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## Evidence-based practice instruction by faculty members and librarians in North American optometry and ophthalmology programs

**Katherine A. MacDonald, BA, BSc, MLIS;**  
**Patricia K. Hrynchak, OD, FAAO;**  
**Marlee M. Spafford, OD, PhD, FAAO**

See end of article for authors' affiliations.

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North American optometry and ophthalmology faculty members and vision science librarians were surveyed online (14% response rate) about teaching evidence-based practice (EBP). Similar to studies of other health care programs, all five EBP steps (Ask, Acquire, Appraise, Apply, Assess) were taught to varying degrees. Optometry and ophthalmology EBP educators may want to place further emphasis on (1) the Apply and Assess steps, (2) faculty- and student-generated questions and self-assessment in clinical settings, (3) online teaching strategies, (4) programmatic integration of EBP learning objectives, and (5) collaboration between faculty members and librarians.

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### INTRODUCTION

Evidence-based medicine was first developed for physicians in the early 1990s [1]. Since then, other health care providers have integrated this concept

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 Supplemental Appendix A and Appendix B are available with the online version of this journal.

into their disciplines, and the phrase has broadened to evidence-based practice (EBP) [2–6].

Optometrists and ophthalmologists provide eye and vision care. Optometry educators are increasingly recognizing the importance of EBP in optometric education. North American EBP competencies for optometrists can be found in accreditation standards and educational competency statements [7, 8]. Curricula are changing to incorporate EBP knowledge and skill development at both the undergraduate and continuing education levels [2, 9–11]. Articles in the optometric literature address EBP's nature, value, and role in the profession as well as barriers to and deficits in its current use in the profession [2]. EBP literature in ophthalmology education predates that in optometric education [12–15]. As a result, ophthalmology may be further ahead than optometry in adopting and integrating EBP into its educational programs.

EBP is normally taught by both faculty members and librarians, although their differing expertise likely informs what, who, and how they teach [16–23]. Surveying ophthalmology and optometry programs can provide useful insights for vision science librarians and faculty members who are interested in introducing EBP training into or enhancing it in their programs. The results should allow comparison of vision-related EBP education in optometry and ophthalmology with that employed by other health care professions. This study is the first to survey both librarians and faculty members regarding educational practices with respect to EBP education.

### METHODS

#### Measures

After obtaining institutional ethics clearance, online surveys (Appendix A and Appendix B, online only) were developed, tested, and administered in 2011 for two North American cohorts: (1) optometry and ophthalmology faculty members and (2) vision science librarians. The survey content was developed based on a literature review [16, 17, 19, 20, 24–29], a previous unpublished survey by the first author, the knowledge and experience of the research team members, and consultations with several vision science librarians. The surveys were pilot-tested using a group of local health sciences or medical librarians and optometry faculty members.

The surveys contained twenty-seven Likert-scale or open-text survey questions that addressed teaching EBP. Questions sought information on respondents' demographics, teaching or learning methods and assessment, and institutional characteristics. Likert-scale questions were either four points (e.g., frequency) or six points (e.g., agreement). Twenty-four of the survey questions were the same for the faculty members and librarians (although six questions contained slight wording differences to fit the unique roles and responsibilities of the respondent groups). A chi-squared test was used to examine differences between cohorts that might emerge because of their

**Table 1**  
Evidence-based practice (EBP) steps taught by respondents

EBP element taught	Total (n=50)		Faculty (n=24)		Librarian (n=26)	
	n	(%)	n	(%)	n	(%)
Ask (Convert need for information into an answerable question)	43	(86.0%)	17	(70.8%)	26	(100.0%)
Acquire (Find best evidence with which to answer question)	46	(92.0%)	20	(83.3%)	26	(100.0%)
Appraise (Critically appraise evidence for validity, impact, and applicability)	37	(74.0%)	21	(87.5%)	16	(61.5%)
Apply (Integrate evidence with clinical expertise and patient values)	29	(58.0%)	20	(83.3%)	9	(34.6%)
Assess (Evaluate own effectiveness)	21	(42.0%)	15	(62.5%)	6	(23.1%)

differing expertise. In many academic institutions, librarians are faculty members, but for the purpose of this study, the authors separated the two groups to gain a functional perspective.

### Sample

Potential survey participants were identified through purposeful and snowball sampling using Internet searches, email queries, and word of mouth. Canadian and US optometry and ophthalmology faculty members involved in teaching EBP were identified by searching the websites of schools and colleges offering doctor of optometry programs and medical schools and facilities offering ophthalmology programs. Vision science librarians were identified through the Association of Vision Science Librarians (AVSL) and/or through websites of institutions offering optometry or medical programs. The websites of 20 optometry and 103 ophthalmology schools or programs were searched, and potential respondents were identified for each site.

Potential respondents were sent a preliminary email to ascertain if they taught EBP and if not, were requested to pass the email on to the appropriate person. Potential participants were asked to respond to the preliminary email. The email addresses of all initial potential participants who did not respond to the preliminary email plus the email addresses of suggested participants formed the final survey participant list. The email addresses of potential participants who indicated that they did not teach EBP or did not want to participate were taken off the list. This list was forwarded to the University of Waterloo Survey Research Centre, who implemented the online survey. Participants were told the study wanted to explore if and how optometry and ophthalmology programs taught their students the EBP process.

## RESULTS

### Survey response

Seven of the 460 distributed surveys were returned due to email address errors or extended out-of-office notices, leaving a potential sample of 453 people (328 faculty members and 125 librarians). Sixty-six surveys were returned with 4 being significantly incomplete (2 faculty members and 2 librarians), leaving 62 complete surveys (14% response rate). The respondents included 34 faculty members (11%) and 28 librarians (24%).

Fifty (81%) of the respondents indicated they taught at least some of the 5-step EBP process as defined by Straus

and Prasad (Ask, Acquire, Appraise, Apply, Assess) [30, 31], and 12 (19%) indicated they did not teach any of the steps. This article reports on the 50 completed surveys from respondents who taught the EBP process (24 faculty members and 26 librarians). The survey was not designed to determine whether the respondents came from the same or differing institutions.

Faculty member respondents were primarily optometrists (75%) who provided clinical care (88%) and had more than 16 years of teaching experience and taught in optometry programs (79%). Most librarian respondents had a master of library and information science degree (92%), more than 13 years of teaching experience, and taught in more than 1 type of health care program (92%).

Respondents obtained EBP training via 1 or more methods, including through self-directed learning (86%), from courses outside a degree program (50%), in a graduate degree program (20%), or in their professional training (18%).

Generally, 80% of respondents worked in professional programs affiliated with a college or university. Sixty-six percent of the respondents described their libraries as multidisciplinary health sciences or discipline-specific.

### Instruction of evidence-based practice (EPB) steps

All 5 steps of the EBP process were taught but to varying degrees among the respondent cohorts (Table 1), based on frequency-based responses. All librarian respondents taught Ask and Acquire, with decreasing proportions teaching Appraise, Apply, and Assess. Overall, Assess was taught by the smallest proportion of all respondents (42%). Faculty member respondents were more likely to teach the steps Apply (83% versus 35%) and Assess (63% versus 23%) than librarians ( $\chi^2 \leq 8.0$ ,  $P \leq 0.01$ ).

### Learner type and duration taught

The librarian and faculty member respondents taught a variety of learners. Using frequency-based responses, in decreasing order, the top 4 types of learners receiving EBP instruction were other faculty members (52%), optometry students (50%), medical students (48%), and non-ophthalmology residents or fellows (46%). Twenty four percent of respondents taught ophthalmology residents. The statistically significant instructor-cohort differences among respondents were that optometry students were more likely to receive instruction from faculty members (88%) than librarians

(15%) ( $\chi^2=29.6$ ,  $P<0.01$ ), while medical students, non-ophthalmology residents or fellows, and graduate students were more likely to receive instruction from librarians (77%, 77%, 58%, respectively) than faculty members (17%, 13%, 21%, respectively) ( $\chi^2\leq 7.06$ ,  $P\leq 0.01$ ). The number of hours of EBP instruction, using a yes/no response, was 10 hours or less (31%), 11–20 hours (27%), and more than 20 hours (43%).

### Settings

The 50 respondents taught EBP in a variety of settings. Using frequency-based responses, the top 4 EBP teaching settings were: small classrooms (64%), seminar rooms (60%), offices (54%), and clinics (52%). The significant instructor-cohort setting differences were that faculty members (79%) were more likely than librarians (27%) to teach in clinics ( $\chi^2=13.7$ ,  $P=0.01$ ), while librarians (77%) were more likely than faculty members (8%) to teach in computer labs ( $\chi^2=26.4$ ,  $P=0.01$ ).

### Teaching methods

Most often, respondents employed lectures (72%); individualized instruction (68%); print or electronic tutorials, handouts, and guides (64%); small group case-based learning (62%); and live demonstrations of tools, resources, and processes (62%), according to frequency-based responses. There were several significant instructor-cohort method differences. Relative to faculty members, librarians were more likely to employ tutorials, handouts, and guides (print or online information modules, exercise sheets, or collections of resources around a specific topic) (89% versus 38%); live demonstrations (92% versus 29%); and practical sessions (hands-on computer lab exercises) (77% versus 33%) ( $\chi^2\geq 0.62$ ,  $P\leq 0.01$ ). Faculty members were significantly more likely than librarians to utilize case discussions (63% versus 23%) and to teach in the course of patient care (67% versus 12%) ( $\chi^2\geq 8.0$ ,  $P\leq 0.01$ ).

### Teaching tools and aids

Respondents used anytime (asynchronous) more frequently than live (synchronous) web-based tools with the most prevalent tools being course management software (54%), online tutorials and modules (44%), and email (30%). The top 4 teaching aids developed were EBP resource lists (50%), search strategy worksheets (42%), question development sheets (38%), and EBP subject guides (34%). Librarian respondents were more likely than faculty members to use search strategy worksheets (63% versus 21%) and subject specific guides (54% versus 13%) ( $\chi^2\geq 8.49$ ,  $P\leq 0.01$ ).

### Assessment strategies

To assess student learning, the 4 most commonly reported assessment strategies using frequency-based responses were final exam questions (54%), EBP worksheets (42%), critical appraisal exercises (42%),

and case reports (40%). Significantly more faculty members than librarians reported using case study reports (58% versus 23%) and observations of the students' clinical practices (63% versus 12%) ( $\chi^2\geq 6.5$ ,  $P\leq 0.01$ ). Librarians (58%) were more likely than faculty members (17%) to use library research assignments involving self-assessment of literature searching skills ( $\chi^2=9.0$ ,  $P\leq 0.01$ ). Of interest is that only 26% of all respondents used a critically appraised topic (CAT) report as an assessment method. A CAT is a 1-page summary of a patient-stimulated EBP learning effort that includes the clinical question, the bottom line, an evidence summary, comments, and citations.

### Collaboration and teaching support

Frequency-based questions were used to ascertain collaboration levels and activities. More respondents collaborated with faculty members (72%) than librarians (56%), with significantly more librarians (77%) than faculty members (33%) collaborating with librarians ( $\chi^2=9.62$ ,  $P=0.01$ ). When asked about engaging with colleagues to teach EBP, significantly more librarians than faculty members collaborated by discussing teaching strategies and assessment outside class (73% versus 25%), teaching a section of the course alone (77% versus 21%), or co-teaching in the classroom (62% versus 8%), laboratory or clinic (23% versus 0) ( $\chi^2\geq 6.3$ ,  $P\leq 0.01$ ). These options were not mutually exclusive. In response to a yes/no question, both faculty members and librarians used campus teaching support mechanisms, such as instructional technologies services (25%) and teaching support services (10%), in a limited way.

### Integration of EBP into program

EBP training was embedded into the learning environment through a variety of strategies. According to frequency-based questions, the 4 most common avenues employed for all respondents were in courses (80%), via individual consults (80%), by continuing education courses (54%), and as program milestones or other form of graduation requirements (34%). None of the cohort differences were statistically significant.

The level of EBP integration into programmatic curricula varied. Indicators of EBP integration most often took the form of EBP-related learning objectives in courses (68%). Less often, EBP was a programmatic milestone requirement (40%); incorporated into the programmatic mission, goals, and objectives (40%); or part of clinic experience learning objectives (36%).

### DISCUSSION

The findings of this study suggest that training for optometry students and ophthalmology residents should address all five steps of the EBP process. Ophthalmology residents may actually receive relatively more EBP training than optometry students, because studies indicate that EBP training normally



starts during undergraduate medical school [16, 22, 23]. Librarian respondents were most likely to report teaching the earlier EBP steps, while faculty members reported teaching across the five steps. This result might reflect the need for clinician-based activity to inform teaching and assessment especially in the Apply step. Librarian involvement in these types of activities would likely be limited. The final Assess step was taught the least frequently by both groups; its absence may reflect time constraints, a lack of teaching methods, or the assumption that it occurs automatically. Unfortunately, in the absence of this final step, students might not learn how to review and refine their EBP process, making them less efficient at and reflective about the process.

The respondents in this survey reported similar approaches to educators in other disciplines in terms of teaching settings [16, 19, 20, 24, 27] and the use of multiple teaching methods [19, 24, 27]. Lectures, with or without interactive methods [16, 19, 20, 24, 27, 32–34], were most commonly used; however, this method has been shown not to change practice behavior in postgraduate education [35]. The majority of respondents also used individual consultation, although less frequently. This approach has been shown to be a good way to introduce, reinforce, and master EBP skills [24, 32, 36, 37]. Results suggest that individual consultation needs to be introduced or expanded if the integration of EBP into clinical practice for optometry and ophthalmology is to be achieved.

Over half the respondents taught EBP in clinical settings, and this finding aligns with the growing recognition that EBP instruction should be clinically based, so that the questions coming out of clinical interactions are asked and answered [24]. Answering patient-specific questions arising during clinical care has been shown to increase knowledge and change clinical decisions among residents [24] as well as medical students [38]. Expanding teaching of EBP in the clinical setting should be encouraged. Only 27% of librarian respondents taught in clinics. Other studies note that the presence and participation of librarians in rounds and morning reports helps learners with developing questions, developing search strategies, and finding clinical evidence [17, 39–41]. Utilizing librarians in clinical settings is an opportunity that could be expanded by optometry and ophthalmology programs.

While the use of CAT reports is well documented in the literature as a method to help novices learn to ask a clinical question, review the literature, and summarize the best available research evidence on the subject [18, 30, 42–44], only just over one-quarter of respondents employed CATs as an instructional method. This assessment strategy was not one of the top four strategies used by respondents. More optometry and ophthalmology educators may want to explore the use of CATs, because patient-focused, self-directed, and personalized learning in the clinical setting should lead to a greater chance of having the EBP behaviors integrated into future practice [5, 24, 26, 36, 38, 42]. Beyond the use of course management

systems, other web-based teaching tools such as online tutorials or modules and videos could be explored by educators. These web-based tools [16, 31, 33, 42, 45–49] were used by few respondents but can be as effective as standard lectures for gaining knowledge and changing attitudes [50].

The most common assessment strategies used were final exam questions, EBP worksheets, critical appraisal exercises, and case reports. This is consistent with other disciplines [18–20, 27, 42–44, 47, 51, 52]. Assessment is often organized around a series of assignments and reports that focus on the various steps of EBP [20, 21, 25, 26]. Active application of the process (the “shows how” level of Miller’s pyramid) [53] has been assessed using clinical vignettes and standardized patients [27, 54–56] and is being used by some respondents. This is another avenue of exploration or expansion because of its value for assessing the Apply and Assess steps.

Integration of EBP into curriculum and programmatic goals or competencies occurred primarily at the level of the individual course rather than the program. While other health care professions talk about the integration of EBP into the curriculum, the degree of formal integration is unreported and requires further study.

Limitations of this study include the small number of respondents, particularly among faculty members and more specifically ophthalmology faculty members. Therefore, the findings might not reflect EBP instruction in North American optometry schools and ophthalmology programs. In institutions where librarians are faculty members, their status as faculty members rather than professional staff members might influence what EBP steps are taught and assessed. Another limitation is that our sampling technique might have incorrectly identified or missed individuals who were responsible for EBP education.

## CONCLUSION

The findings of this survey-based study provide the first indication of EBP educational practices used by faculty members and librarians training optometry students and ophthalmology residents in North America. Optometry and ophthalmology educators may want to increase their emphasis on the Apply and Assess EBP steps to ensure that application and improvement of the EBP process are ingrained in students before they become practitioners. Some of these educators may want to enhance their use of: (1) faculty- and student-generated questions and self-assessment in the clinical setting, (2) online teaching strategies with assistance from teaching support services on campus, (3) greater integration of EBP learning objectives at a programmatic level, and (4) increasing collaboration.

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## AUTHORS' AFFILIATIONS

**Katherine A. MacDonald, BA, BSc, MLIS** (corresponding author), kamacdonald@uwaterloo.ca, Head, Information Services and Resources, Dana Porter Library; **Patricia K. Hrynchak, OD, FAAO**, patricia

.hrynchak@uwaterloo.ca, Clinical Professor and Head, Primary Care Clinic, School of Optometry and Vision Science; **Marlee M. Spafford, OD, PhD, FAAO**, marlee.spafford@uwaterloo.ca, Associate Dean of Science, Undergraduate Studies, and Professor, School of Optometry and Vision Science; University of Waterloo, 200 University Avenue West, Waterloo ON, N2L 3G1, Canada

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