometric education. The four areas tested by the NBEO (part 1) are: Human Biology, Ocular Biology, Optics and Psychology. The total CCTST and CCTDI scores were also compared to clinical performance grouped as follows: group 1 - any grade of remedial or fail at midterm or final; group 2 - two or more final grades of honors; group 3 - all of the others (no remedial or fail and less than 2 final grades of honors). Regression analysis was used to analyze the data in relationship to variables such as GPAs, national board scores and clinical grades. Non parametric testing was

<table>
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<th>Table 1 — Descriptive Statistics: CCTST</th>
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<td>Evaluation</td>
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<th>Table 3 — Total Scores and Subsets / GPA and NBEO</th>
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<tr>
<td><strong>GPA</strong></td>
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<td>Total Disposition</td>
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Table 4 — Clinical Grouping and Critical Thinking Skills (CT)

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<tr>
<th>Clinical Group</th>
<th>Minimum CT Skills Score</th>
<th>Max CT Skills Score</th>
<th>Median CT Skills Score</th>
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<tr>
<td>Group 1</td>
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<td>Group 2</td>
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<td>32</td>
<td>19</td>
</tr>
<tr>
<td>Group 3</td>
<td>18</td>
<td>30</td>
<td>23</td>
</tr>
</tbody>
</table>

Group 1 - any grade of remedial or fail at midterm or final; group 3 - two or more final grades of honors; group two - all of the others (no remedial or fail and less than 2 final grades of honors).

Table 5 — Clinical Grouping and Mean Critical Thinking (CT) Skills and Disposition

<table>
<thead>
<tr>
<th>Clinical Group</th>
<th>Mean CT Skills</th>
<th>Std Dev CT Skills</th>
<th>Mean CT Disposition</th>
<th>Std Dev CT Disp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>17.57</td>
<td>3.60</td>
<td>303.29</td>
<td>32.47</td>
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<tr>
<td>Group 2</td>
<td>18.86</td>
<td>4.09</td>
<td>306.86</td>
<td>28.50</td>
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<tr>
<td>Group 3</td>
<td>23.3</td>
<td>3.17</td>
<td>302.54</td>
<td>22.78</td>
</tr>
</tbody>
</table>

Group 1 - any grade of remedial or fail at midterm or final; group 3 - two or more final grades of honors; group two - all of the others (no remedial or fail and less than 2 final grades of honors).

Results

The critical thinking skills (CCTST) overall total mean was 19.5 with a standard deviation of 4.251 and the critical thinking dispositions overall total mean was 305.8 with a standard deviation of 27.70. (Tables 1 & 2) The total disposition scores were distributed as follows: 13% of the participants received scores of less than 280, 79% scored between 280-350 and 8% scored above 350. Total critical thinking skills and disposition were compared with the three variables of interest (GPA, NBE0-part 1 and clinical grouping). Pearson correlation coefficients were calculated for critical thinking skills total scores, critical thinking skills sub­sets, critical thinking disposition total scores and GPA and NBE0 scores. (Table 3, Figures 1 & 2) Total critical thinking skills scores were found to have a positive and statistically significant correlation with GPA \((r=0.453, p<0.001)\) and NBE0 \((r=0.428, p<0.001)\). The subsets of critical thinking skills were all positively correlated to GPA and NBE0 scores. The subsets of evaluation and induction were more closely related to GPA and NBE0 than any other part of the critical thinking score. (Figures 3-6) Total critical thinking disposition scores demonstrated a very low correlation with GPA \((r=0.0616)\) or NBE0 \((r=0.0187)\).

Clinical performance was grouped into three groups representing high, medium, and low ability. Seventeen percent of the students \((13/78)\) were in the high performing group (group 3), 9% \((7/78)\) were in the low performing group (group 1) and 74% \((58/78)\) were in the middle group (group 2). The clinical groupings were not statistically associated with total disposition (ANOVA \(p=0.9249\)) but were associated with total critical thinking skills (Kruskal-Wallis test \(p=0.0040\)). The range of scores for critical thinking skills and clinical groupings was 10-32. (Table 4) The mean scores for skills and disposition ranged from 17.57-23.3 and 302.54-306.86 across the clinical groups. (Table 5)
Discussion

Critical Thinking Disposition /GPA and NBEO

Critical thinking is both a skill and habit of mind. Critical thinking disposition is defined as one's willingness to use critical thinking as a problem solving strategy. When faced with a problem to solve, ideas to evaluate or decisions to be made, both a student's ability to create and implement a strategy and a student's willingness to use the strategy will determine the success of the endeavor. The data from this study indicate that there is a relatively low correlation between critical thinking disposition, optometric GPA, NBEO scores and clinical performance. A critical thinking disposition score of less than 40 is indicative of a deficiency in the disposition toward critical thinking. An overall disposition score of 350 or greater is considered very strong and is relatively rare. Although the study does not indicate a significant correlation between disposition and the variables of interest, the majority of our students (87%) were willing to use critical thinking. However, educational assessments such as GPA, NBEO scores and clinical performance may be more reflective of a student's critical thinking skills than a student's willingness to use a problem solving strategy.

Critical Thinking Skills / Clinical Performance

Optometrists often use a high level of decision making in their practice of optometry. Success in the clinical environment requires the utilization of factual knowledge and cognitive strategies to regulate the process of attending, learning, remembering and thinking. The nature of the clinical environment demands good clinical problem solving ability and decision making skills to ensure a high level of patient care. Clinical problem solving involves optometric knowledge base, critical thinking and experience. Additionally, the clinical thought process must allow the practitioner to adapt in an efficient manner to a variety of situations some of which they may not have previously encountered. The clinical groupings were statistically associated with critical thinking skills. Those in the lowest performing group tended to have the lowest scores in critical thinking skills. A review of the clinical instructor's comments from the midterm and final evaluations of the students in the lowest performing group revealed that 86% (6/7) of the students obtained their grades because of a weakness in an area associated with clinical thought process.

Critical Thinking Skills /GPA and NBEO

A statistically significant positive linear relationship was found between critical thinking skills and GPA. A statistically significant positive linear relationship was also found between critical thinking skills and NBEO part 1 scores. This finding is consistent with recent trends in optometric education to incorporate more critical thinking into the didactic curriculum. The National Board Examination in Optometry (NBEO) is also incorporating more critical and clinical thought process into its examination. Both critical thought process and clinical decision making are important skills for the successful clinician. Academic (GPA) and NBEO part 1 performance is reflective of many contributing characteristics. A student's ability to retain and utilize knowledge, motivation level, study
Critical Thinking Subset/GPA and NBEO

The subsets of critical thinking skills were all positively correlated to GPA and NBEO scores. However, the subsets of evaluation and induction were more closely related to GPA and NBEO than any other part of the critical thinking score. The experts define evaluation as meaning "to assess the credibility of statements or other representations that are accounts or descriptions of a person's perception, experience, situation, judgment, belief or opinion and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation." Induction means "an argument's conclusion is purportedly warranted, but not necessitated, by the assumed truth of the premise." The skills of evaluation and induction are important in patient care and academic life. Comparing the strength and weakness of alternative interpretations, determining the credibility of a source of information (evaluating case history, evaluating information from professors) and judging if the evidence supports the conclusion (diagnosis) are examples of how evaluative skills can be useful. Inductive reasoning involves the use of existing data and information to draw a general conclusion to confirm a hypothesis. Researchers involved with public health issues often use inductive reasoning for problem solving.

Impact of Critical Thinking

Optometric educators continually explore creative and innovative ways to help students succeed in their academic and professional career. Students who receive a remedial or failing grade in didactic courses or in clinic can experience educational delays as well as emotional stress. The remediation process can prove to be an educational challenge for both student and faculty. A strategy for remediation may involve the teaching of critical thinking skills. Facione has shown that critical thinking skills can be learned, and with instruction, critical thinking skills can improve in college students. However, without specific instruction, no improvement took place. Critical thinking tests can also be used in a predictive manner. Students with weaknesses in critical thinking skills can be identified early in their career and intervention can be initiated early, therefore making the academic and clinical experience more productive. The subset scores offer the potential to specifically target a student's weakness and offer remediation in that specific area. Additionally, since evaluation and induction were most closely related to GPA and NBEO part I, professors may want to use this information when organizing their course curriculum.

Although a statistically significant correlation allows us to predict the score of one variable based on the score of another it does not allow us to infer a causal relationship. The relationship does offer the potential for influencing GPA, NBEO and clinical performance by increasing the critical thinking skills of a student. Future research into a causal effect is needed. There are very few students with a high or low CT skill score; the linear trend and its slope highly depend on the data from these students. Therefore, in the future more
studies with a larger number of students may be needed to generate more data in the high and low range.

The goal of the didactic curriculum is to build a foundation of optometric knowledge and thought process to be used and expanded in the clinical setting. Increasing the critical thinking skills of all students may give students a stronger foundation when entering the clinical setting. Many lecture-based courses still rely on rote learning and concentrate on the acquisition of facts. Students’ study habits in the didactic courses may support the acquisition of factual information and not stress critical thinking skills. Professors might have different interpretations of critical thinking concepts that can lead to inconsistency within the curriculum. Inconsistency in the conceptualization of critical thinking concepts might make utilization more difficult for students. To maximize the potential of all students, the educational system must continue to support the teaching of critical thinking in the optometric curriculum.

Conclusion

This study suggests that there is a positive, moderate to high correlation between a standardized test score evaluating critical thinking skills, GPA and NBEO part 1 scores. This study also suggests that clinical performance is related to critical thinking skills. Students who demonstrated the lowest clinical ability demonstrated low scores in critical thinking skills. The identification of this trend may be important in the early identification of students and in the remediation of students in the clinical setting.

The ideal critical thinker is “habitually inquisitive, well informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal bias, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit.” Educating students to think critically means striving to achieve the characteristics of a critical thinker. To optimize patient care and the education of our students every effort should be made to support the teaching of critical thinking in the optometric curriculum.

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References

Predicting Academic Success in Optometry School

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Nicholas J. Kelsey, B.S.
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Lee Ann Remington, O.D., M.S., F.A.A.O.
Todd E. Bodner, Ph.D.

Abstract

Predicting success in optometry school is challenging. This study aids in selecting admission candidates who are likely to be successful in the optometric curriculum. OAT scores, interview scores, and undergraduate and optometry GPs were gathered for 175 students admitted to Pacific University College of Optometry. All undergraduate GPA variables and most OAT subsections demonstrated a statistically significant difference when comparing students who failed an optometry course and those who did not. Equations were developed to predict optometry GPA and the probability of a student failing an optometric course. These can be used by admission committees to help predict success prior to admitting optometric students.

Key words: admission, optometric education, grade point average, academic difficulty, Optometry Admission Test

Introduction

Predicting student success in optometry school is a difficult task. Optometry admission committees have a pool of applicants from which they are responsible for selecting students who are likely to succeed both academically and clinically. In the process, many academic and non-academic qualities are evaluated prior to allowing admission to optometry school. It is challenging for committees to rank each of these characteristics.

For many years there has been a significant decline in the number of optometry school applicants. Because class size cannot change based on the number of applicants, schools may be compelled to accept students who are less likely to be successful with the rigorous optometric curriculum.

At Pacific University College of Optometry (PUCO) there has been an increase in the number of students experiencing academic difficulty. This situation may cause a student to be dismissed or to be placed on a modified curriculum resulting in scheduling difficulties, decreased coherence of learning, and increased expense on the part of the student and college.

No recent studies have examined the relationship between Optometry Admission Test (OAT) scores, undergraduate (UG) grade point average (GPA), and optometry school performance. Older studies have correlated GPA and admission testing with academic success. However, these studies were performed at least 10 years ago when many state laws did not even allow optometrists to use therapeutic medications. Since that time the emphasis of optometric education has changed greatly. The number and type of required optometric courses, the emphasis of the National Board of Examiners in Optometry, student learning styles, and teaching methods have been modified extensively. These changes warrant a more current investigation into the factors that predict academic success in optometry school.

This study was designed to determine which admission factors have the greatest impact on academic success and to develop methods that admission committee members can use to more accurately select the best candidates from the applicant pool. Specifically, the study attempts to predict the GPA at the end of the first year of optometry school, the GPA at the end of the second year of optometry school, and the probability that students will fail any didactic course during their optometry school education.

Methods

Data were collected for 177 students who were admitted to PUCO during 2001 and 2002. Two students who left school for non-academic reasons were not included in the study leaving 175 records.

Table 1 lists the undergraduate characteristics that were evaluated. The study considered variables that admission committees are likely to consider prior to accepting an applicant. Optometry admission committees rely heavily on undergraduate GPA, OAT scores, a preadmission interview, and letters of recommendation. Due to the difficulty in formulating a standardized score for evaluating letters of recommendation, this variable was not included in the study.

To protect student confidentiality, the Office of the Director of Student Services removed from the undergraduate and optometry school transcripts all information that could be used to identify individual students. This included name, social security number, and undergraduate institution. Additional undergraduate information, including OAT scores and
Table 1

The mean and statistical significance level of undergraduate characteristics that were evaluated comparing those failing and not failing any optometry course. Statistically significant variables are marked with an asterisk using a Bonferroni adjustment to control Type I error, i.e., \( \alpha = \frac{0.05}{12} = 0.0041 \).

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<th>Significance</th>
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<td>Fails</td>
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<td></td>
</tr>
<tr>
<td>Interview Score</td>
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<tr>
<td></td>
<td>Fails</td>
<td>75.458</td>
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</table>

admission interview scores, were obtained from the Admission Office. The Director of Student Services' office assigned all students a randomized number ensuring that all undergraduate grades, OAT scores, interview scores, and optometry grades correlated correctly.

The OAT is a multiple choice examination designed to test the applicant's academic abilities and comprehension of scientific information. Scores in each individual section range from 200-400. A score of 300 represents an average score. Subsections of Biology, General Chemistry, Organic Chemistry, and Physics are combined for the Total Science score. Scores from the Total Science subsections are combined with the Quantitative Reasoning and Reading Comprehension scores to obtain an Academic Average.

GPA data was calculated in several different ways including UG cumulative GPA, GPA of all UG science courses, and GPA of the last 45 credits prior to the time of optometry school application. In order to compare United States transcripts with Canadian school transcripts, each Canadian university provided a legend to convert Canadian grades to the equivalent United States format.

The pre-admission interview score is based on a point scale with a maximum award of 100 points. The total interview score is the average score from two interviewers who are usually members of the admission committee. In general, the committee is looking for personality, communication ability, demeanor, intelligence, knowledge of optometry, and critical thinking skills. A small portion (10 points) of the interview score is based on the quality of an impromptu writing assignment.

GPA after the first year of optometry school, cumulative GPA after the second year of optometry school, cumulative GPA after the third year of optometry school, and the number of didactic courses a student failed, if any, were determined. A grade less than 75% is considered failing in any optometry course at PUCO. Grades that are based solely on clinical performance were not included. Because grades in the fourth year at PUCO are based on clinical performance, this data was not included in the analysis.

Students who failed one or more class (FAILS) were compared with students who successfully passed all optometry school classes on their first attempt (NO FAILS). An unpaired t-test was used to compare parametric characteristics.

Regression analysis allowed weighting of data in order to determine which combinations of variables had the highest correlation with the outcome measures. By using this type of analysis, we established equations to predict academic performance of an optometry student.

Results

At the time of analysis, all students in this study who had not been dismissed from optometry school had completed their third year of the optometry program. There were 135 students who passed all optometry
The correlation values for variables used to compare success in optometry courses. Notes: FAILS = Failure for any course; GPA1 = cumulative GPA at end of first year; GPA2 = cumulative GPA at end of second year; UG = Undergraduate. N for all statistics equals 175 except for those involving GPA2 where N = 172. Correlations significant at _ = .05 level are marked with an asterisk.

<table>
<thead>
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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
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<td>.202*</td>
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<td>.117</td>
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<td>.734*</td>
<td>.367*</td>
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<td>.188*</td>
<td>.160*</td>
<td>.645*</td>
<td>.268*</td>
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<td>.471*</td>
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<td>.243*</td>
<td>.276*</td>
<td>.165*</td>
<td>.916*</td>
<td>.436*</td>
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<td>.023</td>
<td>.012</td>
<td>.033</td>
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Group mean differences. Table 1 shows the results of the t-tests comparing FAILS and NO FAILS. To control the Type I error rate for these 12 tests, a Bonferroni adjustment on the significance level was used (i.e., \( \alpha = .05/12 = .0041 \)). Thus, a p-value less than .0041 was considered statistically significant. Failing students had significantly lower group means than non-failing students for UG cumulative GPA (p = .0023), the UG Science GPA (p = .0002), and the GPA of the last 45 credits prior to the time of optometry school application (p = .0003). Descriptively, the UG Science GPA shows the greatest difference between the means (0.28) followed by the last 45 credit hours GPA (0.23) and cumulative GPA (0.19).

Five of the eight OAT scores showed significant mean differences between groups. Table 1 lists the means for individual sections of the OAT. Failing students had significantly lower group means than non-failing students on Academic Average OAT (p = .0003), Quantitative Reasoning OAT (p = .0037), General Chemistry OAT (p = .0027), Organic Chemistry OAT (p = .0019), and Total Science OAT (p = .0013). The Academic Average OAT for NO FAILS was 322.44. The FAILS averaged 308.57 for a difference of 13.87. The Reading Comprehension, Physics, and Biology OAT sections did not show a statistically significant mean difference between the groups (p’s = .13, .05, and .02, respectively).

Finally, mean interview scores were not significantly different between the two groups (p = .14).

Bivariate associations. The correlations among the studied variables are shown...
in Table 2. All undergraduate GPA variables show a low (i.e., \( r \) between .2 and .4), yet significant, correlation with failing a course in optometry school and a moderate to substantial correlation (i.e., \( r \) between .4 and .7) with the first and second year GPA. UG Science GPA and the GPA of the last 45 credits taken were stronger correlates of optometry school GPA and failing a class than the cumulative undergraduate GPA. All OAT subsections demonstrated significant low to moderate correlations with first and second year GPA. Reading Comprehension OAT exhibited a negligible and nonsignificant correlation with whether a person was likely to fail an optometry course. The interview score correlated negligibly and nonsignificantly with the two optometry school GPA variables and with whether a person failed an optometry course.

**Prediction of first and second year cumulative grades.** The magnitude of the correlations among the variables suggests a degree of redundancy in their ability to predict academic success. Thus, the following regression analyses serve to select the variables with the strongest unique potential to predict the ability to pass all courses in optometry school and predict the optometry GPA. Four independent variables: Total Science OAT, Quantitative Reasoning OAT, Reading Comprehension OAT, and UG Science GPA were considered due to the significant correlation with the outcomes of interest and because the largest correlation between these four variables was \( r = .44 \) (between Total Science OAT and Quantitative Reasoning OAT) minimizing multicollinearity concerns. Furthermore, the Total Science OAT was used in the statistical analysis because it reflects the scores of Biology, General Chemistry, Organic Chemistry, and Physics. The Academic Average OAT has many components and our correlations suggest that not all of these components are useful. The Reading Comprehension and Quantitative Analysis OATs, which are not included in the Total Science OAT, were included as distinct components to determine whether each component had predictive utility. Finally, the UG Science GPA was used rather than the other two undergraduate GPA indices because all three indices were interrelated and because this and other studies found a high correlation between UG Science GPA and GPA after the first and second year of optometry school (See Table 2).

A stepwise regression analysis using the four predictor variables was performed in order to predict the cumulative optometry GPA at the end of the first year. In the first step, the four predictors account for 36.2% of the variance in the cumulative first year GPA (\( R^2 = .362, p < .001 \)). Total Science OAT, Quantitative Reasoning OAT, and the UG Science GPA had significant partial associations with the cumulative first year GPA; however, the partial association for Reading Comprehension OAT was not statistically significant \( (p = .19) \). This result suggests that Reading Comprehension OAT does not add significant predictive utility once the other three predictor variables are included in the equation.

\[
\text{Predicted GPA after the first year of optometry school} = -.404 + .004 \times (\text{Quantitative Reasoning OAT}) + .003 \times (\text{Total Science OAT}) + .002 \times (\text{UG Science GPA})
\]

In the second step, regression analysis was conducted without the Reading Comprehension OAT. The remaining set of predictors accounts for 33.2% of the variance in the cumulative second year GPA (\( R^2 = .332, p < .001 \)). Reading Comprehension OAT, again, does not add significant predictive utility after the other three predictor variables are included in the equation \( (p = .17) \). After dropping the Reading Comprehension OAT, it was found that the remaining three predictors account for 32.5% of the variance in the cumulative GPA after the second year of optometry school (\( R^2 = .325, p < .001 \)). All three partial regression slopes were statistically significant (i.e., \( p \)-values ranging from .009 to < .001). Thus, the final prediction equation for the cumulative second year GPA is as follows:

\[
\text{Predicted GPA after the second year of optometry school} = .700 + .002 \times (\text{Total Science OAT}) + .002 \times (\text{Quantitative Reasoning OAT}) + .381 \times (\text{UG Science GPA})
\]

**Prediction of course failure.** Using the same four predictor variables, logistic regression analysis was performed with failure in any course as the outcome variable. The set of four predictors accounts for 18.7% of the variance in the log-odds of course failure (Nagelkerke \( R^2 = .187, p < .001 \)). Because the predictors are correlated, a backward selection logistic regression analysis was conducted to drop non-significant predictors one at a time. The final model has two predictors: Total Science OAT and UG Science GPA. As a set, the two predictor variables significantly predict the log-odds of course failure \( (p < .001) \) and each individual partial logistic regression coefficient was statistically significant. Descriptively, these two predictors account for 16.9% of the variance in the log-odds of course failure (Nagelkerke \( R^2 = .169, p < .001 \)).

Using an empirically predicted probability of failure of 23%, this final model correctly classifies 70% of those who fail any course (sensitivity) and correctly classifies 62% of those that do not fail any course (specificity). The prediction equation is as follows:

\[
\text{Predicted log-odds of failure} = 8.321 - .016 \times (\text{Total Science OAT}) - 1.463 \times (\text{UG Science GPA})
\]

**Discussion**

Admission committees take into account several factors when assessing an optometry school applicant. Undergraduate GPA and OAT scores are used by admission committees in the selection of candidates. Students
Table 3
Predicted probabilities of at least one optometry course failure given particular Admission Scores. The Admissions Score is based on the equation 8.321 - .016 * (Total Science OAT) - 1.463 * (UG Science GPA).

<table>
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<tr>
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<tbody>
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<td>-3.931</td>
<td>.02</td>
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<tr>
<td>-3.628</td>
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<td>1.831</td>
<td>.86</td>
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</table>

who have academic difficulty in undergraduate studies appear to have difficulty with one or more courses in optometry school.

Emphasis can be placed on specific application data to evaluate optometry applicants and help determine if they have the potential to succeed in the challenging optometric curriculum. The UG Science GPA was found to be a significant predictor of academic success in optometry school. The majority of OAT scores were also found to correlate with didactic abilities. Reading Comprehension OAT, Physics OAT, Biology OAT, and the interview score were not found to be significant predictors of whether or not a student will fail a course in optometry school.

Ideally an admission committee would have a concrete formula that could predict success or failure in optometry school. Due to the multiple factors involved in academic success, including both cognitive and non-cognitive factors, it is impossible to predict this with 100% certainty. However, using regression analysis, the likelihood of failing a class in optometry school and the student GPA at the end of each academic year can be estimated based on UG Science GPA and OAT scores. As the results of the regression analyses indicate, this information is useful in selecting applicants for admission who are likely to exhibit acceptable academic progress in the program.

The following example illustrates how to translate the predicted log-odds of failure into a predicted probability of course failure:

Suppose there are three individuals, each with the same Total Science OAT. For illustrative purposes, the sample mean of 323.43 is used. However, these three individuals differ with respect to their UG Science GPA. Person A has an average one standard deviation (SD) below the mean (2.73), Person B has an average at the mean (3.17), and Person C has an average one SD above the mean (3.61). The predicted log-odds, odds, and probability of course failure for each individual is as follows:

**Person A:**

Predicted log-odds = 8.321 - .016 * (Total Science OAT) - 1.463 * (UG Science GPA)

= 8.321 - .016 * (323.43) - 1.463 * (2.73) = -.84787

Predicted odds = exp(-.84787) = .4283

Predicted probability = .4283 / (1 + .4283) = .300

**Person B:**

Predicted log-odds = 8.321 - .016 * (Total Science OAT) - 1.463 * (UG Science GPA)

= 8.321 - .016 * (323.43) - 1.463 * (3.17) = -1.49159

Predicted odds = exp(-1.49159) = .2250

Predicted probability = .2250 / (1 + .2250) = .183

**Person C:**

Predicted log-odds = 8.321 - .016 * (Total Science OAT) - 1.463 * (UG Science GPA)

= 8.321 - .016 * (323.43) - 1.463 * (3.61) = -2.13531

Predicted odds = exp(-2.13531) = .1182

Predicted probability = .1182 / (1 + .1182) = .106

As this example illustrates, for individuals at the mean Total Science OAT, a person with an UG Science GPA 1 SD below the mean has almost three times the predicted probability of failure in any course compared to a person with an UG Science GPA 1 SD above the mean.
Using various Total Science OAT and UG Science GPA values, a table was constructed to link predicted log-odds admission scores to predicted probabilities (see Table 3). Note that lower admission scores correspond with lower predicted probability of failing at least one course. This table may be used by admission committees to help predict success in optometry school. For example, if you want the probability of course failure to be less than .50, the needed admission score would need to be below .011. For a probability of course failure less than .23 (the failure base rate in this sample), an applicant would need an admission score less than -1.2. To illustrate this latter situation, consider that a student scoring better than 315 on the Total Science OAT with an UG Science GPA better than 3.06 would have an admissions score less than -1.2. Of course poorer Total Science OAT scores could be offset by better UG Science GPA to achieve an admissions score less than -1.2.

No recent studies have evaluated the relationship between OAT scores, undergraduate GPA, and optometry school performance for incoming optometry applicants. However, older studies have found similar results. Corliss1 designed a study in 1991 to help admission committees predict first year optometry GPA. He found that UG Science GPA, variability in UG cumulative GPA, and Optometry College Admission Test (OCAT) Average had the highest correlation with first year optometry GPA. He found that UG Science GPA, variability in UG cumulative GPA, and Optometry College Admission Test (OCAT) Average had the highest correlation with first year optometry GPA. In 1997, Kramer and Johnston2 evaluated 534 students from seven optometry schools. Similar to the current study, this analysis found that the Total Science OAT showed the strongest correlation with the first year optometry GPA. The next highest correlations were Academic Average OAT and UG science GPA. Results were similar for the second year GPA. In contrast, Wingert et al found very different results. This study found that the best predictors of performance in the first year of optometry school were the UG cumulative GPA in combination with the score on the OCAT Reading Test and the personal interview. In that same study, the most significant predictor of the second year GPA was found to be the interview score, the OCAT biology subtest, and the UG Science GPA. This contrasts with our current results which demonstrate that the interview score was of little value in predicting first or second year GPA. We also demonstrated that Reading Comprehension OAT has minimal effect on predicting optometry GPA and did not demonstrate statistical difference between students who fail a class in optometry school and students who pass all optometry classes. Variation and subjectivity in scoring the interview may play a role in the differences between the two studies. Significant changes in the optometry curriculum, admission testing, student learning styles, and teaching methods may also account for this disparity. Given the immense changes that have occurred since other studies have taken place, the updated results of the current study will be extremely useful to admission committees in deciding whether an applicant will likely succeed in optometry school.

Limitations. Due to confidentiality issues, our study did not take into account the competitiveness of the undergraduate institution. This value has been shown to aid in predicting academic success and can be found in sources such as Barron's Profile of American Colleges. Competitiveness can be determined by predmission variables such as ACT and SAT scores and the applicant to acceptance ratio. Data on students with very low GPA or OAT scores are not available for analysis because these students are not admitted. This selection process may influence the statistical relationship.

The fact that 70% of FAILS were correctly classified is good, suggesting reasonable sensitivity of the logistic regression equation for prediction purposes. However, the fact that 38% of NO FAILS were classified as failing a course suggests a lower level of specificity than desired. It should be noted that these classification statistics were based on an empirical predicted probability of failure of 23%. Altering the cutpoint for predicted failure would create a trade-off between specificity and sensitivity (i.e., sensitivity increases and specificity decreases as the cutpoint is increased). Given these levels of sensitivity and specificity, some caution is needed in using the logistic prediction equation for admission purposes. Future studies could explore other academic and non academic variables, including letters of recommendation, that might increase the prediction accuracy both in terms of the sensitivity and specificity of the prediction equation.

Success in optometry school is dependent on both cognitive and non-cognitive aspects. Although the non-cognitive aspects might help determine student success in optometry school, this study was designed to focus primarily on cognitive characteristics. It is also important to note that this study attempts to predict academic success. The results do not necessarily correlate with clinical performance or success in an optometric practice situation. Future studies are necessary to evaluate which characteristics predict success in a clinical setting.

Conclusion

There is no single predictor to determine success in optometry school. The models generated by regression analysis can decrease time spent on the decision process by decreasing the number of variables and by creating a standardized tool that can be applied to all applicants. Predicting success before admitting students can decrease expense, frustration, and wasted time on the part of the students as well as optometric faculty and administration.

References

Clinical Ethics: More Than Meets the Eye

ASCO Student Award in Clinical Ethics

Alison D. Harapiak

**Case Report**

**History**

A 14-year-old white female presented to the clinic accompanied by her mother. Her chief complaint was blurred vision at distance and near which had progressively worsened over the course of a week. Her last eye exam 3 years ago was unremarkable and she had never worn glasses. She was currently in 8th grade and doing well in school, earning A's and B's according to her mother. All childhood milestones were reached within a normal time frame and she had an uneventful birth. Patient medical history was unremarkable as was family ocular history. The patient was currently taking no medications and had no known medical or drug allergies. It was observed that the patient was reluctantly interactive, minimally vocal and made little eye contact.

**Clinical Findings**

On examination best corrected distance visual acuities were 20/70 in the right eye and 20/60 in the left. Pinhole showed no improvement. Near visual acuities were 20/40 in both the left and right eye. Pupils were equal, round, reactive to light revealing no afferent pupillary defect. Bed cap desaturation showed a 50% reduction in the left eye compared to the right eye.

Extraocular muscles showed full range of motion in both eyes. Stereopsis was reduced to 40º of arc and Ishihara color vision testing revealed a deficit yielding 9/12 color plates correct in the right eye and 8/12 color plates correct in the left eye. Bilateral constricted visual fields were evident on confrontation visual fields. Goldmann applanation tonometry indicated pressures of 16mmHg in the right eye and 15mmHg in the left eye.

Retinoscopy: OD: +0.50 DS
OS: +0.25 -0.25 X 175
Manifest: OD: +0.25 DS
20/60
OS: +0.25 -0.25 X170
20/60

Both anterior and posterior segment exam were unremarkable. Given the patients decreased visual fields, a Humphrey 24-2 SITA Fast visual field was performed on both eyes. Results showed a reliable test confirming bilateral constricted visual fields. The visual deficit which included decreased vision and bilateral constricted visual fields could not be attributed to any ocular etiology, indicating additional workup.

The tentative diagnosis at this point was hysterical versus malingering vision loss. Since both are diagnoses of exclusion, other etiologies such as retrobulbar optic neuritis, substance abuse, as well as systemic disease of a cerebral, vascular, infectious, or neoplastic origin had to be ruled out. The clinical findings were discussed with both the mother and patient where it was explained that there was no ocular abnormalities that correlated with the clinical findings. The patient was scheduled to return to clinic in 2 days for follow-up and a tangent screen visual field.

Additional historical information was obtained from the mother in a private discussion following the exam. The mother revealed a marked change in her daughter’s demeanor coinciding with her “vision loss.” She reported her daughter was a popular and outgoing teenager who had become quiet and withdrawn during the past few weeks. The mother was unable to attribute the behavioral change to any specific cause.

The patient returned for follow-up two days later where I closely observed the patient as she entered the exam room. For someone with drastically constricted visual fields and reduced acuities she moved through the waiting area to the exam room flawlessly. At this visit the patient requested that the mother not be present in the exam room. The patient stated her vision was unchanged. Visual acuities at distance were 20/100 in the right eye and 20/80 in the left eye and 20/40 at near in both eyes. All other ocular findings were the same as the previous visit.

On tangent screen testing, the patient was seated at one meter using a white test stimulus of 3mm. The patient was then moved to a 2-meter test distance and the test was repeated with a target size of 6mm. If the field had been normal or a pathology-induced deficit was present, the size of the isopter plotted on the tangent screen should have doubled at the second distance. Instead the field was approximately the same at both distances. This tubular visual field confirmed our

Dr. Harapiak, a 2007 graduate of the Illinois College of Optometry, is the winner of ASCO's 2007 Student Award in Clinical Ethics. The award, graciously funded by Ciba Vision, was begun by ASCO's Ethics Educators SIG to develop greater interest in ethics among optometry students.
diagnosis of hysterical versus malingering vision loss.

During this exam, the patient was notably more conversational and interactive. I wondered if this was because her mother was not in the room. While I was setting up the tangent screen the patient asked me if she could tell me something in confidence. I answered, "of course" wanting to help this girl any way I could. However, what she told me left me confused not only in my role as an optometry student, but also as a human being.

What had not occurred to me prior to that moment was that every time I put on my clinic coat I maintain the same morals, values, and belief system that I do in my every day life. As I set up the tangent screen I felt confused by an ethical dilemma. Should I breach my patient’s confidence and tell someone that she had been raped at a party two weeks earlier? If I did, who would I tell; the police, my attending, or her mother? Did I now have legal responsibilities? Was she telling me the truth? The questions seemed endless.

I finished the exam and then met with my attending doctor and her mother in private to discuss the results. I sat there and listened as my attending discussed nature, causes and treatment options for hysterical and malingering vision loss. He began to question the mother about any significant changes in her daughter’s life that could contribute to a condition of this magnitude. He continued, suggesting co-management with an occupational counselor, psychologist or other health care provider.

I sat there contemplating my moral dilemma. I wanted to tell them, but would this be a breach of my patient’s trust? I had never been put in a situation like this before and I had no idea what to do. Rape was a crime and I could not even begin to imagine what this girl was going through. Ultimately, my instincts told me that my patient needed help and that hiding her secret could only lead to more harm. So I decided the ethical decision was to inform both the attending doctor and the parent of what the patient told me in the exam room. I believed that breaching her trust could be justified in light of the circumstances.

**Discussion**

Some of the documents that govern ethics in optometry include the American Optometric Association Code of Ethics and the Optometric Oath. Both speak of values, but do not give answers on how to handle particular situations such as the one I was in. The AOA Code of Ethics, states that “optometrists hold in professional confidence all information concerning a patient, and to use such data only for the benefit of the patient.” The Optometric Oath indicates “I will hold as privileged and inviolable all information entrusted to me in confidence by my patients.” It is clear that doctor patient confidentiality is held in high ethical regard.

An additional consideration is Illinois’s mandatory reporting law under the Abuse and Neglected Child Reporting Act. This law requires that medical and other personnel must report cases of child abuse which would include rape. Furthermore, failure to report can be considered a misdemeanor on the first violation and a felony on subsequent violations. An ethical person strives to obey reasonable laws such as this. However, one can easily conceive of the conflict with issues of patient confidentiality. Ultimately being ethical is not the same as following the law; however, there is overlap. The law often incorporates ethical standards to which most citizens subscribe.

**Conclusion**

I do not know why this patient chose to reveal her secret to me. I do know is that she needed someone, and laws and ethics aside, what matters most is that someone was available to hear her. Currently the patient is undergoing psychological treatment and has regular eye exams. At her recent visit her vision had returned to 20/20 in both eyes and she demonstrated full visual fields. At this last exam the patient thanked me for helping her in this situation.

This case report presents an ethical dilemma where the ethics that govern our profession contradict that of the law, a situation that is not unique to rape or to the profession of optometry. It is a reminder that a clinico coat does not separate one from the responsibility to be a human being. As individuals we all have our own set of values and beliefs, which are added to by our profession and carried with us in to the exam room. What matters most at the end of each day is that we are there for our patients anyway we know how.

**References**


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Publication Guidelines for Optometric Education

Circulation

Optometric Education, a national publication of the Association of Schools and Colleges of Optometry, is published three times during the academic year. Its circulation includes all of the accredited optometric educational institutions in the United States, as well as students, practitioners, government leaders, and others in the health sciences and education. It is also sent to numerous optometry schools outside the United States. Established in 1975 as the Journal of Optometric Education, it is the forum for communication and exchange of information pertinent to optometric education. It is the only publication devoted entirely to optometric education.

Background

These instructions are in accordance with the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (Uniform Requirements).12

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Manuscripts should be organized within the framework of a format outline. The standard outline for reporting of studies, experiments, or other research projects is as follows:

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The introduction has several functions. It acquaints the reader with other relevant work performed in the subject area. Only contributions that bear on the interpretation of the results should be referenced. The introduction also presents the general nature of the problem to be addressed, the specific aspect of the problem that was studied, and the hypothesis and the manner in which it was tested.

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The methods should be described in enough detail so that others could replicate them. However, if portions of the methods have been described elsewhere, a summary with appropriate citations is sufficient. It is essential to describe how case and control subjects were selected for study. It is important to describe any commercially available apparatus used in the study by identifying the manufacturer’s name and address. Brief descriptions of meth-
ods that have been published but may not be universally understood should be presented. In addition, limitations of the methods employed should be presented, and new or modified methods should be described in detail. It is important to identify precisely all contact lenses, chemicals, drugs, or ophthalmic lenses, including generic names, dosages, and administration where appropriate. It is inappropriate to publish names of subjects or patients, their initials or other personal identification. Also, it is inappropriate to use ethnic terms when they serve only to perpetuate unnecessary, unscientific or derogatory connotations.

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The results should be presented in a logical order, emphasizing only important findings of the study without elaboration. Limitations of the results and any implications should be stated. The statistical analysis, if any, should be clear and relevant.

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The discussion should elaborate on the data, noting the relationships among the results and relating them to the original question asked in the study. Acceptance or rejection of the hypothesis should be stated. In addition, the discussion should emphasize any unique or new aspects of the study, and discuss the relevance of the results. It is important to draw those conclusions that can be supported by the results. Implications for basic and applied issues should be stated wherever possible.

Acknowledgements

Only those who have made a substantial contribution to the study should be acknowledged. Authors are responsible for obtaining written permission from those acknowledged by name, because readers may infer that acknowledged persons have endorsed the methods and conclusions of the manuscript. Many contributions justify acknowledgement, but not authorship. Such contributions might include acknowledgement of technical help, financial support, sources of materials, and persons who have contributed intellectually to the development of the manuscript.

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A list of references is placed at the end of a manuscript following the corresponding author’s address. References should be listed in sequential order as they are cited in the text by superscript numbers. Accuracy of citations is of major importance because it makes each specific reference retrievable by the reader. Authors should make every attempt to cite references that are relevant, original and current, and only references actually consulted. References to personal communication, unpublished information and papers either in preparation or submitted for publication are discouraged. Manuscripts that have been submitted for consideration for publication, but that have not been accepted, should not be referenced.

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This type of manuscript generally describes a program, teaching method or technique useful to the health professions educator. Manuscripts submitted in this category frequently discuss programs or methods, which might otherwise be a research article but for which an assessment of effectiveness has not been done. Communications can also review a body of literature on a specific subject for the purpose of providing the practitioner with guidelines or recommendations regarding the subject matter. Headings for a communications paper do not usually follow the standard format for a research paper, but the author should use headings and subheadings that promote understanding of the topic.

Teaching Case Reports

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The use of too many tables, figures or other illustrations in relation to the length of the text may produce page layout difficulties. In general, Optometric Education publishes one illustration for every 1,000 words of text. Authors should consult the CBE Style Manual for further information on preparation of tables, figures and other illustrative material.

Appendices

Occasionally it is necessary for the author to supply subordinate information that is relevant to the study but that might distract the reader because of excessive detail, e.g., computer programs, mathematical formulas, address lists, surveys or other data that might be cumbersome to present in the text. Appendices should be labeled Appendix A, Appendix B, Appendix C, etc. Each should have a short, descriptive title.

References


Revised November 2006

This book gives a comprehensive description of the potential complications of LASIK. It briefly describes some of the recent technology in this field including wavefront analysis and the Orbscan. However, a significant portion of the book is spent addressing the limited privileges of optometrists in the United Kingdom. A more direct title to the book would be LASIK. A Handbook for Optometrists in the U.K.

The book goes into great detail regarding pre- and post-operative patient counseling for routine symptoms as well as problematic visits. There is a good review of surgical candidate selection based on keratometry readings, corneal thickness, patient expectations, and ocular dominance. A detailed review of the different corneal maps for the Zeiss Humphrey Topographer includes the axial vs. tangential views and Pathfinder Analysis.

Two of the chapters are dedicated to postoperative complications. The first chapter describes the routine symptoms of patients in the different stages of recovery and some of self-limiting problems encountered. The author emphasizes different ways to reassure the patient for the variety of routine symptoms encountered during the initial few months after surgery. The more self-limiting conditions include subconjunctival hemorrhages, mild flap edema, red blood cells at the interface, and other interface opacities. The following chapter on complications gets into the more serious problems. The color photos of flap complications, diffuse lamellar keratitis (DLK), epithelial ingrowth, and interface opacities are excellent.

Some topics that are not applicable in the U.S. are the topical medications used for post-op. care. Typical post-op. medicines in the U.K. are Exocin tid (antibiotic), dexamethasone tid, and Voltorol (not Voltaren) if needed for pain management. The most commonly cited source for the book is the Royal College of Ophthalmologists (RCO) in the U.K. The RCO is cited in every chapter of the book.

Another area that is not applicable is the assignment of liability. In the U.K., the optometrist has to work under the umbrella of the ophthalmologist’s malpractice insurance. This fact leads to the concept of the ophthalmologist being responsible for care provided by the O.D. Due to this and the restriction on optometrists prescribing topical steroids, there is little to no problematic postoperative care being provided by the optometrist. The text recommends that the O.D. contact the general physician for treatment if the ophthalmologist is not available in the event DLK develops.

In conclusion, the book is useful as a review for LASIK complications. It includes a good variety of color photographs of normal and problematic flaps. I would not use it as the main refractive surgery text for students because the focus of the book does not apply to the mainstream of optometric practice in the U.S.

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