The Journal of the Association of Schools and Colleges of Optometry

OPTOMETRIC EDUCATION

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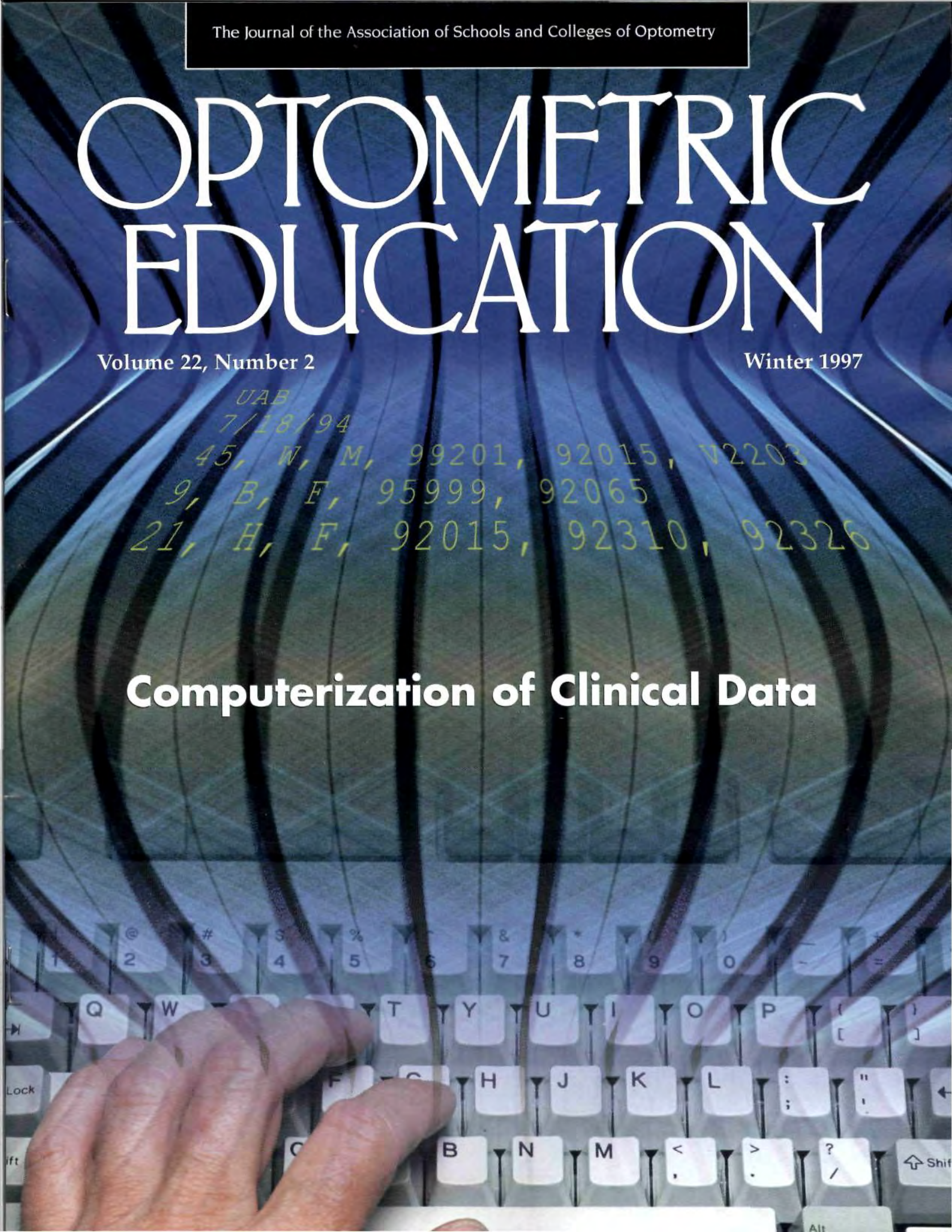
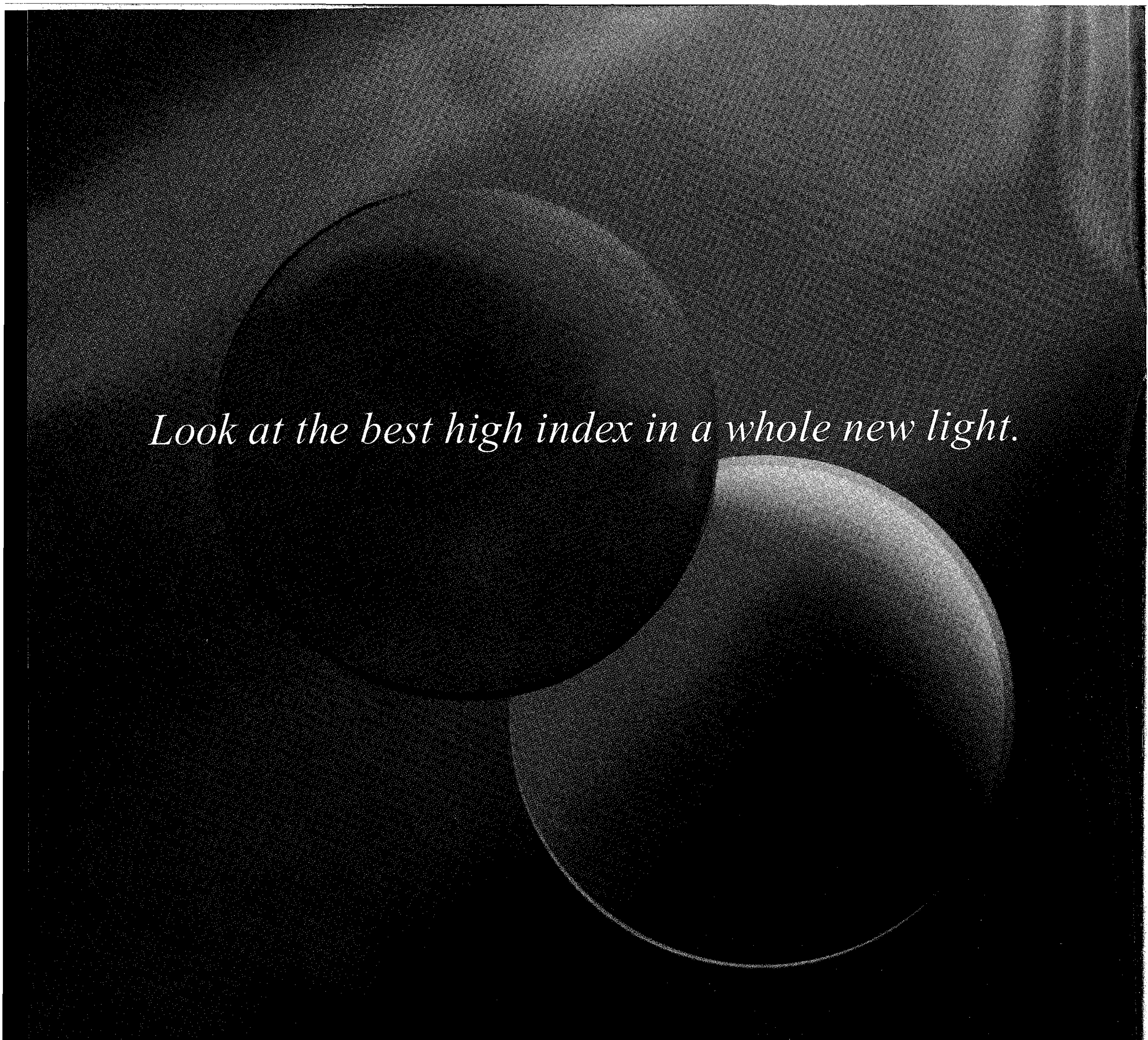
Winter 1997



Computerization of Clinical Data



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OPTOMETRIC EDUCATION

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CONTENTS

WINTER
1997

The Journal of the Association of Schools and Colleges of Optometry

COMMUNICATIONS

ARTICLES

DEPARTMENTS

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References:

1. Data on file, Angelini Pharmaceuticals, River Edge, NJ.
2. Allinson RW, Gerber DS, et al. Reversal of mydriasis by dapiprazole. *Ann Ophthalmol.* 1990;22:131-138.

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The reconstituted solution has a pH of approximately 6.6 and an osmolarity of approximately 415 mOsm.
The inactive ingredients include: mannitol (2%), sodium chloride, hydroxypropyl methylcellulose (0.4%), edetate sodium (0.01%), sodium phosphate dibasic, sodium phosphate monobasic, water for injection, and benzalkonium chloride (0.01%) as a preservative.
RĒV-EYES Eyedrops, 0.5% is supplied in a kit consisting of one vial of dapiprazole hydrochloride (25 mg), *one vial of diluent (5 mL) and one dropper for dispensing.*

CLINICAL PHARMACOLOGY

Dapiprazole acts through blocking the alpha-adrenergic receptors in smooth muscle. Dapiprazole produces miosis through an effect on the dilator muscle of the iris.
Dapiprazole does not have any significant activity on ciliary muscle contraction and, therefore, does not induce a significant change in the anterior chamber depth or the thickness of the lens.
Dapiprazole has demonstrated safe and rapid reversal of mydriasis produced by phenylephrine and to a lesser degree tropicamide. In patients with decreased accommodative amplitude due to treatment with tropicamide, dapiprazole partially restores the accommodative amplitude. This activity is not only due to its miotic effect but also to a direct effect on accommodation.
Eye color affects the rate of pupillary constriction. In individuals with brown irides, the rate of pupillary constriction may be slightly slower than in individuals with blue or green irides. Eye color does not appear to affect the final pupil size.
Dapiprazole does not significantly alter intraocular pressure in normotensive or in eyes with elevated intraocular pressure.

INDICATIONS AND USAGE

Dapiprazole is indicated in the treatment of iatrogenically induced mydriasis produced by adrenergic (phenylephrine) or parasympatholytic (tropicamide) agents. Dapiprazole is not indicated for the reduction of intraocular pressure or in the treatment of open angle glaucoma.

CONTRAINDICATIONS

Miotics are contraindicated where constriction is undesirable, such as acute iritis, and in those subjects showing hypersensitivity to any component of this preparation.

WARNING

For Topical Ophthalmic Use Only. NOT FOR INJECTION. Do not touch the dropper up to lids or any surface, as this may contaminate the solution. Dapiprazole should not be used in the same patient more frequently than once a week.

PRECAUTIONS

Information to Patients: Miosis may cause difficulty in dark adaptation and may reduce the field of vision. Patients should exercise caution when involved in night driving or other activities in poor illumination.
Carcinogenesis, Mutagenesis, Impairment of Fertility: Dapiprazole has been shown to significantly increase the incidence of liver tumors in rats after continuous dietary administration for 104 weeks. This effect was found only in male rats treated with the highest dose administered in the study, ie, 300 mg/kg/day (80,000 times the human dose) and was not observed in male and female rats at doses of 30 and 100 mg/kg/day and female rats at doses of 300 mg/kg/day.
Negative results have been reported on the mutagenicity and impairment of fertility studies with dapiprazole.
Pregnancy: *Pregnancy Category B:* Reproduction studies have been performed in rats and rabbits at doses up to 128,000 (rat) and 27,000 (rabbit) times the human ophthalmic dose and revealed no evidence of impaired fertility or harm to the fetus due to dapiprazole. There are, however, no adequate and well-controlled studies in *pregnant women. Because animal reproduction studies are not always predictive of human response, this drug* should be used during pregnancy only if clearly needed.
Nursing Mothers: It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when dapiprazole is administered to a nursing woman.
Pediatric Use: Safety and effectiveness in children have not been established.

ADVERSE REACTIONS

In controlled studies the most frequent reaction to dapiprazole was conjunctival injection lasting 20 minutes in over 80% of patients. Burning on instillation of dapiprazole was reported in approximately half of all patients. Reactions occurring in 10% to 40% of patients included ptosis, lid erythema, lid edema, chemosis, itching, punctate keratitis, corneal edema, browache, photophobia and headaches. Other reactions reported less frequently included dryness of eyes, tearing, and blurring of vision.

DOSAGE AND ADMINISTRATION

Two drops followed 5 minutes later by an additional 2 drops applied topically to the conjunctiva of each eye should be administered after the ophthalmic examination to reverse the diagnostic mydriasis. Dapiprazole should not be used in the same patient more frequently than once per week.

Directions for Preparing Eyedrops:

1. Use aseptic technique.
2. Tear off aluminum seals, remove and discard rubber plugs from both drug and diluent vials.
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4. Remove dropper assembly from its sterile wrapping and attach to the drug vial.
5. Shake container for several minutes to ensure mixing.

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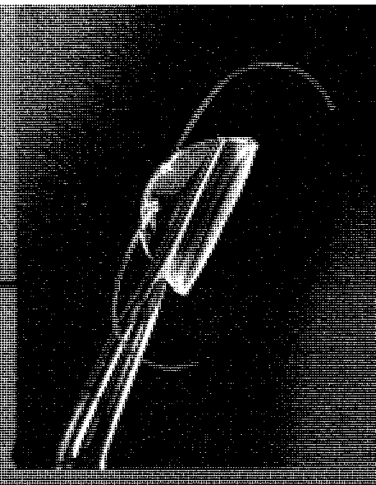

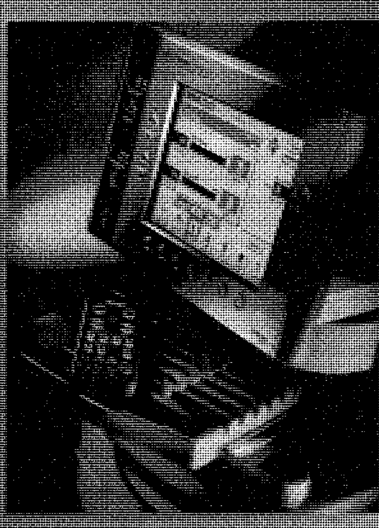

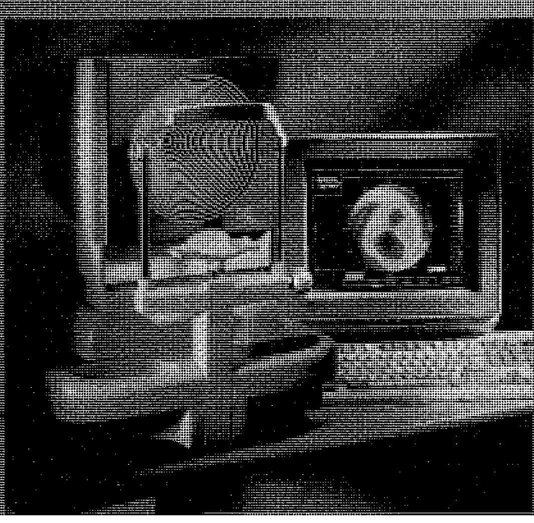

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Guest

EDITORIAL

A National Center For Optometric Data

Felix M. Barker, II, O.D., M.S.

This issue of *Optometric Education* highlights two important issues: admissions testing and computerization of clinical data.

Authors Kramer and Johnston, staff members at the Optometry Admission Testing Program (OAT), present correlational data between optometry school candidate entrance qualifications and academic performance outcomes from a recent admissions year. The presentation of this data is timely in light of the increased application rate to schools and colleges of optometry and the other health professions. Not surprisingly, their conclusions not only reaffirm the value of standardized aptitude testing and pre-optometry academic performance, but they also reinforce the importance of other, less tangible, personal factors like motivation and perseverance to academic success in optometry school. Their detailed analysis is an important contribution and is worthy of critical reading by both admissions staff and faculty alike.

In another paper, Dr. Larry Thibos presents a report of the work of the ASCO task force to evaluate Standards for the Electronic Management of Optometric Records (SEMOR). Driven by the increasing availability of "paperless" eye examination records, this task force report outlines three levels of data base complexity, each with flexible guidelines for inclusion of patient examination data. The stated purpose of this project was to create a realistic basis for taking better advantage of the increasing amounts of electronically accessible exam data, all with an eye toward the greater development of clinical research opportunities.

Perhaps the more important issue addressed by the SEMOR task force was its call for ASCO leadership in engaging our educational institutions in the process of formalizing the "optometric electronic data set" as well as in the creation of a "National Center for Optometric Data," suggesting the establishment of a "virtual laboratory" within our profession.

On a local basis, the ability to electronically search for and to sort patients by condition has proved to be an increasingly valuable asset to clinical research development at our schools. Ready access to retrospective data and to prospective patient contacts has been helpful, at various institutions, to our inclusion in NIH clinical trials such as CLEK, OHTS, Head Start, and, most recently, the COMET study.

The ASCO Board's approval of the task force's recommendations on standards for the electronic management of optometric records was a welcome first step. Its decision to refer the idea of a National Center to the Academic Affairs Committee for further study offers time to broaden involvement in this exciting opportunity.

Whatever ASCO's role in promoting a National Center, both the American Optometric Association (AOA) and the American Academy of Optometry (AAO) can provide critical support through the combined activities of the AOA Council on Research and the Academy's Research Committee. Working together, these two groups have already done a great deal to foster research project development in the clinical domain through the biennial Summer Invitational Research Workshop. Designed as a research skills development program and information exchange forum, the "Summer Camp" produced several active working groups dealing with key research topics, and these activities have lead directly or indirectly to the establishment of projects such as CLEK, Head Start and COMET.

Needless to say, the availability of ubiquitous electronically accessible patient research data would be a tremendous asset to our continued and growing involvement in the type of clinical research promoted by the National Eye Institute, the AOA and the Academy. Dr. Thibos' identification of ASCO's leadership status should be expanded to include a call to the AOA and the Academy to support the establishment of such a National Center for Optometric Data.

OPHTHALMIC INDUSTRY NEWS

Companies appearing on these pages are members of ASCO's Sustaining Member Program. Sustaining Members are listed on the inside front cover of each issue. Membership is open to manufacturers and distributors of ophthalmic equipment and supplies and pharmaceutical companies.

Top Optometry Students Receive Vistakon Award of Excellence

For the eighth consecutive year, Vistakon, a division of Johnson & Johnson Vision Products, Inc., recognized top optometry graduates with the "Vistakon Award of Excellence in Contact Lens Patient Care." The awards, each of which consisted of a plaque and a check for $1,000, were presented to the graduates at their respective optometry schools and colleges.

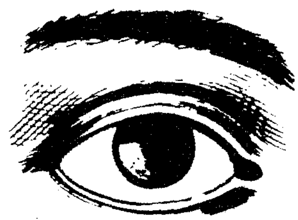
The winners were: Dr. Orly Maslavi, SUNY; Dr. Gregory Nixon, TOSU; Dr. Michael Hill, MCO; Dr. Heriberto Sanchez, IAUPR; Dr. Carlos Sanchez, SEUCO; Dr. Kirsten Jones, NEWENCO; Dr. Christine Chatten, PUCO; Dr. Matthew Craig, UW; Dr. Brenda Hutchison, UMSL; Dr. Chris Wilmer, UCB; Dr. Dominick Opitz, ICO; Dr. Stephanie Willett, SCO; Dr. Kelly Malloy, PCO; Dr. Gina Kim, UH; Dr. Ron Bound, IU; Dr. Earlena McKee, NSUCO; Dr. Norah Krol, UAB; Dr. Teri Tsuchiya, SCCO; and Dr. Antonio Canuto, UM.

Dr. George Mertz, director of academic affairs at Vistakon, noted that, "We are proud to recognize these new doctors of optometry, who not only managed to persevere through four years of demanding training to earn their degrees, but in the process, performed at a level which distinguished them among their fellow students as the best in this category. We applaud them for the fine example they set for the profession of optometry."

CIBA Offers New, Compact Packaging

CIBA Vision Corporation announced that they are now adding Visitint to New Vues, making it one of the only disposable contact lenses available with either a visibility tint or enhancing tint. NewVues Visitint will also be the first product available in CIBA Vision's new compact packaging.

NewVues' new packaging offers several advantages to eye care professionals. By reducing the original size and weight of its previous packaging by nearly half, it conserves valuable inventory space in offices and is much easier to handle and open. The significant reduction in material is also better for the environment because there is less post-consumer waste. CIBA Vision will convert its entire line of high-volume lenses (Focus and NewVues) to new packaging in 1997.



Transitions Optical Launches Nationwide Managed Vision Care Program

A Transitions Optical-commissioned study, conducted by the research firm of Louis Harris and Associates, examined responses from 1,000 consumers and 400 professionals involved with the managed vision care delivery system. It found that of the 61 percent of insured Americans, less than half, 47 percent, are fully satisfied with their current vision care coverage. In addition, while 148 million Americans currently are enrolled in some type of managed care plan, they do not understand which eye care services should be covered in their vision benefits. Even more have insufficient information about the broad array of vision products and services available today.

"Every day, 14,000 consumers enroll in some type of managed health care plan, and by 1997, more than 60 percent of consumers are expected to be enrolled in a managed vision care plan," said Richard C. Elias, president of Transitions Optical, Inc. "The Transitions in Managed Vision Care program will serve as the catalyst to educate consumers about the critical importance of eye health and show them how to maximize their vision coverage within their managed vision care benefits.

"We intend to rally the optical industry and consumers to urge corporations to work with plan providers to negotiate flexible vision benefits that give employees maximum choice in how they use their benefits," Elias said.

For more information on Transitions in Managed Vision Care or to obtain a copy of the brochure, contact Transitions Optical, Inc. 1-800-388-8847.

Wesley-Jessen Acquires PBH, Looks to Future

With the acquisition of Pilkington Barnes Hind (PBH), Wesley-Jessen has the most comprehensive line of high value lenses in the world, and will adopt a more aggressive approach to assisting practitioners in increasing their contact lens revenues.

"One of the major concerns we hear from doctors is that disposables have driven down the profitability of fitting contact lenses. Our unique product line and our marketing programs provide the practitioner excellent tools to counter that trend," said Thomas F. Steiner, W-J's vice president of marketing.

"Practice revenue can be enhanced, with little added chair time, by encouraging patients to consider higher value lenses that offer more benefits, such as cosmetic lenses, soft torics and premium spheres," said Steiner.

Under the terms of an agreement negotiated with the Federal Trade Commission, W-J will divest rights to market Natural Touch opaque lenses in the U.S. W-J will continue to market the line in Canada and other international markets. With the acquisition, W-J's sales now exceed $250 million annually.

Bausch & Lomb Announces Big Growth in Market

Bausch & Lomb recently released Trends in Lens Care 1996, the company's annual report on opportunities in contact lens practice. The 1996 report provides new data that profiles the growing number of patients choosing contact lenses, their needs and expectations, and the untapped practice-building potential that these patients represent. According to the report, a rebounding economy and increased consumer confidence during the first half of 1996 were reflected in a 14% increase, nearly 1.5 million, in new contact lens wearers, in comparison to the same time period in 1995.

These gains were offset by a significant increase in the number of patients who have dropped out of lens wear. The Trends report provides insight into how eye care professionals can minimize contact lens wearer dropouts by strengthening the doctor/patient relationship and positioning themselves to tap important patient markets such as teens, young adults and Baby Boomers.

"Practitioners will find evidence throughout the report that renewed focus on increasing contact lens wearer success is a significant strategy to realize economic benefits and deliver long term value to the practice," said William T. Reindel, O.D., director of professional market development for B & L. "This year's report is dedicated to helping eye care professionals identify and apply strategies for growth that will increase the value of a thriving contact lens patient base."

A complimentary copy of Trends in Lens Care 1996 is available to eye care professionals by calling 1-800-832-7368 or via a Bausch & Lomb representative.

Corning Offers Photochromic Lens Selection Guide

Dispensers can get quick answers to many of their questions by referring to the new Corning Photochromic Products Lens Selection Guide available from Corning Optical Products. Almost everything dispensers need to know about the family of Corning photochromic products is highlighted in this handy, laminated reference card.

"From product features to patient benefits to Rx ranges of PhotoGray THIN and DARK lenses, the guide has been designed to give dispensers the information they need on Corning photochromic products," said Rosemary Russell, senior sales promotion specialist.

Russell said the new Corning guide "will help keep busy dispensers up-to-date concerning the range of photochromic options while attracting a growing number of patients to the benefits of Corning photochromic lenses." For copies of the lens selection guide, write Corning Optical Products, HP-CB-5, Corning, NY 14831 or contact your regional Corning sales consultant.

ASCO Meetings Calendar 1997

March

21st-23rd — Ethics Educators SIG Conference (Westfields Conference Center, Chantilly, Virginia)

April

11th — Executive Committee (Woodlands Conerence Center, Woodlands, Texas)
11th — Spring Board of Directors Meeting (Woodlands Conference Center, Woodlands, Texas)
11th-13th — Critical Issues Seminar (Woodlands Conference Center, Woodlands, Texas)

June

10th — Executive Committee (St. Louis, Missouri)
10th-11th — Annual Meeting (St. Louis, Missouri)
11th — Annual Luncheon (St. Louis, Missouri)
13th — Sustaining Member Advisory Committee Breakfast (St. Louis, Missouri)

July

18th-20th — Ophthalmic Optics Educators SIG Conference (Westfields Conference Center, Chantilly, Virginia)

Standards for the Electronic Management of Optometric Records

Recommendations of the SEMOR Task Force

Larry N. Thibos, Ph.D.

Background

This report describes the outcome of a national task force called SEMOR which was charged by the ASCO Committee on Academic Affairs to develop Standards for the Electronic Management of Optometric Records. The idea for the project emerged in April 1993 during the Research Summit Conference sponsored by ASCO and the American Optometric Association in which leading optometric researchers met with key administrators and other leaders in optometry to discuss and plan for the future of optometric research. One of the major themes to emerge from that conference was that a pressing need exists for closer cooperation, collaboration, and communication between the research establishments of our schools and colleges and the practicing optometrists in the field. The science and profession of optometry stands to gain enormously if a renewed spirit of cooperation can be translated into tangible research initiatives. A consensus view of the summit participants was that optometry has the potential, as well as the obligation, to become the acknowledged leader in basic and clinical research into outstanding problems related to visual health. To achieve this goal, however, optometry needs to draw upon the unique strengths of our diverse research institutions to create coalitions of basic and clinical researchers of the highest caliber who are willing and able to collaborate on a national scale on projects of national importance.

Abstract

Proliferation of computerized record systems in optometry provides a new opportunity to promote collaborative research on a national and global scale. An ASCO task force charged with developing standards for the electronic management of optometric records (SEMOR) recommends a hierarchical organization of optometric data into three levels called Basic, Enhanced, and Comprehensive. Compliance with a given level of ASCO standards would assure compatibility with other institutions at the same level of compliance, thus providing a common language for the exchange of optometric data.

Key words: *data archive, computer database, paperless records*

Dr. Thibos is a professor of optometry and visual science at the Indiana University School of Optometry. Dr. Thibos was chair of the Standards for the Electronic Management of Optometric Records (SEMOR) task force.

In order to position optometry for collaborative research on a national and global scale, new methods must be found for removing the barriers to collaborative research. One such barrier is simply the lack of proximity of individuals at different institutions. How can colleagues interact, share information, and carry on an effective research collaboration when physically separated by hundreds or thousands of miles? One answer to this question spurred the formation of the SEMOR task force: use modern communication technology to shrink the world and make distant competitors into close colleagues. For example, optometry needs to take advantage of the emerging "information superhighway" to create "virtual research laboratories" that will provide the infrastructure for collaboration. Another idea is to create a research collection of optometric data that can be accessed rapidly and conveniently by researchers, educators, and practitioners from any location on earth that has a connection to the internet. To achieve such lofty goals, however, requires a consensus on a rather mundane issue: how to organize, encode, store, and share optometric data in a common language and format which everyone can understand and utilize?

The Vision

Traditionally, optometric records are kept on paper in various forms but in all of our institutions there are projects currently underway, or being contemplated, to place optometric data in computer form. This change from paper to electronic media has far reaching consequences for optometric research. Imagine the power of having computer access to a research library of optometric patient records which contain fundus pictures, slit lamp images, corneal topographic maps, diagnostic test results such as visual fields, color confusion tests, or electrodiagnostic waveforms, as well as conventional textual data describing the results of standard diagnostic procedures. Now imagine the research potential of many such databases from all the schools and colleges of optometry, linked together by the present and expanding national computer network, with tools which permit search/sort operations on the basis of image and graphical features as well as key words. Then put into the equation the use of such a system for rapid, convenient exchange of information between researchers at various institutions. By providing network access to this wealth of information to optometrists in the field, a mechanism emerges for "waking the sleeping giant" by including the practicing optometrist as a valued, contributing member of the research team. This is the vision of a "virtual research laboratory" - the use of the global communication network to free researchers from the constraints of space and time.

All of this is possible with existing technology, but it will take a coordinated effort by the leaders in the profession to make it happen. If optometry as an academic community can act decisively to develop systems for the electronic management of optometric records that will facilitate the exchange of information, then we will be able to leverage individual successes to achieve a common goal far greater than any of our schools can achieve by itself. If managed with vision, the result will be the creation of an infrastructure which will position optometry to capitalize upon the unique strengths of our diverse institutions. The result will be an increased ability to form research coalitions which will be competitive for research funding, for participating in large-scale clinical studies, and ultimately for elevating the prestige of the optometric profession and its political impact.

Scope of the Task Force

The SEMOR national task force is comprised of representatives of the ASCO institutions. On a local level, each representative gathered advice and information from clinical, academic, and technical colleagues. The task force was *not* concerned with the design or implementation of any specific computerized database system nor did it deal with financial records. Rather, the focus of the task force was aimed at the broader issues relating to inter-school communication of research information. Accordingly, the charge of the task force was to produce design specifications which any particular school should incorporate into its own electronic patient records system in order to be in a position to participate in the future sharing of information through this network of optometric computer databases. In defining standards for optometric data we must avoid introducing rigidity that would limit the freedom of different institutions to develop customized patient record systems in whichever way is best for their own purposes. Rather, our goal was to make it possible for institutions to proceed with development efforts, confident in the knowledge that they were complying with established conventions. Thus, it should be clear that adopting a common standard does not imply that all institutions agree to make their records freely available to all other institutions, only that institutions will adhere to a set of rules which will facilitate the exchange of information if they so choose.

Assumptions and General Principles

In approaching its charge, the task force adopted the following guidelines for its activities and recommendations.

- ▶ **Be flexible.** Develop scaleable solutions which will grow with the project and which will enable the participation of the entire family of optometric institutions, despite their heterogeneity of research activity and computing resources.
- ▶ **Be smart.** Avoid the hasty adoption of technical standards that will be left behind by rapid advances in technology.
- ▶ **Be realistic.** Expect obsolescence, but plan for evolution. Anticipate the need for periodic review of standards by including mechanisms which will allow for conceptual and technical review of progress over time.

Technology Survey

In order to gauge the state of technological infrastructure at ASCO institutions, a survey was conducted in June 1994 to which 10 institutions replied. The survey revealed that our schools and colleges are highly computerized but our clinical database systems are used exclusively for patient management, not for educational or research purposes. The existing clinical databases come in every conceivable variety, running on every major brand of computer, under every popular operating system. In short, we have almost nothing in common except our data. A statistical summary of the results follows:

- all ASCO institutions are able to communicate by email.
- 100% of institutions maintain a computerized database for patient management.
- no two institutions use the same hardware/software combination to run the clinic database.
- 80% of institutions routinely record ICD-9 diagnostic codes and CPT procedure codes in the clinic computer database.

Table 1: What is the Nature of Optometric Data?

Optometric data come in several different types

Text
- categorical
- short descriptions

Numeric
- scalar
- vector

Graphical
- bitmap
- vector

Image
- single frame
- movies

Optometric data are inherently chronological

Patients have multiple visits
Clinical tests are repeated at intervals of time
Diagnosis can be re-evaluated several times
Effect of treatment is tracked in follow-up examinations

Optometric data have multiple uses

Routine management of patients
Local research projects
Multi-site research projects
Public health demographics

Table 2: How Should Optometric Data be Organized?

Is there a small core of patient information which everyone agrees is essential?

Can a larger set of data elements be identified which defines the fundamental results of a general, routine examination?

How do we ensure organized extensibility needed for growth?

• 60% of institutions are not able to easily retrieve data from their database in a text format suitable for transmission by email.
• 100% of institutions have very high utilization (>90%) of personal computer workstations by faculty.
• 90% of institutions have equal utilization of computers by clinical and regular faculty.

Consensus Observations

The first step towards achieving agreement on optometric standards requires general consensus on the nature of optometric data and how it is used. Table 1 presents a summary of the kinds of data encountered in optometry, their chronological features, and ways they are used for patient management and research. Next, there needs to be an understanding of how optometric data are organized. This is a more difficult task since there are many valid ways to organize patient data and no two institutions do it the same way. Despite this variety, it is essential that some common structure be imposed upon the data to permit its navigation. To approach this issue, the task force deliberated the questions illustrated in Table 2. Our answers to these questions resulted in a hierarchical model of optometric data embodied in the following recommendations.

Summary of Task Force Recommendations

In response to the direct charge to develop standards for optometric data, the SEMOR task force recommends the following:

Recommendation #1: ASCO should endorse the hierarchical specification of standards for the electronic management of optometric records which defines three voluntary, graduated levels of compliance called *Baseline, Enhanced, and Comprehensive* (see Tables 3-5).

Note: Endorsement implies that each ASCO institution would be encouraged to record in electronic form, for every patient visit, the minimum data set contained in the specification of *Basic* level of compliance. Each institution would also be encouraged to develop their patient record systems further to achieve compliance with the *Enhanced* level, and ultimately with the *Comprehensive* level, as specified below. In this hierarchical structure, Enhanced compliance includes Basic compliance, and Comprehensive includes Enhanced. By complying with ASCO standards, each institution will be assured of compatibility with other ASCO institutions and with centralized collections of optometric data.

In response to the challenge of finding ways to facilitate collaborative optometric research on a national and global scale, the SEMOR task force further recommends the following:

Recommendation #2: ASCO should create and fund a National Center for Optometric Data which will build upon the foundations laid by the SEMOR task force to achieve the following:

1. Create a research collection of optometric data that can be accessed rapidly and conveniently by researchers from any optometric institution in the world.
2. Write technical specifications defining an Optometric Interchange Format (OIF) for transmission of optometric records over the Internet between ASCO institutions and the Center, between peer ASCO institutions, and between individual researchers and the Center.
3. Create and publish all necessary technical specifications needed to ensure compliance with the Center's database at each of the three levels of compliance specified in Recommendation #1.

One possible configuration of a national data archive is illustrated in Fig. 1. Individuals and institutions maintain patient records for their own purposes, but contribute a subset of that data to a national archive using a standard interchange format. Although the national data archive appears to the user as a single entity, current World-Wide-Web technology makes it possible for the archive to be geographically distributed. On a smaller scale the same technology could be used to support specific multi-center clinical trials.

Table 3: Level 1 ASCO Standards

I. BASIC COMPLIANCE: demographics, procedures, diagnoses

I.1 *Personal/Demographics* (age, race, gender)
- Unique ID# (e.g. file number + school code)*
- Birthdate
- Race/ethnicity
- Sex
- *[Note: the purpose of the ID# is to allow controlled access to confidential information such as name, address, telephone number, etc.]

I.2 Procedures Performed (CPT codes)
- List of CPT codes for all procedures performed on a given visit
- Date procedures were performed

I.3 Diagnoses (ICD codes)
- Primary diagnosis code (including refractive codes)
- List of secondary diagnosis codes (including refractive codes)
- Date of diagnosis

FIGURE 1
Institutions (left) and individuals researchers (right) may deposit and retrieve data from a centralized repository over the Internet using a common "Optometric Interchange Format" (OIF)

A National Research Archive for Optometric Data

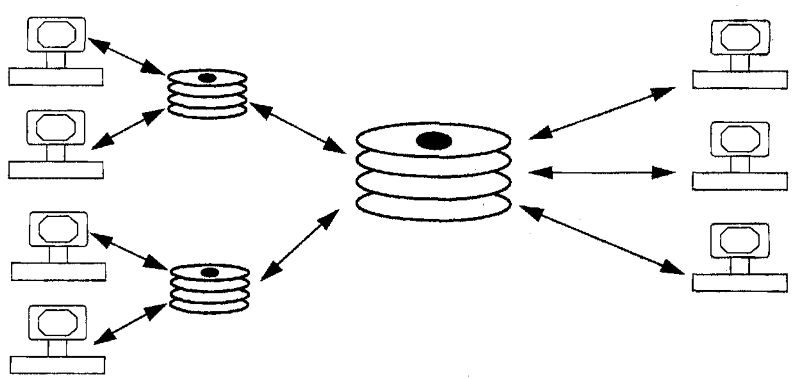


Table 4: Level 2 ASCO Standards

II. ENHANCED COMPLIANCE: essential numerical and categorical (©) data
II.1 Visual Acuity
 OD, Corrected distance VA
 OS, Corrected distance VA
 OD, unaided distance VA
 OS, unaided distance VA
II.2 Oculomotor
 Phoria, distance
 Phoria, near
 Horizontal tropia, distance:
  constant or occasional (©)
  OD, OS, or alternating (©)
  eso- or exo- (©)
  magnitude (pd)
 Horizontal tropia, near:
  constant or occasional (©)
  OD, OS, or alternating (©)
  eso- or exo- (©)
  magnitude (pd)
 Vertical tropia, distance:
  constant or occasional (©)
  OD, OS, or alternating (©)
  hyper- or hypo- (©)
  magnitude (pd)
 Vertical tropia, near:
  constant or occasional (©)
  OD, OS, or alternating (©)
  hyper- or hypo- (©)
  magnitude (pd)
 Cyclo tropia, near:
  OD, or OS (©)
  in-cyclo or ex-cyclo (©)
  magnitude (deg)
 DVD
  OD, OS or both (©)
  magnitude (pd)
II.3 Keratometry
 OD flat power
 OD steep power
 OD axis
 OD flat power
 OD steep power
 OD axis
 mire quality (©)
II.4 Refraction
 OD sphere power
 OD cylinder power
 OD axis
 OD add power
 OD new distance VA
 OS sphere power
 OS cylinder power
 OS axis
 OS add power
 OS new distance VA
II.5 Anterior segment evaluation
 OD IOP
 OS IOP
 angle assessment (©)
 media assessment (©)
II.6 Posterior segment evaluation
 cup/disk ratio
 fundus assessment (©)

Table 5: Level 2 ASCO Standards

III. COMPREHENSIVE COMPLIANCE: additional numerical and categorical data, plus graphical (†) and image (🍎) data
Unrestricted comments
Other optional demographic data
Other refraction data
Pupillary responses
Spectacle correction data
Contact lens correction data
Visual field map (†)
Corneal topographic map (†)
Electrodiagnostic waveforms (†)
Fundus photograph (🍎)
Slit-lamp photograph (🍎)
Disability glare assessment
Contrast sensitivity functions
Learning disabilities assessment
Refractive surgery data

Table 6: Optometric Interchange Format for Level I Compliance

Message format:
- School code
- Date of patient visit
- List of data records, one record per patient

Record format:
- Age, Race, Gender, list of all procedures performed

Data format:
- Age (in years): an integer number
- Race: a one-letter code (A, B, H, P, W, U)
- Gender: a one-letter code (M, F, U)
- Procedures: standard CPT codes

An example message:
To: aao_iu@indiana.edu
From: optp011@uabdpo.dpo.uab.edu
Subject: SEMOR pilot project data from Alabama

UAB
7/18/94
45, W, M, 99201, 92015, V2203
9, B, F, 95999, 92065
21, H, F, 92015, 92310, 92326

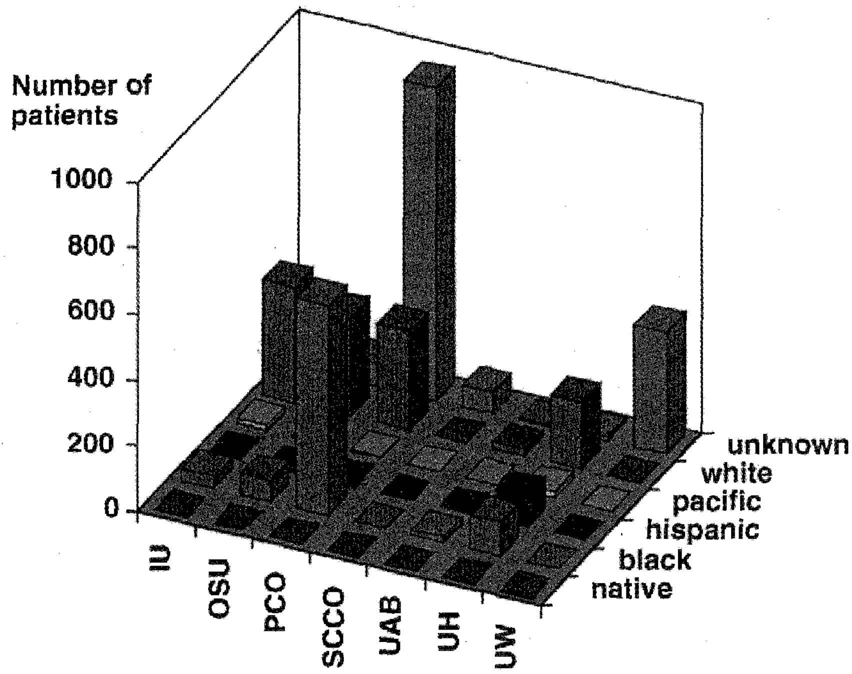
Pilot project: A Week in the Life of Optometry

To demonstrate the feasibility of using the internet to collect routine clinical information from a variety of sites across the nation, the SEMOR task force undertook a pilot project called "A Week in the Life of Optometry" in July 1994. The primary goal was to implement the *Basic* level of compliance as specified in Table 3. A secondary goal was to define an Optometric Interchange Format suitable for collecting basic demographic data using electronic mail. The resulting format is illustrated in Table 6. To place the project in the context of optometric research, we proposed to answer two questions: (1) what kinds of optometric procedures are being done in university-based optometric clinics in the USA and Canada? and (2) on what kinds of patients? Each participating institution (IU, OSU, PCO, SCCO, UAB, UH, UW), recorded demographic information (age, race, gender) and a list of clinical procedures performed on each patient seen during the week of 18-22 July, 1994. At the end of each day, the data were sent as an electronic mail message to a collection site (IU) for processing and analysis. When the mail arrived at the collection site, it was automatically read, processed, and the individual data items were broken out of the message and stored in a database. All this was done entirely by magic, and practically instantaneously, thanks to the elegant system of computer programs conceived and written by Mr. Kevin Haggerty at Indiana University. Even more miraculous was the way data were retrieved by remote clients. Within seconds after the mail had arrived in Indiana it could be retrieved by any computer in the world running a world-wide-web browser (e.g. Netscape®). When the remote client connects with the web server, a menu appears on the client's computer screen inviting the user to query the database. The web server then interprets that request, launches a system-level control program to carry out the requested query, and returns either the answer itself, or else a pointer to a file which contains the answer.

The results of the pilot study were reported at the 1994 Annual Meeting of the American Academy of Optometry[1] and a live demonstration of the interactive database of patient

Figure 2
An example of the demographic data collected during a pilot project conducted by the SEMOR task force. An interactive database of the data is available on the internet (see ref. 2).

Ethnic Distribution of Patients (18-22 July, 1994)



information was presented at a poster session at the same meeting. These presentations are currently available for reviewing with any browser[2]. Readers are invited to explore the database interactively through any web browser connected to the address specified in footnote[2]. An example of the kind of demographic information which may be gleaned from this database is illustrated in Fig. 2. The generality of conclusions which may be legitimately drawn from these demographic data would have been much greater, of course, had all institutions been in a position to participate in the study.

In our judgment, the pilot project was an unqualified success. It demonstrated unequivocally the feasibility of collecting optometric data from a widely distributed group of institutions in "real time" plus the rapid, automatic organization of that data into a database which could be accessed almost immediately from any remote location via the Internet. The project also revealed a number of practical problems which must be overcome if we are to transition successfully from the pilot project to routine collection of clinical data. Chief among these is the need for development of data-entry systems which are fast, easy to use, and acceptable for routine use in a busy clinical setting. One simple idea is to employ first year optometry students who are anxious to gain clinical experience as "computer scribes" responsible for entering patient data into the database as it is generated during the patient examination. Introducing students to the clinical routine in this capacity would have the added benefit of imparting good work habits of careful record keeping and logical progression through the diagnostic process.

Another idea is to adapt the method of "co-generation" used in the charge card industry. The basic idea of co-generation is that when paperwork is generated as part of a transaction, an electronic version of the same transaction is generated at the same time and transmitted to a central repository. This simple concept avoids the labor-intensive step of manually transferring the data from paper records into the computer. Clearly a system of co-generation in optometry would be a mighty sword with which to battle the data-entry dragon. Commercial development of such a system may appear very attractive in the present climate of health-care reform in which computerized billing systems are seen as a mechanism for reducing the costs of health care delivery.

The Next Steps

Where do we go from here? First, we need to get the technology developed for the SEMOR pilot project into the hands of people running multi-site research projects so that active researchers can begin to gain experience using the WEB to manage and access their data. Second, we need to build upon the success of the pilot project by taking aggressive steps towards developing a National Center for Optometric Data. This is where the optometric community must step forward. If educators and researchers agree that such a center would be a significant way to foster optometric education through research, then we urge you to voice your support to your local SEMOR task force member and to your administrative representative to ASCO.

Acknowledgements

On behalf of ASCO, I wish to thank all participants in the SEMOR task force and their local SEMOR committees for their time and effort spent on this project. Special thanks are due to the staff at the Indiana University Computing Services for technical advice and to Mr. Kevin Haggerty for implementing the pilot project described in this report.

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Validity of the Optometry Admission Test in Predicting Performance in Schools and Colleges of Optometry

Gene A. Kramer, Ph.D.
JoElle Johnston, M.S.

Abstract

The relationships of Optometry Admission Test (OAT) scores and pre-optometry or undergraduate grade point averages (GPAs) with first and second year performance measures in schools and colleges of optometry were examined. Although limited, the predictive validity of the OAT as specified by these relationships was significant and comparable to those reported for other major admission tests. Furthermore, the OAT scores contributed information regarding performance measures apart from that contributed by undergraduate GPAs.

Key Words: *admission criteria, educational measurement, Optometry Admission Test, predictive validity, standardized tests*

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Introduction

The Optometry Admission Test (OAT) is designed to differentiate among the achievement levels of applicants seeking admission to schools and colleges of optometry. Essentially, this information is used to make predictions regarding the applicants' potential for success in optometric educational programs. To the extent that the OAT provides information related to actual performance in the educational programs, the test inferences are considered valid. It is incumbent upon optometry schools to demonstrate that the test information is appropriate for inclusion in the selection process.[1,2] For some schools, however, it is not feasible to conduct validity studies.

As a service to the schools and colleges of optometry, the Optometry Admission Testing Program routinely conducts validity studies. These studies examine the relationship of test scores and pre-optometry or undergraduate grade point averages (GPAs) with the performance measures of students enrolled at some of the schools and colleges of optometry. In these studies, wide ranges in the correlations that assess this relationship have been found both among schools of optometry and across years.[3] The findings of studies based on samples drawn from individual optometry schools provide useful and necessary information regarding the validity of the OAT for those programs.[4] However, the findings of these studies do not address the validity of the OAT for those schools and colleges that are unable to provide the testing program with information on the predictors and performance measures of enrolled students.

For these schools, the findings of research using a national sample of students and schools would provide information on the relative importance of the OAT in the selection of applicants for admission. It is appropriate to generalize from the findings of research based on a national sample **if there is a high degree of similarity between the national and school situations.**[2] Specifically, there should be a strong correspondence between the national sample and the individual program with regard to the characteristics of the applicant pool, the selection ratio, and the program curriculum.[5] No previously published research has examined the validity of the OAT using a national sample, however.

Data gathered from a national sample of students grouped by school were used to examine three concerns related to the predictive validity of the OAT. The first concern related to the relationship of OAT scores and undergraduate GPAs to optometry school performance measures. The second one related to the extent to which OAT scores contribute information to the selection process apart from that provided by undergraduate school GPAs. The third concern related to the relative contribution of OAT scores and undergraduate GPAs to the prediction of performance measures.

Methods

The files of the Optometry Admission Testing Program contained the data used in this study. Seven schools and colleges of optometry originally provided undergraduate GPA predictors and optometry school performance measures. Predictor and first and second year student performance data were available for the 1993-1994 academic year. Student data were included for all students enrolled as of the beginning of the fall 1993 academic year. First year data were available for 534 students enrolled at seven schools and colleges of optometry in the United States, and second year data were available for 484 students enrolled at six of the same seven schools. The performance data included two summary measures of performance, i.e., overall first and second year optometry school GPAs, as well as average performance in each of seven tracks and their constituent course(s) and/or subject matter(s). The tracks were defined as follows.

I. ***Optics:*** geometric, visual, physical, ophthalmic.

II. ***Basic Biomedical Sciences:*** human anatomy (gross), histology, neuroanatomy, human physiology, microbiology, general pathology, systemic pathology, general pharmacology, general biochemistry.

III. ***Basic Vision Science:*** ocular anatomy, ocular biochemistry, psychophysics, perception, color vision, vegetative physiology of the eye, normal binocular vision, ocular motility.

IV. ***Ocular Health Science:*** ocular disease, ocular pharmacology.

V. ***Clinical Science:*** clinic methods, environmental vision, anomalies of binocular vision, contact lenses, pediatric optometry, developmental vision, sports vision, low vision, geriatric optometry, clinical management.

VI. ***Clinic:*** all clinics.

VII. ***Other:*** epidemiology, practice management, professional communications, ethics.

Performance data grouped according to tracks allowed the majority of schools to provide data. Acceptable data included course grades, averages for several courses, and/or averages for subject matter in tracks. If combinations of grade data were necessary for a track, then the data were converted to a common system prior to averaging. Letter grades with or without + or -, GPAs, or percentages were allowed. Fewer than one-half of the schools reported first year data for tracks IV and VI and second year data for track VI. Therefore, some analyses did not include these track data.

This study incorporated 13 predictors. Eight predictors from the OAT were the quantitative reasoning, reading comprehension, biology, general and organic chemistry, and physics scores as well as the total science composite score and the academic average. All OAT results were in standard-score form. Three of the undergraduate predictors were: overall GPA, Mathematics and Science GPA, and other GPA. Two additional, or optional, predictors were included. Typically, these optional predictors were used to rank students prior to admission. They might have included interview ratings or ratings of undergraduate schools. These other predictors were different for each optometry program. All undergraduate information was on the same scale, i.e., predictor GPAs based on different point systems were converted before any analyses were conducted. Standard scores for the OAT ranged from 200 to 400 in units of ten. The scores are ability referenced and based on the Rasch measurement model.[6] The performance of examinees on different editions of the OAT was equated; the base year is 1987. Thus, scores from different editions of the OAT have the same meaning. Not all of the data included in the study were available for all students and schools in the overall sample. Therefore, sample sizes varied among individual analyses.

Using undergraduate GPAs and OAT scores is more predictive of total performance than the use of either GPAs or OAT scores alone.

The validity of the OAT was examined using correlational and linear regression techniques. These statistical techniques served to assess the extent of the relationship between predictors and performance measures. Analyses were performed using the Statistical Analysis System software.[7]

First, to assess the relationship of OAT scores and undergraduate GPAs to optometry school performance measures, Pearson product-moment correlation coefficients were computed on a school-by-school basis for predictors and performance measures. Median coefficients were computed across all schools in the sample. Correlations were computed for each school to control for the differences in the grading systems used in reporting the performance of students enrolled at various schools.

Second, to assess the extent to which OAT scores contribute information to the selection process apart from that provided by undergraduate school GPAs, data from all schools in the sample were submitted to canonical correlation analyses. Three canonical correlation analyses were conducted for both the first and for the second year performance of students in the various tracks as one set of variables. The other set of variables was different for each of the three analyses conducted for each year. The sets were 1) the overall undergraduate, mathematics and science, and other GPAs, 2) the independent OAT quantitative reasoning, reading comprehension, physics, biology, general chemistry, and organic chemistry scores, or 3) all predictors.

All predictors and performance measures were converted to z-scores on a school-by-school basis prior to analysis. Canonical correlation is a technique that examines the relationship between two sets of variables. This technique identifies a number of weighted linear combinations for each of the two sets of variables so that the correlations between the combinations are maximized. [8]

One set of variables was comprised of the predictors while the other set was comprised of the performance measures. By including different groups of predictors in the canonical correlation analyses, it was possible to examine changes in the canonical correlations to evaluate the unique contribution of each set of predictors to the various performance measures. It was reasoned that if an optimal linear combination of undergraduate GPAs and OAT scores taken together resulted in a higher canonical correlation than either a combination of GPAs or OAT scores taken separately, then each set of predictors would contribute unique information to the selection process. Previous research has used multiple correlation analyses in a similar manner to determine whether groups of predictors contribute unique information. [9,10]

Third, to assess the relative contribution of OAT scores and undergraduate GPAs to the prediction of performance in tracks, multiple regression analyses were conducted for independent predictors with each performance measure. These analyses resulted in multiple correlations (R) and sets of standardized regression coefficients for the undergraduate GPAs as well as the OAT scores. The resulting multiple Rs indicated the extent of the relationship between an optimal linear combination of the set of predictors and each performance

Table 1: Median and Mean Correlation Coefficients for Predictors with Measures of First Year Performance§

Predictors	Overall GPA	First year Performance Measures (N = 7 Schools) Tracks I	II	III	IV	V	VI	VII
Undergraduate GPA measures								
Overall GPA	.33/.39*	.26/.27	.32/.31	.32/.33	.31/.31	.26/.26	-.06/-.06	.13/ .13
Mathematics and Science GPA	.43/.45	.32/.37	.34/.36	.44/.43	.28/.28	.31/.28	-.07/-.07	.10/ .10
Other GPA	.25/.31	.16/.23	.26/.26	.18/.23	NA/NA	.17/.13	-.06/-.06	.10/ .10
Option 1	.24/.26	.27/.27	.17/.17	.13/.13	.06/.06	.18/.18	-.08/-.08	-.06/-.06
Option 2	.40/.34	.22/.22	.22/.22	.29/.29	.03/.03	.28/.28	-.01/-.01	.11/ .11
OAT Scales								
Quantitative Reasoning	.27/.25	.37/.36	.16/.14	.27/.25	.19/.19	.22/.39	.01/ .01	.13/ .11
Reading Comprehension	.24/.26	.12/.11	.25/.24	.22/.29	.02/.02	.15/.30	.02/ .02	.14/ .13
Biology	.39/.40	.26/.27	.39/.37	.37/.33	.28/.28	.17/.32	-.04/-.04	.15/ .16
General Chemistry	.36/.39	.37/.34	.29/.30	.27/.29	.14/.14	.31/.10	-.04/-.04	.10/ .10
Organic Chemistry	.41/.35	.36/.35	.35/.32	.32/.30	.21/.21	.21/.38	-.03/-.03	.12/ .12
Physics	.37/.38	.35/.36	.26/.27	.26/.29	.26/.26	.30/.07	.10/ .10	.09/ .06
Total Science	.54/.50	.46/.44	.43/.42	.37/.42	.31/.31	.41/.48	.02/ .02	.15/ .15
Academic Average	.50/.48	.46/.42	.40/.39	.36/.37	.24/.24	.35/.47	-.01/-.01	.15/ .16

§ The number of students included in the sample was 534.
* Median/Mean; mean correlation coefficients were computed for comparison purposes.

measure. The regression coefficients provided information regarding the effect of each predictor on the performance measures with adjustments made for the effects of the remaining predictors.[11]

Results

Table 1 shows the median correlations among predictors and first year performance measures. As shown, the median correlations for predictors with the overall, first year optometry GPA ranged from 0.24 to 0.54. The OAT total science composite score and the academic average showed the strongest relationships at 0.54 and 0.51, respectively. The next highest correlation of 0.43 is associated with the undergraduate mathematics and science GPA. The median correlations for predictors with first year track performance ranged from -0.08 to 0.46. With few exceptions, the OAT total science composite score and the academic average showed the stronger relationships with the performance data when grouped in tracks. The correlations ranged from a low of -0.01 to a high of 0.46. While more moderate, the mathematics and science GPA also predicted performance. These coefficients ranged from a -0.07 to a 0.44.

The median correlations in Table 2 show the relationship between predictors and second year performance measures. The findings reflect the pattern shown in Table 1. Median correlations for predictors with the overall, second year optometry GPA ranged from 0.29 to 0.53. The OAT academic average showed the strongest relationship of 0.53. The next highest correlations of 0.50 and 0.49 are associated with the undergraduate mathematics and science GPA and the OAT total science score, respectively. The median correlations for predictors with second year track performance ranged from 0.01 to 0.51. The OAT total science score, the OAT academic average, and the undergraduate mathematics and science GPA showed strong, comparable relationships with the performance data grouped by tracks. The correlations ranged from 0.14 to 0.51.

Table 3 shows the percentages of intraschool correlations for predictors with summary measures of performance that were significant at or beyond the 0.05 probability level. For the percentages shown, the correlations indicated direct relationships between predictors and performance measures.

A concern examined in this study is the extent to which OAT scores contribute information to the selection process apart from that provided by undergraduate school GPAs. The canonical correlation coefficients in Table 4 address this issue. As shown, for both first and second year performance described in tracks, the canonical correlations are significant and range from 0.37 to 0.66. Further, the correlations associated with the OAT scores are stronger than those associated with the undergraduate GPAs. The composite of GPAs and scores is stronger than either GPAs or scores separately. The squares of these coefficients give the percentage of variance in one linear combination accounted for by the other linear combination. For first year performance, a combination of GPA measures accounts for 14 percent (0.37^2) of the variance in a

Table 2: Median and Mean Correlation Coefficients for Predictors with Measures of Second Year Performance§

Predictors	Overall GPA	I	II	III	IV	V	VI	VII
	Second year Performance Measures (N = 6 Schools) Tracks							
Undergraduate GPA measures								
Overall GPA	.42/.43*	.31/.34	.35/.37	.37/.39	.39/.36	.39/.39	.31/.31	.26/.26
Mathematics and Science GPA	.50/.51	.43/.44	.44/.45	.48/.47	.42/.45	.42/.44	.24/.24	.41/.35
Other GPA	.28/.33	.20/.22	.33/.31	.33/.35	.23/.26	.30/.30	.38/.38	.45/.35
Option 1	.29/.19	.27/.13	.22/.17	.05/.08	.18/.06	.17/.14	.31/.31	.09/.09
Option 2	.39/.37	.34/.34	.33/.33	.26/.26	.43/.43	.26/.26	.23/.23	.36/.36
OAT Scales								
Quantitative Reasoning	.30/.25	.28/.25	.26/.16	.30/.25	.17/.11	.23/.24	.08/.08	.18/.17
Reading Comprehension	.36/.36	.18/.17	.34/.30	.36/.33	.39/.37	.29/.25	.12/.12	.22/.26
Biology	.41/.45	.31/.31	.48/.47	.38/.37	.35/.37	.34/.33	.01/.01	.28/.26
General Chemistry	.41/.38	.41/.39	.37/.32	.41/.34	.25/.24	.41/.34	.20/.20	.16/.17
Organic Chemistry	.31/.33	.31/.35	.29/.27	.25/.27	.25/.25	.23/.25	.04/.04	.19/.17
Physics	.39/.37	.38/.38	.36/.26	.37/.32	.23/.26	.36/.30	.12/.12	.20/.24
Total Science	.49/.49	.46/.45	.45/.41	.45/.41	.36/.36	.42/.38	.12/.12	.28/.27
Academic Average	.53/.50	.46/.44	.49/.43	.51/.42	.41/.40	.46/.41	.14/.14	.31/.31

§ The number of students included in the sample was 517.
* Median/Mean; mean correlation coefficients were computed for comparison purposes.

combination of the track performance measures. A combination of OAT scores accounts for 26 percent (0.51^2) of the variance, and a combination of GPAs and scores accounts for 30 percent (0.55^2). More than a 100 percent increase in the amount of variance in the track performance is accounted for when OAT scores are added. For second year performance measures, there is a 69 percent increase in the amount of variance accounted for when OAT scores are included in the linear combination. A combination of GPA measures accounts for 26 percent (0.51^2) of the variance in a linear combination of the track-performance measures. A combination of OAT scores accounts for 27 percent (0.52^2) of the variance, and a combination of GPAs and scores accounts for 44 percent (0.66^2).

Tables 5 and 6 show the multiple Rs and the standardized regression coefficients resulting from the regression analyses of first and second year optometry school performance and the various predictors. The multiple Rs ranged from 0.21 to 0.53 for the first year tracks and from 0.49 to 0.63 for the second year. Generally, the multiple Rs showed a stronger relationship for non-clinic related tracks and for second year track performance. The former finding seems reasonable. The OAT assesses achievement, and, therefore, the test is a better predictor of achievement-based estimates of performance than of clinic-related performance. The latter finding, however, is somewhat surprising. It would be anticipated that the more remote the school performance is from the testing experience, the weaker should be the relationship.[12]

The multiple R^2 indicated the proportion of variance in the performance measure that is accounted for by the predictors. The proportion of variance accounted for in the performance when grouped in tracks ranged from 4 percent (0.21^2) to 28 percent (0.53^2) during the first year and from 24 percent (0.49^2) to 40 percent (0.63^2) during the second year.

The regression coefficients showed the contributions of individual predictors with the effects of the other predictors held constant. For first year performance, the multiple Rs ranged from a low of 0.21 to a high of 0.53. The regression coefficients ranged from -0.1994 to 0.3073. Overall, the undergraduate mathematics and science GPA contributed to estimating performance in optics, and the biomedical and vision sciences. The OAT quantitative reasoning score as well as organic chemistry and physics scores contributed to performance in optics. Biology and organic chemistry scores tended to contribute to performance in the biomedical sciences.

For second year performance, the undergraduate mathematics and science GPA tended to contribute to performance in all tracks. The OAT reading comprehension score and the physics score made the strongest relative contribution to performance in most tracks.

Discussion

This study examines three concerns related to the validity of the OAT. The first of these issues concerns the relationship of OAT scores and undergraduate GPAs to optometry school performance measures. The results of the correlational analyses indicated the extent of this relationship. The median correlations between predictors and first year performance measures tend to be low or moderate for the overall GPA and tracks I through V. For tracks VI and VII, the median correlations are virtually zero. For second year performance measures, the median correlations also tend to be low or moderate for the overall GPA and tracks I through V. However, the coefficients associated with tracks VI and VII are higher than those shown for the first year. These findings suggest that the performance data in tracks VI and VII are more stable in the second year. Tracks VI and VII summarize performance in clinic and other areas such as practice management and ethics. The second year of the curriculum might focus more attention on these areas. This increased attention might explain these findings.

To evaluate the validity of a test, more than the actual values of the correlation coefficients are considered. It is difficult to determine the degree of correlation that is required to demonstrate that a particular test is valuable in the selection process. The appropriate approach is to compare the correlations for a test to those correlations found for other tests developed and used for similar purposes. For example, the median correlations for first and second year overall GPA with OAT scores compare favorably with the median correlations reported for the Dental Admission Test (DAT) scores with first and second year dental school grades. The DAT correlations ranged from 0.15 to 0.45 for the first year and from 0.14 to 0.40 for the second year.[10] Comparable correlations are reported for the DAT on an annual basis.[13] Correlations in the same range have been reported for the traditional Medical College Admission Test (MCAT). The correlations reported for the MCAT scores with first and second year medical school grades ranged from 0.14 to 0.34.[9] Also, similar correlations have been reported for the Law School Admission Test scores with first year law school grades.[14] Also, the correlations among OAT scores and performance in tracks are comparable to the correlations among DAT scores and grades in specific first and second year dental school disciplines. Median correlations between 0.02 and 0.49 were reported.[10,13] Median correlations among MCAT scores and grades in various medical school disciplines ranged from 0.08 to 0.61.

The extent of the relationship between OAT scores and optometry school grades supports using the OAT in the selection process. For most schools, the relationship is significant, both in a practical and statistical sense. A concern arises, however, regarding the value of the OAT for those schools where the extent of relationship between OAT scores and grades is not significant. It might be argued that any measure that provides even scant information that is useful in selecting applicants for possible admission is of value. However, for these schools, other measures should take on a more influential role in the selection process.

The second concern examined in this study pertains to the extent to which OAT scores contribute information to the selection process apart from that provided by undergraduate GPAs. One of the assumptions underlying the use of both undergraduate

Table 3: Percentage of Positive Median Correlation Coefficients Significant at the 0.05 Probability Level: Predictors with Summary Measures of First Year and Second Year Performance

	Summary Performance Measures (N = 7 Schools)	
Predictors	First year Overall GPA (N = 534)	Second year Overall GPA (N = 517)
Undergraduate GPA measures		
Overall GPA	86%	100%
Mathematics and Science GPA	83%	100%
Other GPA	75%	50%
Option 1	33%	75%
Option 2	67%	100%
OAT Scales		
Quantitative Reasoning	71%	83%
Reading Comprehension	43%	100%
Biology	100%	100%
General Chemistry	86%	83%
Organic Chemistry	86%	100%
Physics	100%	100%
Total Science	100%	100%
Academic Average	100%	100%

Table 4: Canonical Correlation Coefficients for Predictor Composites with First Year and Second Year Performance Composites

	Performance Composites§ (N = 7 Schools)	
Predictor Composites‡	First year Performance (N = 534)	Second year Performance (N = 517)
Undergraduate GPA measures	0.37*	0.51*
OAT scores	0.51*	0.52*
Undergraduate GPA measures/ OAT Scores	0.55*	0.66*

§ First year performance composite includes data from Tracks 1, 2, 3, 5, and 7; second year performance composite includes data from Tracks 1, 2, 3, 4, 5, and 7.

‡ Undergraduate GPA measures include the overall, the mathematics and science, and other GPAs; OAT scores include the quantitative reasoning, reading comprehension, physics, biology, and general and organic chemistry.

* p <0.001

GPAs and OAT scores in the selection process is that each set of predictors provides unique and complementary information.[9,10] Based on this assumption, using only undergraduate GPAs or OAT scores would be inadequate. The results of the canonical correlation analyses support this assumption. Using undergraduate GPAs and OAT scores is more predictive of total performance than the use of either GPAs or OAT scores alone. The multiple Rs resulting from the regression analyses also support this assumption. Specifically, the multiple Rs show that GPAs and scores taken together are more predictive of performance than GPAs and scores taken separately. It is interesting to note that the multiple Rs reported in Tables 5 and 6 are comparable to those reported for the Allied Health Professions Admission Test[15] and the Veterinary College Admission Test.[16]

The third concern examined in this study relates to the relative contribution of individual OAT scores and undergraduate GPAs to the prediction of performance measures. The standardized regression coefficients for predictors with first and second year track performance addressed this concern. The correlations indicated that various undergraduate GPAs and OAT scores were differentially predictive of track performance. For example, the mathematics and science GPA was predictive of performance in first year track I grades and predictive of performance in most second year track grades. The OAT organic chemistry and physics scores were predictive of first and second year track I grades, and the OAT reading comprehension score was predictive of performance in most second year tracks.

As discussed by Kramer[10], there are several methodological problems associated with studies of this kind. First, correlations have to be interpreted with caution. The extent of the relationship shown by the correlation might be influenced by the selection procedures used by schools and colleges of optometry. There is a tendency for schools to accept those applicants who perform well on the OAT. Therefore, performance measures are not available for those students who achieve lower scores on the test, and, therefore, the lower end of the score range is not available for analysis. Further, enrolled students tend to have similar knowledge and skill levels. Because of this, the range in reported performance measures tends to be narrow. Artificially low correlation coefficients result. Therefore, the correlations reported most probably are conservative estimates of the relationship between predictors and performance measures.

Second, the grading schemes used by different optometry schools are inconsistent. Similar performance by students enrolled at different schools might be awarded different grades. Also, different systems of grade reporting are used at different schools. Because of a lack of a clear and consistent ranking system, combining all data in one analysis would result in artificially low correlations. This type of problem was overcome by computing intraschool correlations and by computing a median of these correlations. For the other analyses, performance measures grouped by school were converted to z scores. Then school data were combined.

Third, the canonical correlation and regression analyses involved three undergraduate GPAs and six OAT scores. Because all variables include a random component, including more OAT scores might enhance the canonical and multiple correlations even if there were no real relationship. However, the increases in

Table 5
Standardized Regression Coefficients for Predictors with First Year Track Performance§

Predictors	First year Performance Measures (N = 7 Schools) Tracks‡ I R = 0.53	II R = 0.47	III R = 0.41	V R = 0.33	VII R = 0.21
Undergraduate GPA measures					
Overall GPA	-0.1994	-0.0362	0.0051	0.2284	0.2755
Mathematics and Science GPA	0.3073*	0.2160	0.1991	-0.0342	-0.1812
Other GPA	0.0780	0.0711	0.0526	-0.0654	-0.0422
OAT Scales					
Quantitative Reasoning	0.2493*	-0.0557	-0.0682	0.0633	0.0883
Reading Comprehension	-0.1092	0.0915	0.0993	0.0115	0.0385
Biology	0.0285	0.1903*	0.0839	-0.0643	0.1121
General Chemistry	0.0377	0.0146	0.0069	0.1577*	-0.0733
Organic Chemistry	0.1938*	0.1392*	0.1065	0.1086	0.0693
Physics	0.1324*	0.0668	0.1209	0.0399	-0.0179

§ The number of students included in the sample was 534; the number included in the analyses was 259.

‡ Regression analyses were not conducted on tracks 4 and 6 because less than half of the schools reported grades in these tracks.

* $p < 0.05$

Table 6
Standardized Regression Coefficients for Predictors with Second Year Track Performance§

Second year Performance Measures (N = 7 Schools) Tracks‡

Predictors	I R = 0.56	II R = 0.63	III R = 0.60	IV R = 0.55	V R = 0.56	VII R = 0.49
Undergraduate GPA measures						
Overall GPA	-0.0504	-0.2036	-0.1408	-0.1283	-0.0070	-0.3881*
Mathematics and Science GPA	0.3586*	0.4599*	0.4083*	0.4572*	0.3265*	0.4491*
Other GPA	-0.0053	0.1507*	0.1511*	0.0324	0.0946	0.3513*
OAT Scales						
Quantitative Reasoning	0.0731	0.0217	-0.0431	-0.0455	0.0944	0.1007
Reading Comprehension	0.0037	0.1562*	0.1760*	0.2377*	0.1242*	0.1550*
Biology	-0.0133	0.2482*	0.0747	0.0944	0.0624	0.1092
General Chemistry	0.1243	0.0470	0.1038	-0.0250	0.0738	-0.0819
Organic Chemistry	0.1299*	0.0420	0.0231	0.0467	0.0081	-0.0381
Physics	0.2072*	0.0711	0.1943*	0.1532*	0.1323*	0.0892

§ The number of students included in the sample was 517; the number included in the analyses was 270.

‡ Regression analyses were not conducted on track 6 because less than half of the schools reported grades in this track.

* $p < 0.05$

correlations are great enough to suggest that the relationship is a significant one, both in a statistical and a practical sense.

Conclusion

The results of this study support the use of undergraduate GPAs, OAT scores, and other optional predictors such as interview ratings in the selection process. These predictors should be considered complementary in nature. Undergraduate GPAs provide information not only on an applicant's achievement level but also provide suggestions as to other characteristics such as their perseverance and motivation. GPAs clearly are not standardized across undergraduate schools or even courses. Because of this, GPAs are beneficial only when the selection process includes some information on the undergraduate schools and courses. OAT scores provide unique, standardized information on applicants' levels of achievement. Using both the GPAs and the OAT scores is substantially better than using either the GPAs or OAT scores independently. These findings support the view that schools and colleges of optometry should grant final acceptance only to applicants who have completed the OAT. Finally, other information such as interview ratings can be useful. Research has shown that interview ratings can be predictive of performance especially in the later years of professional education.[12]

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Quantifying the Risk of Blood Exposure in Optometric Clinical Education

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Abstract

Background *New questions are being raised about implementing appropriate infection control and safety precautions in optometric practice. Increased awareness and discussion of occupational blood exposure naturally leads to policy development and decision making. The process of policy decision making first involves the evaluation and quantification of a problem. This study attempts to quantify the risk of blood exposure in optometric clinical education by surveying optometric student interns participating in their fourth year of education at Southern California College of Optometry.*

Methods *Student interns were asked to complete a brief survey describing their history of blood exposure or use of a needle during their fourth year of clinical training. A panel of experts was established to help clarify the responses and to review the results.*

Results *After expert review, it was determined that the number of blood exposures or uses of a needle ranged from 0.95 to 18.71 per 10,000 patient encounters. Alternatively, one blood exposure or use of a needle occurred per 534 to 10,526 patient encounters.*

Discussion *This information can be helpful in establishing policies relating to infection control, immunizations, and testing for blood borne disease in optometric educational settings.*

Key Words: *blood exposure, hepatitis B, HIV, immunization, needle stick injuries*

Introduction

As optometric practice has expanded in scope, new questions are being raised about implementing appropriate infection control and safety practices. Universal precautions have been recommended to reduce occupational exposure to blood and body fluids[1], and there has been increasing discussion about recommending Human Immunodeficiency Virus (HIV) testing and hepatitis B virus (HBV) vaccination for optometrists. Furthermore, the Centers for Disease Control and Prevention (CDC) has recommended that blood exposure-prone procedures be identified by the medical, surgical, or dental organizations and institutions at which the procedures are performed to minimize the risk of HIV or HBV transmission.[2] The Occupational Safety and Health Administration (OSHA) Blood Borne Pathogens Standard[3] also requires that employers develop a list of all job classifications, tasks and procedures having potential blood or body fluid exposure.

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The increase in awareness and discussion of occupational blood exposure naturally leads to policy development and decision making. However, no studies on the risk of occupational blood exposure within the practice of optometry are available to help in the formation of these policy decisions. This study attempts to quantify the risk of potential blood exposure in optometric education by surveying optometric student interns participating in their fourth year of education at Southern California College of Optometry.

Chronister and Gurwood[4] state: attention needs to be directed toward the protection of all health care workers from hepatitis B. They include optometric teaching faculty, clinicians, private practitioners, residents and students as important members of the health care community who might consider the need for hepatitis B vaccination. Bowyer, Engels, and Frank[5] go even further by stating that "it is necessary that schools and colleges of optometry require students to undergo hepatitis B vaccination." Cockburn and Lindsay[6] also advise that optometrists are at risk of contracting hepatitis B from infected patients and should have immunizations. These recommendations and other similar policy recommendations may be made on the basis of published reports relating to occupational blood exposure among other health professionals and knowledge of disease transmission. However, it is uncertain whether known risks in other professions are the same as those in the optometric profession.

The usual process of policy decision making initially involves the evaluation and quantification of a problem and then the consideration of several alternative interventions to address the problem. Once an alternative is selected, implementation and evaluation of the intervention is critical. Most often, the development and implementation of policy will follow the sequential order as described by Henderson and MacStravic[7]:

1. Evaluating existing and predicted problems, threats, and opportunities in the organization and/or its environment, assuming the absence of intervention[6];
2. Identifying, selecting, and using interventions designed to move the organization and the community it serves in some desired direction (or to keep it from moving in an undesired one); and

3. Monitoring the current state of affairs to check whether interventions were successful and whether additional problems, threats, and opportunities have arisen.

Marshall[8] emphasizes that descriptive studies are valuable tools in administrative decision making and in planning the future development and use of programs, facilities, and personnel. As a first step in the policy decision-making process for infection control, hepatitis B immunization, and HIV testing as challenges in optometric practice and optometric education, it is very important to accurately quantify the risk of blood exposure in optometric practice.

Methods

Fourth year students at Southern California College of Optometry participate in an extensive outreach clinical education program. In addition to a minimum of 10 weeks spent on campus at the Optometric Center of Fullerton, students are able to select from over 80 different affiliated sites and the school-run Optometric Center of Los Angeles for their fourth year of clinical education. In the class of 1995, time spent in training away from the Fullerton campus ranged from a total of 21 weeks of training (for 2 of the 92 students) to 34.5 weeks of training (for 27 of the 92 students).

The clinical education takes place in a wide variety of settings including Department of Veterans' Affairs hospitals, community clinics, military bases, Indian Health Service hospitals, and Health Maintenance Organizations. Each student is required to complete at least one clinical rotation at a site that emphasizes hands-on training in the use of therapeutic pharmaceutical agents (TPA's). It is during these assigned rotations that students are most likely to participate in patient care activities that may put them at risk for blood exposure.

During the final six weeks of their fourth year, student interns were asked to complete a brief survey describing their history of potential blood exposure or use of a needle during their entire fourth year of clinical training (see survey form figure 1). Because needle-stick injuries have been implicated as the primary transmission route for HIV in health care workers[9], students were specifically asked to report the number of times they had used a needle for giving an injection or puncturing the skin. Survey forms were sent to each outreach site, and the preceptors were asked to encourage students to complete this survey and mail it back. As students returned to the campus to complete their final paperwork before graduation, they were reminded to turn in the survey and were given another copy if they had not already done so. All answers were both anonymous and confidential.

To help clarify the responses and to determine whether physical contact with blood was likely to have occurred or whether a needle was used in a manner that would result in a potential exposure to blood or body fluids, a panel of experts was established to review the responses. Expert reviewers were selected from the outreach clinical program's adjunct faculty, and included one optometrist from the Department of Veterans' Affairs, one optometrist from the Indian Health Service, one optometrist from an optometry/ophthalmology co-management center, and the chief of staff from the Optometric Center of Fullerton. All reviewers routinely practice full scope optometry.

Reviewers were given the following instructions: "Please review each situation described below and then indicate whether this situation is **likely** to result in an exposure to blood during the provision of 'usual' eye care services. While some unusual circumstances may result in a blood exposure, please make your determination based on what you would consider usual optometric practice. These descriptions have been provided by students anonymously, so some may be vague. Use your best judgment to interpret the situation described." It was agreed, prior to sending out the descriptions for review, that 3 out of 4 reviewers would have to concur in order for the potential blood exposure to be counted.

Results

All 92 students in the class were asked to complete this survey. Seventy-five surveys were completed and returned, resulting in a response rate of 81.5%.

An initial review of the responses suggested that the first question regarding potential blood exposure may have been interpreted differently than was intended by the survey. Some responses suggested that stu-

Figure 1 - Sample Survey Form

Outreach Survey
Fourth Year Students

Please answer each question below.
Your information is very important - even the "no's."
All answers are anonymous and confidential.
(Do not include any situations that may have occurred while working in a part time job or in another profession, i.e., as a nurse or med tech)

1. During your fourth year clinical experience, including the first three rotations and the fourth rotation to date, at any time have you ever been directly exposed to blood while providing patient care?

   ☐ yes ☐ no

2. If yes, how many times did this happen?
   (if not sure — estimate) ________

Please provide a brief description of the circumstances for each exposure:

____
____
____
____
____

3. Have you ever given an injection or used a needle to puncture the skin while providing patient care?

   ☐ yes ☐ no

4. If yes, how many times did you do this type of procedure?
   (if not sure — estimate) ________

Thank You For Your Time!!

dents may have interpreted "exposure" to mean "viewing" or "observing" blood rather than actually coming into physical contact with blood. Use of a needle proved to be somewhat ambiguous as well. Students included situations that did not reflect the hands-on use of a needle. The initial results before the expert review process showed that 20 students (26.7% of those responding, or 21.7% of the entire class) reported some potential blood exposure. An additional 2 students (2.7% of those responding, or 2.2% of the entire class) reported having done some type of injection or used a needle to puncture the skin, and 2 students (2.7% of those responding, or 2.2% of the entire class) reported having both a potential blood exposure and the use of a needle. The initial response showed 145 episodes of exposure to blood and 6 injections or uses of a needle.

The results of the expert review process showed that in the case of nine students (12.0% of those responding, or 9.8% of the entire class), potential blood exposure was likely to have occurred. One student (1.3% of those responding, or 1.1% of the entire class) was likely to have been exposed to blood and used a needle, and one student (1.3% of those responding, or 1.1% of the entire class) was determined to have used a needle in a manner that might potentially result in an exposure to blood or body fluids. This represented a total of 17 episodes. An additional two student responses did not describe the exposure or use of a needle so they could not undergo the expert review process. This accounts for 16 unspecified exposures to blood and 4 unspecified uses of a needle. Results are shown in Table 1. Table 2 lists the exposures and uses of a needle that were considered to be likely to place the student at risk of potential blood exposure as determined by expert review.

It was helpful to quantify these results in terms of potential blood exposures or use of a needle per patient encounter. To do so, student patient logs were reviewed to enumerate a denominator. During the 1994 - 95 academic year students were required to keep a detailed patient encounter log quantifying the numbers and types of patient encounters.

For the 92 students who participated in this study, 115,353 total patient encounters were logged. It should be noted that this number reflects patient encounters and not the total number of actual patients. For this analysis, using patient encounters as the denominator is appropriate because each different patient encounter has equal likelihood of resulting in a potential blood exposure.

In the development and analysis of policy, it can be misleading to arrive at a single number quantifying risk of exposure. Often times it is more useful to generate a range of numbers that quantify the risk in terms of circumstances. Tables 3 and 4 demonstrate this type of contingency analysis. The numbers in the first column reflect the original student responses, before the expert review. The middle column shows the calculations using the exposures that were agreed upon in the expert review plus the unspecified exposures. The third column shows only those exposures agreed upon in the expert review and not the unspecified exposures.

The denominator varies by row. Going from top to bottom, the denominator decreases. In both Tables 3 and 4, row one uses the entire number of 115,353 patient encounters logged as the denominator. Row two scales the number of patient encounters to reflect the survey response rate of 81.5%.

It may also be useful to eliminate some types of patient encounters due

Table 1
Results of Survey and Expert Review

Descriptor	Initial response	Expert agreement + unspecified	Expert agreement only
number of students (percentage of class)reporting a potential blood exposure or use of a needle	24 (26.1%)	13 (14.1%)	11 (12.0%)
number of potential blood exposures or uses of a needle	151	37	17

Table 2
Likely Potential Blood Exposure/ Use of a Needle by Expert Consensus

Situation description	Reported number of occurrences
Sutures "not holding" after blepharoplasty	1
Using a needle to puncture a hordeolum	1
Suturing an accident victim	1
Treatment of a pellet gun wound	1
Treating a cut on a lower lid	1
Patient in car accident and sustained multiple cuts on face and eyelids	1
Chalazion removal	1
Chalazion removal - dabbed blood with a sponge	2
Lid laceration	1
Doing (assisting) a blepharoplasty	1
Doing blood sugar testing on a diabetic patient	4
Throwing away the needle used for fluorescein angiography	3

to low likelihood of potential blood exposure or because of the changing role of optometrists in different practice settings. For example, in many practice settings optometrists themselves do not participate in the hands-on provision of dispensing services, and these types of services are not likely to result in an exposure to blood. Furthermore, an office visit for in-office vision therapy or dyslexia testing would very rarely result in a potential blood exposure. Row three does not include services where potential blood exposure can be considered extremely unlikely in the denominator.

Finally, it has been suggested that the likelihood of potential blood exposure will increase as the scope of optometric practice increases. In the survey, because of confidentiality, none of the site locations where an exposure or use of a needle took place were identified. However, it may be helpful to consider only the patient encounters that took place at a site where TPA's are utilized. Therefore, in row four, the denominator represents all of the patient encounters that took place at a site where TPA's are prescribed.

By using a different numerator in each of the columns and a different denominator in each of the rows, the cells of Tables 3 and 4 demonstrate the different contingencies for risk of potential blood exposure. The number of potential blood exposures or uses of a needle ranges from 0.95 to 18.71 per 10,000 patient encounters.

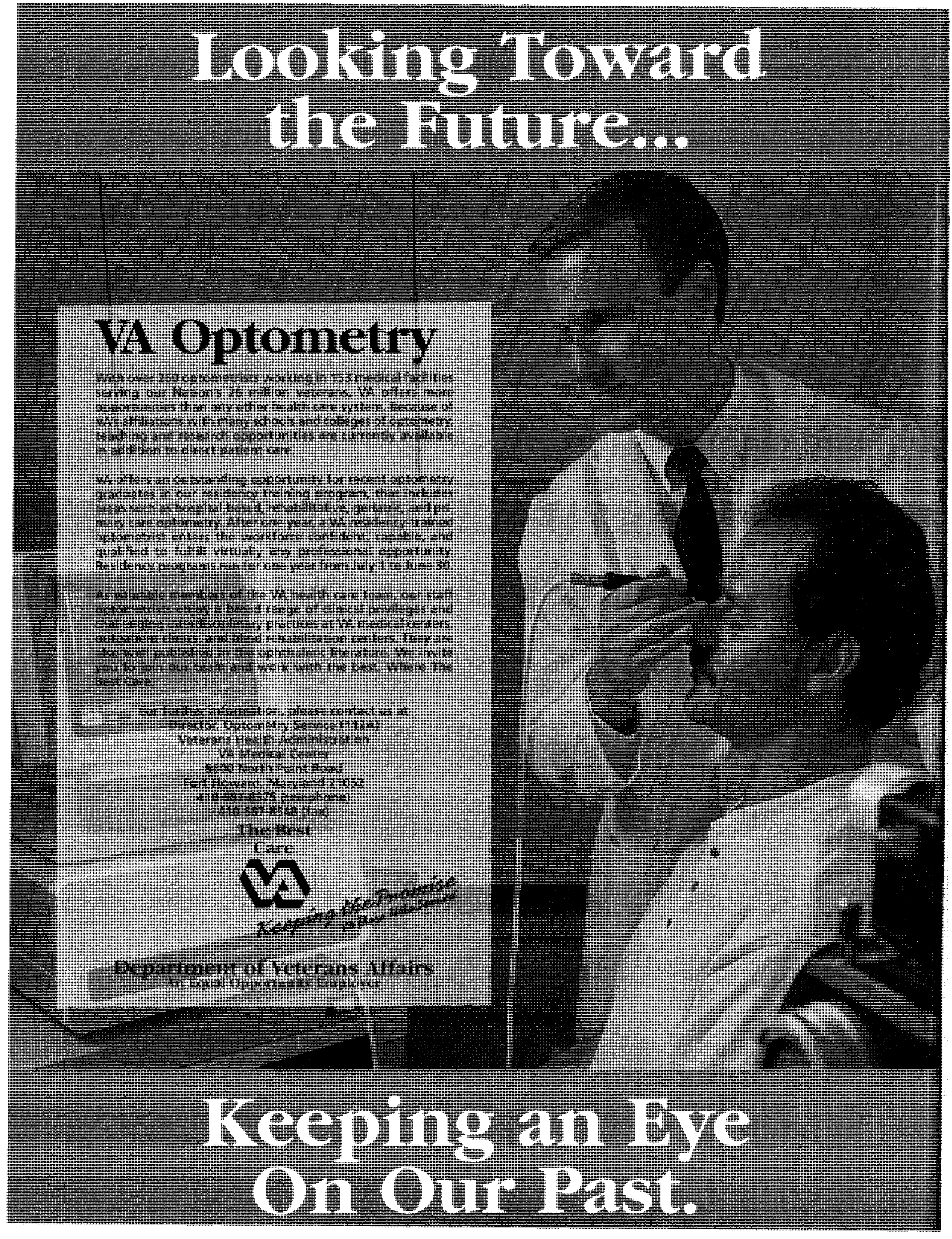
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Table 3
Contingency Analysis Quantifying Risk of Potential Blood Exposure Number of Potential Blood Exposures or Uses of a Needle per 10,000 Patient Encounters

Denominator Used	Initial response	Expert agreement + unspecified	Expert agreement only
All patient encounters 115,353	13.09	3.21	0.95
81.5% of all patient encounters (scaled denominator) 94,013	16.06	3.94	1.17
Scaled denominator less dispensing and other "low risk" services 89,493	16.87	1.45	1.23
Patient encounters at sites where TPA's are prescribed 80,726	18.71	1.61	1.36

Table 4
Contingency Analysis Quantifying Risk of Potential Blood Exposure Number of Patient Encounters per One Potential Blood Exposure or Use of a Needle

Denominator Used	Initial response	Expert agreement + unspecified	Expert agreement only
All patient encounters 115,353	764	3,115	10,526
81.5% of all patient encounters (scaled denominator) 94,013	623	2,538	8,547
Scaled denominator less dispensing and other "low risk" services 89,493	593	6,897	8,130
Patient encounters at sites where TPA's are prescribed 80,726	534	6,211	7,353

Table 4 shows the number of patient encounters per one potential blood exposure or use of a needle. The number of patient encounters per one potential blood exposure or use of a needle ranges from 534 to 10,526.

Limitations of the Study

Several limitations to this study should be noted. First, this survey was done retrospectively. Any study relying on subject recall of behaviors over the past year is subject to recall bias. Asking the students to recall behaviors over the past year may result in both over and under reporting.

Fowler[10] recognizes that small events that have less of an impact are more likely to be forgotten than big events. As such, students may underestimate more routine occurrences such as use of a needle to drain a chalazion, yet recall larger events such as treatment of a trauma victim.

Secondly, this study reflects a response rate of 81.5% rather than the full complement of the graduating class. Generally, this level of response is considered adequate to represent the whole population. Academic survey organizations usually achieve response rates in the range of 75%,[10] and mailed surveys often receive response rates under 50%. Therefore, although the response rate of 81.5% does not include all of the students, it is high enough to be considered representative.

This study includes information on fourth year optometric students at Southern California College of Optometry only. It does not reflect the risk of exposure to blood during earlier optometric clinical education while providing patient care or during pre-clinic laboratory courses. Additionally, the experiences of these students may not reflect the risk of students enrolled at other schools and colleges of optometry or a practicing optometrist. The mode of practice, scope of practice, and location of a practice must be considered for each individual optometrist.

This research does not consider other risk factors outside of blood or body fluid exposure during clinical education. Students may be employed or do volunteer work in situations where such exposure may occur. Students may also engage in lifestyle behaviors that put them at risk of exposure to blood or body fluids. Numerous sources[2] cite sexual behaviors, medical treatment with blood or blood products, and use of illegal injecting drugs as important risks for both hepatitis B and HIV infection. These considerations are beyond the scope of this study.

Finally, this study does not consider tears as a mode of transmission for blood borne disease. Conrad[11] states that because HIV has been isolated in tears, transmission of HIV during normal ocular examination is theoretically possible but highly unlikely due to the fragile state of the virus outside of the host. OSHA[3,12] does not consider individuals coming in contact with tears (unless they contain visible blood) to have occupational exposure. The CDC[1] does not consider tears a vector for primary concern unless they are blood stained. The literature [12,13] supports the exclusion of tears as a mode of transmission by stating that to date, HIV has never been transmitted through tears because the viral titer is so low that it is below the level at which transmission could occur.

Discussion

This analysis of the reported potential blood exposures and uses of a needle among the fourth year students at Southern California College of Optometry shows an estimated range of **0.95 to 18.71** potential blood exposures or uses of a needle **per 10,000 patient encounters**, or **one** potential blood exposure **per 534 to 10,526 patient encounters**. This information can be helpful in establishing policies relating to infection control, immunizations, and testing for blood borne disease.

As a first step in the policy decision-making process for infection control, hepatitis B immunization .... it is very important to accurately quantify the risk of blood exposure in optometric practice.

Health care workers, overall, have an approximately four times greater risk for hepatitis B infection than the general adult population,[14] and health care workers face greater risk of occupational infection by HIV through blood exposure or needle sticks. However, the practice of optometry cannot necessarily be lumped together with all other health care professions because of optometry's unique scope of practice. Further analysis of the risk of occupational blood exposures among practicing optometrists needs to be conducted.

As the scope of optometric practice expands, periodic review of the occupational hazards and risk of blood exposure should be conducted. It will also be important to revisit this issue in the face of newly emerging infectious disease such as the ebola virus and other risks yet unknown.

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IN REVIEW

Contact Lens Optics & Lens Design (Second Edition). W.A. Douthwaite, Oxford:Butterworth-Heineman Ltd, 1995, 334 pages, 134 figures (b & w), 8 tables, 1 computer disk, $45.00.

Contact Lens Optics & Lens Design is a comprehensive contact lens optics text written by one of the foremost authorities on this subject, William Douthwaite. In the preface, he notes that he intends this book to be "Notes on the Optics of Contact Lenses for Busy Contact Lens Practitioners." For the most part, he achieves this goal. This text includes chapters on basic visual optics (i.e., lens power and vergence, accommodation, magnification, anisometropia, convergence), the contact lens (contact lens/fluid lens, thickness and power considerations), aspherical surfaces, measurement of the cornea, contact lens design, astigmatism and corneal toricity, miscellaneous features (bifocals, underwater lenses, low vision, aphakia, lenticulars), lens verification and computer programs.

There are several sections which are outstanding including the basic visual optics — particularly magnification, prism, and accommodation — the information on the contact lens-fluid lens and the interaction of lens design parameters. In the latter section, he expands upon the excellent work by Janet Stone and others on edge life and edge clearance calculations and what the practitioner needs to know about the peripheral lens design. In fact, there are frequent "bottom line" statements in bold for the clinician which are often beneficial although I did not totally agree with the statement that "a change of 0.05mm in the BOZD must be accompanied by a fluid lens power change of 0.25D" as this is only true in excessively flat corneal curvatures.

The section on optics pertaining to bifocal and toric lens designs is beneficial; the latter, in particular, was outstanding as the author explains the concepts pertaining to how back surface torics induce astigmatism and why correcting this error on the front surface provides a spherical power effect type of bitoric design. As the examples only pertain to PMMA lenses, a table of RGP materials and their refractive indices would be beneficial for these calculations. The section on the optics of instruments was both indicated and useful. Likewise, the figures used in this text were of excellent quality and assisted the reader in understanding the principles involved.

There were some areas in which this text may not be as beneficial, especially for the American practitioner. There is an over-emphasis on PMMA scleral lens designs. There were numerous examples in which these designs were used in design calculations to demonstrate power, thickness, and curvature relationships and this information is not beneficial when considering corneal designs. Likewise, although a section on the optics of expanding the keratometer range was present, it only described the use of minus lenses to expand the keratometer in the flatter direction (for scleral lens designs) as opposed to the more common need to expand the range in the steeper direction in keratoconus. Although the topic of corneal topography was briefly discussed, an entire chapter on the optics of computerized topography instrumentation would have been a very useful addition to this updated edition. Some of the terminology used — particularly for lens design parameters — is common to practitioners in the United Kingdom but not for U.S. practitioners. Quite often the author succeeds in not using excessively lengthy formulas which could be too complex for the busy practitioner; however, on some topics, including aspheric and lenticular designs, this was not the case.

Reviewer: Dr. Edward Bennett
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School of Optometry

Clinical Ophthalmology — A Text and Colour Atlas. James L. Kennerley Bankes, New York: Churchill Livingstone, 1994, 138 pages, 159 figures, $39.95.

The author condensed a vast body of knowledge into a 138-page volume. However, the book has two shortcomings relative to optometry. The first is that the book, although updated in 1993, was originally designed in 1982. The second problem is that the author of this book is practicing in England. Optometry certainly has functioned differently in this country than in England even in 1982 although the scope has broadened since then.

Such a large body of knowledge is covered that the book suffers from over-simplification. Statements such as "artificial tears, as used for treating dry eyes, will be necessary for the rest of the patient's life," and that "the increase in myopia and astigmatism over weeks is 'characteristic' of keratoconus" are examples of over-simplification. The over-simplification carries through to discussions of testing. The discussion of color vision testing is condensed to the statement that isochromatic plates and lanterns form the two practical color vision tests. Over-simplification by omission is also present, i.e., the discussion of ptosis where no mention is made of acquired ptosis.

Geographical differences in practice, such as the discussion of reversal of pupil dilation with pilocarpine 2%, the advocacy of using chloromycetin in the treatment of conjunctivitis, and the treatment of adenoviruses with acyclovir, are not consistent with routine practice as it is most often found in this country.

While I appreciate the clear, concise presentation, the limitations of this book for the practicing optometrist are obvious, and I would hesitate to endorse it for every optometric bookshelf.

Reviewer: Dr. Scott Richter
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