Canadian ophthalmology residency training: an evaluation of resident satisfaction and comparison with international standards

Alysia W. Zhou,* HBSc; Jason Noble,† BSc, MD; Wai-Ching Lam,† MD, FRCSC

ABSTRACT • RÉSUMÉ

Objective: To evaluate the adequacy of Canadian ophthalmology residency programs in achieving the competencies outlined by the International Council of Ophthalmology (ICO) and to assess residents' satisfaction with their training programs.

Design: Cross-sectional web-based survey.

Participants: Canadian residents enrolled in the final 2 years of English and French ophthalmology programs, as well as recent graduates from 2005 to 2008.

Methods: Graduates and eligible residents were invited to participate in the 43-item survey during the autumn of 2008. Data were categorized by demographic variables, and basic statistics were done.

Results: Of the 99 individuals surveyed, 40 (40%) responded, representing 26 current residents and 14 graduates. The vast majority (85%) of respondents were satisfied with their residency program. Clinic-based training was generally rated satisfactorily; however, respondents reported insufficient exposure to low-vision rehabilitation (77.5%), refraction and glasses prescription (65%), and neuro-ophthalmology (45%). Respondents were similarly satisfied with their surgical experiences, most of them (>60%) rating case volume, complexity, and variety as satisfactory or better. However, many stated that they had insufficient exposure to extracapsular cataract extraction (72.5%), refractive surgery (72.5%), and orbital surgery (57.5%). Of the graduates surveyed, all passed their Royal College licensing examinations on the first attempt and felt that residency adequately prepared them for the examinations. They reported insufficient training in certain nonclinical areas, such as practice management, and staffing and administration skills.

Conclusions: Canadian ophthalmology residents express high levels of satisfaction with their residency training programs. Although most programs appear to adequately address most ICO core objectives, certain curriculum modifications are required.

Objet : Évaluation de l'adéquation des programmes canadiens de formation ophtalmologique en résidence en regard des compétences définies par le Conseil international d'ophtalmologie (CIO) et estimation de la satisfaction des résidents de leurs programmes de formation.

Nature : Sondage transversal par internet.

Participants : Résidents canadiens des deux dernières années des programmes anglais et français d'ophtalmologie, ainsi que diplômés récents de 2005 à 2008.

Méthodes : Les diplômés et les résidents admissibles ont été invités à participer à un sondage en 43 points à l'automne 2008. Les données ont été réparties selon les variables démographiques et on en a tiré les statistiques de base.

Résultats : Parmi les 99 personnes interrogées, 40 (40 %) ont répondu, soit 26 résidents et 14 diplômés. La grande majorité (85 %) des répondants se sont dits satisfaits du programme de résidence. La formation en clinique a été estimée satisfaisante; les répondants ont cependant fait part d'une insuffisance d'exposition à la réadaptation pour malvoyance (77,5 %), à la réfraction et la prescription de lunettes (65 %) et à la neuro-ophtalmologie (45 %). Les répondants furent aussi satisfaits de leurs expériences chirurgicales, la plupart (>60 %) estimant le nombre, la complexité et la variété des cas satisfaisantes, ou davantage. Toutefois, plusieurs ont dit ne pas avoir eu suffisamment d'exposition à l'extraction de la cataracte extra-capsulaire (72,5 %), à la chirurgie réfractive (72,5 %) et à la chirurgie orbitaire (57,5 %). Tous les diplômés avaient passé l'examen du Collège royal dès leur première tentative et tous estimèrent que la résidence les y avait bien préparés. Ils ont fait état d'une certaine insuffisance de formation dans certains secteurs non cliniques, comme la gestion de la pratique ainsi que les capacités de recrutement du personnel et d'administration.

Conclusions : Les résidents canadiens en ophtalmologie ont exprimé un haut degré de satisfaction pour les programmes de formation en résidence. Bien que le programme semble satisfaire en grande partie aux principaux objectifs du CIO, les curriculums ont besoin de certaines modifications.

From *the Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ont., and †the Department of Ophthalmology and Vision Sciences, University of Toronto, Toronto, Ont.

Correspondence to Wai-Ching Lam, MD, Toronto Western Hospital, Room EW 6432, 399 Bathurst St., Toronto ON M5T 2S8; waiching.lam@utoronto.ca

Originally received Apr. 9, 2009. Revised May 9, 2009
Accepted for publication May 15, 2009
Published online Sep. 10, 2009

This article has been peer-reviewed. Cet article a été évalué par les pairs.

Can J Ophthalmol 2009;44:540–7
doi:10.3129/i09-155

The Canadian postgraduate medical education system retains international acclaim for its high standards. This is in part due to the stringent national accreditation and regulatory processes that postgraduate medical education programs must weather in order to obtain certification by the Royal College of Physicians and Surgeons of Canada (RCPSC).[1] On the international stage, as part of its global vision health initiative, the International Council of Ophthalmology (ICO) published a position paper in 2006[2] outlining the core competencies that residents should achieve upon graduating from ophthalmology specialty training programs. The document meticulously defines the goals, expectations, knowledge, competencies, and technical training objectives that should be included in postgraduate ophthalmology curricula.

Table 1—Demographic characteristics of all respondents (*n* = 40)

Characteristic	*n* (%)
Mean age (SD), yr	31.5 (4.2)
Level of training	
PGY-4	13 (32.5)
PGY-5	13 (32.5)
2008 graduate	6 (15.0)
2007 graduate	5 (12.5)
2006 graduate	2 (5.0)
2005 graduate	1 (2.5)
Province of training	
Alberta	4 (10.0)
British Columbia	1 (2.5)
Nova Scotia	2 (5.0)
Ontario	20 (50.0)
Quebec	13 (32.5)
Saskatchewan	0 (0)
Current work status of graduates*	
Pursuing fellowship in Canada	5 (35.7)
Pursuing fellowship internationally	2 (14.3)
Working in a community practice	3 (21.4)
Working in an academic practice	4 (28.6)

*The total number of graduate respondents was 14.
Note: PGY, postgraduate year.

Canadian ophthalmology residency programs have not been systematically evaluated in relation to these standards. In fact, there has been no formal investigation into the effectiveness of Canadian ophthalmology residency programs in recent years. In the present study, we evaluate the adequacy of Canadian ophthalmology residency training programs in achieving the objectives outlined by the ICO, as well as evaluate the satisfaction and effectiveness of such programs in preparing residents for the RCPSC examinations and for entering clinical practice.

Methods

Canadian ophthalmology residents in postgraduate years (PGY) 4 and 5, as well as recent graduates from 2005–2008, were invited by e-mail to participate in a 43-item survey during the fall of 2008. Respondents were questioned about their experiences in ophthalmology residency with reference to the competencies outlined by the ICO. The survey data were entered into a spreadsheet and categorized by demographic variables. Basic statistical analyses were performed.

Results

Of the 99 residents and graduates surveyed, 40 (40%) responded, consisting of 26 current PGY 4 and 5 residents and 14 recent graduates. There were 30 male and 10 female respondents (75% and 25%, respectively). The average age was 31.5 (range 25–43) years. The demographic characteristics of the respondents are detailed in Table 1.

Table 2 illustrates the overall satisfaction of residents with their residency program. The vast majority of respondents (85%) stated that generally they were satisfied with their residency program. Respondents were also satisfied with the quality of teaching in most settings (Table

Table 2—Overview of residency program satisfaction (*n* = 40)

Questions	Satisfied, *n* (%)	Neutral, *n* (%)	Dissatisfied, *n* (%)	N/A, *n* (%)
What is your overall level of satisfaction with your ophthalmology residency program?	34 (85)	3 (7.5)	2 (5)	1 (2.5)
How do you feel about the operative experience in the following areas?				
Case volume	28 (70)	4 (10)	5 (12.5)	3 (7.5)
Case complexity	29 (72.5)	5 (12.5)	4 (10)	2 (5)
Case variety	24 (60)	8 (20)	6 (15)	2 (5)
How do you feel about the quality of teaching in the following settings?				
Formal didactic teaching	31 (77.5)	5 (12.5)	4 (10)	0 (0)
Operating room	31 (77.5)	5 (12.5)	4 (10)	0 (0)
Clinic/outpatient office	34 (85)	2 (5)	4 (10)	0 (0)
Hospital-based rounds	30 (75)	5 (12.5)	2 (5)	3 (7.5)
Grand rounds	34 (85)	4 (10)	1 (2.5)	1 (2.5)
Morbidity and mortality rounds	19 (47.5)	10 (25)	4 (10)	7 (17.5)
Surgical skills/wet laboratory	27 (67.5)	5 (12.5)	6 (15)	2 (5)
Videotapes of surgical procedures	14 (35)	14 (35)	7 (17.5)	5 (12.5)
Surgical virtual simulation system	14 (35)	6 (15)	6 (15)	14 (35)
Conferences	35 (87.5)	5 (12.5)	0 (0)	0 (0)
Journal club	36 (90)	2 (5)	1 (2.5)	1 (2.5)

Note: N/A, not answered.

2). Most respondents (85%) felt that the amount of time allocated to clinical and surgical training during residency was adequate (Fig. 1). Additionally, the majority of residents stated that both the clinical and surgical training during residency prepared them for practice (92.5% and 87.5%, respectively).

The reported adequacy of clinical training across various subspecialty disciplines is shown in Fig. 2. Clinic-based training across most subspecialties was generally considered satisfactory; however, a significant proportion of residents stated that they had insufficient exposure to the areas of low-vision rehabilitation (77.5%), refraction and glasses prescription (65.0%), and neuro-ophthalmology (45.0%). Indeed, these were identified as areas requiring further training after residency (Fig. 2).

Respondents were also satisfied with their overall operative experiences, the majority (>60%) rating case volume, complexity, and variety as satisfactory or better (Table 2). Exposure to the surgical aspects of various subspecialties was also generally rated well, although many respondents stated that they had insufficient exposure to extracapsular cataract extraction (72.5%), refractive surgery (72.5%), and orbital surgery (57.5%) (Fig. 3). Refractive surgery was the most commonly identified area in which respondents felt they required extra training after graduation. Self-reported surgical volumes for cataract surgery, trabeculectomy, and strabismus surgery are shown in Table 3. There was some variation in actual self-reported surgical volumes for various procedures within and between training programs.

Table 4 shows the self-reported confidence of respondents in achieving competency in various ICO learning objectives. In the area of cataract/refraction training, most respondents felt comfortable prescribing glasses (77.5%) and performing phacoemulsification (85%). However, 75% of respondents felt uncomfortable with contact lens prescription and refractive surgery, and 55% did not feel confident in performing extracapsular cataract extraction and corneal surgery. Similarly, 50% of respondents felt uncomfortable performing vitreoretinal surgical procedures. Areas of weakness identified within oculoplastics included treatment of orbital trauma (55%) and lacrimal surgery procedures

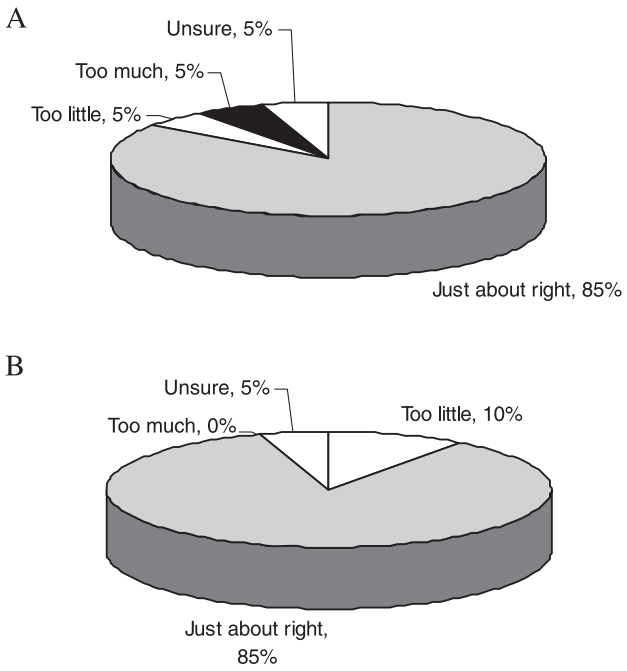

Fig. 1—Responses to the question "What do you feel about the amount of a) clinic-based, and b) surgery-based training in your program?"

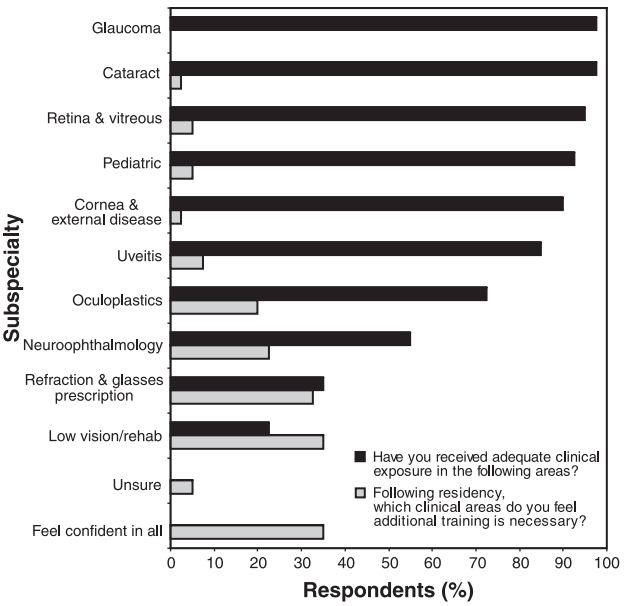

Fig. 2—Percentage of respondents stating that *clinical* training during residency across subspecialties was adequate (black bar) and percentage stating that further training after residency would be required (grey bar).

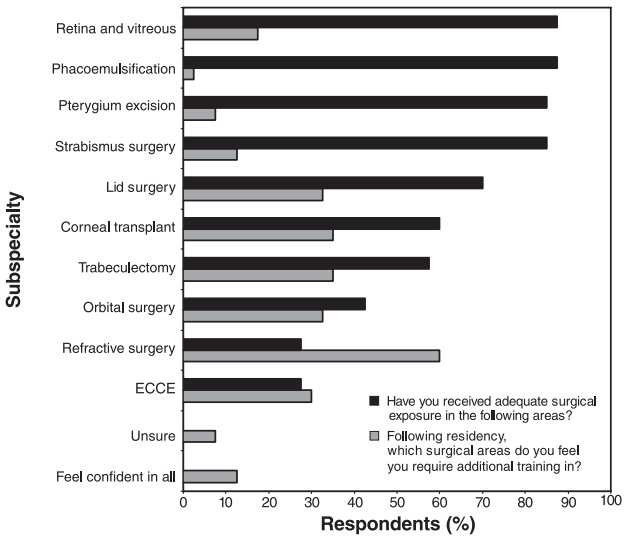

Fig. 3—Percentage of respondents who felt that they received adequate *surgical* training during residency in different subspecialties (black bar) and areas of weakness requiring further training after residency (grey bar). (ECCE, extracapsular cataract extraction.)

(52.5%). Within the realm of pediatric ophthalmology, most respondents felt comfortable performing pediatric clinical assessments (92.5%), as well as performing strabismus surgery (77.5%); however, only 45% of respondents felt comfortable managing children with retinopathy of prematurity. Only a minority of respondents (15%) felt comfortable prescribing low-vision rehabilitative therapies.

Table 3—Self-reported surgical volume experienced during residency training (*n* = 40)

Question	Response, *n* (%)
How many cataract surgeries have you performed upon completion of your residency training?	
<100	2 (5.0)
100–200	5 (12.5)
201–300	11 (27.5)
301–400	8 (20.0)
401–500	6 (15.0)
>500	6 (15.0)
Unsure	2 (5.0)
How many trabeculectomy surgeries have you performed after completing your residency training?	
0	4 (10.0)
<10	13 (32.5)
10–20	14 (35.0)
21–30	3 (7.5)
31–40	3 (7.5)
41–50	1 (2.5)
>50	0 (0)
Unsure	2 (5.0)
How many strabismus surgeries have you performed after completing your residency training?	
0	1 (2.5)
<10	2 (5.0)
10–20	4 (10.0)
21–30	5 (12.5)
31–40	15 (37.5)
41–50	6 (15.0)
>50	6 (15.0)
Unsure	1 (2.5)

Nonclinical areas of teaching during residency are outlined in Table 5. Most respondents received teaching in ethics (100%), professionalism (97.5%), and relationships with referring doctors (79.5%) and allied health professionals (82.5%). Administrative issues such as staffing, practice models and management, and information technology were not uniformly addressed across all programs (Table 5).

Respondents who were recent graduates were asked a separate subset of questions assessing the adequacy of residency programs in preparing them for the RCPSC licensing examination and for entering clinical practice. All of the graduates surveyed had successfully passed the Royal College licensing examination on their first attempt; all felt that their residency program had prepared them adequately for it (Table 6). Although most programs (92.9%) had protected study time, some respondents (35.7%) felt that the amount of dedicated study time allocated was insufficient. Most respondents (71.4%) did not experience anything that negatively affected their performance on the examination, but 28.5% felt that ongoing clinical and call duties interfered with their performance. When graduates were asked whether they felt that their residency program adequately prepared them to practise as comprehensive ophthalmologists, almost all respondents (13 or 92.9%) agreed.

Table 4—Self-reported competency in achieving various ICO learning objectives upon graduating from residency (*n* = 40)

Competency	Yes, *n* (%)	No, *n* (%)	Unsure, *n* (%)
Cataracts/refraction			
I feel comfortable prescribing glasses	31 (77.5)	7 (17.5)	2 (5)
I feel comfortable prescribing contact lenses	5 (12.5)	30 (75)	5 (12.5)
I feel comfortable performing phacoemulsification	34 (85)	1 (2.5)	5 (12.5)
I feel comfortable performing extracapsular cataract extraction	10 (25)	22 (55)	8 (20)
I feel comfortable implanting toric intraocular lenses	20 (50)	12 (30)	8 (20)
I feel comfortable performing refractive surgery	4 (10)	30 (75)	6 (15)
I feel comfortable performing corneal surgery	9 (22.5)	22 (55)	9 (22.5)
Glaucoma			
I feel comfortable performing glaucoma ALT/SLT	28 (70)	9 (22.5)	3 (7.5)
I feel comfortable managing complications of glaucoma surgery	34 (85)	5 (12.5)	1 (2.5)
Retina			
I feel comfortable performing posterior segment examinations (including scleral depression)	39 (97.5)	0 (0)	1 (2.5)
I can perform vitreoretinal surgical procedures	16 (40)	20 (50)	4 (10)
Plastics			
I can treat eyelid trauma	37 (92.5)	2 (5)	1 (2.5)
I can treat orbital trauma	12 (30)	22 (55)	6 (15)
I can perform lid surgical procedures	33 (82.5)	4 (10)	3 (7.5)
I can perform lacrimal surgical procedures	15 (37.5)	21 (52.5)	4 (10)
I can perform enucleation	25 (62.5)	11 (27.5)	4 (10)
I can excise conjunctival tumours	29 (72.5)	8 (20)	3 (7.5)
Pediatrics			
I feel comfortable performing pediatric clinical assessments	37 (92.5)	1 (2.5)	2 (5)
I feel comfortable managing children with strabismus	31 (77.5)	5 (12.5)	4 (10)
I feel comfortable managing children with retinopathy of prematurity	18 (45)	17 (42.5)	5 (12.5)
I feel comfortable performing strabismus surgery	33 (82.5)	3 (7.5)	4 (10)
Other			
I can prescribe low-vision rehabilitative therapies and optical devices	6 (15)	29 (72.5)	5 (12.5)

Note: ICO, International Council of Ophthalmology; ALT, argon laser trabeculoplasty; SLT, selective laser trabeculoplasty.

Conclusions

Although most Canadian ophthalmology residents do well on their national certification examinations, there has been no formal evaluation of their competencies in relation to international standards. The ICO document on residency education clearly outlines the basic requisite clinical competencies for the ophthalmology resident. It serves as an excellent reference standard for administrators, educators, and certifying bodies to follow in the creation and modification of postgraduate ophthalmology education curricula.[2] In the present study, we evaluated residents' self-reported comfort and competency in achieving several key objectives outlined by the ICO in order to identify any potential areas of deficiency in current Canadian ophthalmology residency programs. Overall, Canadian residents conveyed a high level of satisfaction with their training programs and were proficient in most of the competencies outlined by the ICO. However, there were some areas in their training that residents felt to be inadequate.

One area that respondents identified as deficient during residency was clinical and surgical refractive training, including contact lens prescription and refractive surgery (Table 4). These results echo those of McDonnell et al.,[3] who found that training in clinical and refractive surgical conditions was inadequate in residency programs across the United States. Clearly, having a solid knowledge base and clinical skill set in refractive conditions is fundamental to any ophthalmology residency program. With regard to refractive surgery specifically, given that this is a relatively new and constantly changing field it is perhaps not surprising that many programs have yet to develop and incorporate comprehensive training in refractive surgery into their curricula. Additionally, the majority of refractive surgical procedures occur in private settings, and this makes resident access to learning difficult. It is important for residency programs to update their curriculum to ensure that residents obtain adequate exposure to this increasingly popular area, possibly by partnering with private clinics that perform refractive surgery. Indeed, both practising comprehensive and subspecialty ophthalmologists found in their surveys that anterior segment knowledge and skills, including refractive surgery, were very important skills for residents to obtain.[4,5] This training should extend beyond the technical aspects of refractive surgery itself into understanding the interplay of refractive surgery with other diseases and procedures (e.g., glaucoma, axial length measurements for cataract surgery).

Another area that residents identified as deficient in their training programs was low-vision rehabilitation. This is quite unfortunate, given that patients typically access such services, which can offer substantial gains to their quality of life, by referral from ophthalmology.[6] As the burden of age-related eye diseases increases with an aging population,

Table 6—Graduates' responses to questions about preparedness for RCPSC licensing examination (*n* = 14)

Questions	Responses, *n* (%)
How many times have you taken the Royal College exam?	
1	14 (100)
>1	0 (0)
During your training, do you feel you were given adequate and timely feedback in the following setting(s)?	
Clinic/outpatient	14 (100)
Operating room	14 (100)
Opportunity to discuss progress with Program Director	14 (100)
During your PGY5 year, what was your on-call frequency?	
1:2	0 (0)
1:3	1 (7.1)
1:4	6 (42.9)
1:5	3 (21.4)
1:7	1 (7.1)
1:8	1 (7.1)
No call	2 (14.3)
Did your program have protected study time prior to your Royal College exam?	
No	1 (7.1)
Yes, but too little	4 (28.6)
Yes, just about right	9 (64.3)
Yes, too much time	0 (0)
Did you feel your training program prepared you adequately to perform well on the Royal College exam?	
Yes	14 (100)
No	0 (0)
What methods did you use to prepare for the Royal College exams? Check all that apply	
Individual study	14 (100)
Review sessions with staff	9 (64.3)
Review sessions with peers	10 (71.4)
Simulated exams	13 (92.9)
Review course offered by the residency program	1 (7.1)
Other review course	4 (28.6)
Did any factors negatively affect your performance on the Royal College Exam? Select all that apply.	
Nothing negatively affected my performance	10 (71.4)
Continuing clinic duties while studying	3 (21.4)
Continuing call duties while studying	1 (7.1)
Inadequate clinical exposure during residency	0 (0)
Inadequate teaching during residency	1 (7.1)

Note: RCPSC, Royal College of Physicians and Surgeons of Canada; PGY, postgraduate year.

Table 5—Responses to the question: "Which nonclinical areas of ophthalmology practice did you receive training in during residence?" (*n* = 40)

Area	Yes, *n* (%)	No, *n* (%)	Unsure, *n* (%)
Professionalism	39 (97.5)	1 (2.5)	0 (0)
Practice management skills	18 (45)	15 (37.5)	7 (17.5)
Staffing and administration skills	9 (22.5)	26 (65)	5 (12.5)
Ethics	40 (100)	0 (0)	0 (0)
Relationships with referring doctors	31 (77.5)	8 (20)	1 (2.5)
Relationships with allied health professionals	33 (82.5)	7 (17.5)	0 (0)
Information about practice settings/models	13 (32.5)	21 (52.5)	6 (15)
Professional/political advocacy	23 (57.5)	15 (37.5)	2 (5)
Information management and technology	15 (37.5)	21 (52.5)	3 (7.5)

it will be more important for ophthalmologists to become comfortable in appropriately managing patients with low vision.[6] The poor low-vision training reported by residents, coupled with the unpopularity of subspecialization in low-vision rehabilitation, may impair the effective provision of low-vision care services in Canada in the near future.[7] Universities could consider networking with organizations that specialize in low-vision support, such as the Canadian National Institute for the Blind, to enhance resident exposure to and familiarity with low-vision resources.

Surgical exposure to most ophthalmic surgeries was deemed satisfactory, but many respondents stated that they had insufficient exposure to extracapsular cataract extraction. Surgical rates for this procedure have fallen in concert with the popularity and perfection of phacoemulsification techniques. Despite this, it is important for residents to obtain training in extracapsular cataract extraction since it is a procedure of last resort and remains the only option for cataract removal in settings without phacoemulsification technology or for very dense lenses.[4,8,9] Residents may need to partake in international electives in order to obtain training in this procedure.

Many Canadian programs use surgical skills laboratories and the observation of videos to facilitate the surgical training of residents (Table 2). Recently, several schools have embraced the latest innovation in surgical training—surgical simulation. At the time of writing this manuscript, 5 of 14 Canadian schools are using such simulators as part of the surgical skills training of residents. Virtual simulation systems have been reported to help residents develop a baseline level of visual-spatial and fine motor skills before beginning their formal operative training experiences.[10–14] The efficacy of virtual reality simulation in ophthalmic surgical training has been documented in several studies and warrants further consideration as an education tool complementary to the resources already in use.[12,15–21]

Surgical volumes were found to be adequate for cataract and noncataract surgery. In the current study, it appears that Canadian residents graduate with a mode of 201–300 cataract procedures, 11–20 trabeculectomies, and 31–40 strabismus surgical procedures (Table 3). Although these volumes are higher than those reported by many programs in the United Kingdom and the United States, the length of training varies among these countries.[9,22–24] Further, there is a large amount of variability in the range of surgical volumes both within and between residency programs in Canada, meaning that some residents will graduate with relatively fewer cases than average whereas others may greatly exceed the mean volumes. Of course, in order for residents to achieve comfort, competency, and safety in performing various procedures, it is important for schools to ensure that residents graduate with adequate surgical volumes. Since different residents will require different volumes to attain competency, it may be difficult to set "minimum volumes" required for graduation. However, it is important to set such standards, as previous work has shown that, for phacoemulsification, complication rates were significantly reduced after residents had completed 80 cases or more.[25] The goal of achieving adequate surgical volumes may become more of a challenge as training programs cope with an increase in the total number of matriculating residents and the need to accommodate the different learning curves of each resident. It may therefore be important for Canada to develop, as has the United States, a minimum benchmark of case volumes that residents must achieve in order to obtain certification.[26]

The adoption of a competency and outcome-based residency education evaluation in both the United States and Canada requires residents to be not only proficient in clinical and surgical procedures but also competent in the interpersonal skills demanded of them by both the public and program regulators.[1,27] These practical, nonmedical skills are rated as being among the most important skills to obtain by practising comprehensive and subspecialty ophthalmologists.[3,4] Our study has demonstrated that most Canadian programs have successfully incorporated many nonmedical components of the Canadian Medical Education Directions for Specialists (CanMEDS) competencies within the existing curriculum (Table 5). Within the nonclinical areas of training, Canadian residents and graduates felt that residency had adequately prepared them for the relationship-building and practice-management aspects of their career, more so than their American colleagues.[4]

One of the difficulties in designing a residency program is deciding what constitutes core knowledge and skills and what should be considered advanced training objectives. It can be argued that some of the objectives outlined by the ICO represent skills beyond the scope of the comprehensive ophthalmologist. For example, orbital surgery, which most residents in the present study did not feel comfortable performing, would likely not be attempted by comprehensive ophthalmologists in Canada. Others have questioned the usefulness of international guidelines, arguing that by their nature they aim for the attainment of only a "minimum standard" of competency and thereby do not serve to promote excellence,[28] and further that they are not entirely applicable across different regions and situations. From their inception, the ICO residency curriculum guidelines were not intended to be used as a rigid cookbook approach to curriculum development but, rather, to serve as "an educational tool" from which to modify and expand training programs.[2] In that capacity, the ICO guidelines represent an excellent reference for curriculum development, modification, and evaluation.[29] Ideally, guidelines and benchmarks should be integrated into residency within a competencies-based framework, such as the CanMEDS framework in Canada.[1,30–34]

Canada's national vision plan has identified education as a key component to averting a potential vision-health crisis.[35] Unfortunately, the postgraduate education system is likely to face several challenges in the coming years, including an increase in the number of resident trainees, a diver-

sion of procedures to private settings, and a struggle to keep abreast of therapeutic and technological advancements.[36] Consequently, it is important for Canadian ophthalmology residency programs to continually re-evaluate, reassess, and reshape their curricula to ensure that residents are graduating with the requisite skills to function as effective modern-day ophthalmologists.

There are several limitations to the present study. A 40% response rate, although typical for this type of investigation, carries with it a potential source of bias. The low participation from recent graduates may be due to many programs not keeping contact information of their recent graduates. Further, the data represent self-reported evaluations by residents and therefore are subjected to recall bias. The data also contain the opinions of residents in training, whose final assessment of their satisfaction with their program as well as self-reported confidence in various skills may change when they finish the latter stages of their training.

In summary, Canadian postgraduate ophthalmology training retains a high level of satisfaction among senior residents and graduates and is effective in achieving many of the key competencies outlined by the ICO. Modification of current curricula in reference to the ICO objectives can improve the educational experiences of residents and can ensure that new graduates attain confidence in the skills required to function as effective, modern-day ophthalmologists.

Funding provided by the Toronto Western Hospital/University Health Network, Department of Ophthalmology Academic Enrichment Fund.

The authors have no proprietary or commercial interest in any materials discussed in this article.

References

1. Royal College of Physicians and Surgeons of Canada. Canadian medical education directions for specialists. Available at: http://rcpsc.medical.org/canmeds. Accessed February 28, 2009.
2. International Council of Ophthalmology. Principles and guidelines of a curriculum for education of the ophthalmic specialist: *Klin Monatsbl Augenheilkd* 2206;223:S3–48. Available at: http://www.icoph.org/pdf/icocurricres.pdf. Accessed January 18, 2009.
3. McDonnell PJ, Kirwan TJ, Brinton GS, et al. Perceptions of recent ophthalmology residency graduates regarding preparation for practice. *Ophthalmology* 2007;114:387–91.
4. Michels KS, Hansel TEB, Choi D, Lauer AK. A survey of desired skills to acquire in ophthalmology training: a descriptive statistical analysis. *Ophthalmic Surg Lasers Imaging* 2007;38:107–14.
5. Lee AG, Koch DD. The Baylor survey of ophthalmology residency graduates: rationale for reform in residency training. *Ophthalmic Surg Lasers* 1998;29:649–57.
6. Gold D, Zuvela B, Hodge WG. Perspectives on low vision service in Canada: a pilot study. *Can J Ophthalmol* 2006;41:348–54.
7. Noble J, Schendel S, Daniel S, Baerlocher MO. Motivations and future trends: a survey of Canadian ophthalmology residents. *Can J Ophthalmol* 2007;42:821–5.
8. Oetting TA, Lee AG, Beaver HA, et al. Teaching and assessing surgical competency in ophthalmology training programs. *Ophthalmic Surg Lasers Imaging* 2006;37:384–93.
9. Rowden A, Krishna R. Resident cataract surgical training in United States residency programs. *J Cataract Refract Surg* 2002;28:2202–5.
10. Hikichi T, Yoshida A, Igarashi S, et al. Vitreous surgery simulator. *Arch Ophthalmol* 2000;118:1679–81.
11. Sinclair MJ, Peifer JW, Haleblian R, Luxenberg MN, Green K, Hull DS. Computer-simulated eye surgery: a novel teaching method for residents and practitioners. *Ophthalmology* 1995;102:517–21.
12. Rossi JV, Verma D, Fujii GY, et al. Virtual vitreoretinal surgical simulator as a training tool. *Retina* 2004;24:231–6.
13. Webster R, Sassani J, Shenk R, et al. Simulating the continuous curvilinear capsulorhexis procedure during cataract surgery on the EYESI system. *Stud Health Technol Inform* 2005;111:592–5.
14. Henderson BA, Neaman A, Kim BH, Loewenstein J. Virtual training tool. *Ophthalmology* 2006;113:1058–9.
15. Jonas JB, Rabethge S, Bender HJ. Computer-assisted training system for pars plana vitrectomy. *Acta Ophthalmol Scand* 2003;81:600–4.
16. Peugnet F, Dubois P, Rouland JF. Virtual reality versus conventional training in retinal photocoagulation: a first clinical assessment. *Comput Aided Surg* 1998;3:20–6.
17. Feldman BH, Ake JM, Geist CE. Virtual reality simulation. *Ophthalmology* 2007;114:828e1–e4.
18. Mahr MA, Hodge DO. Construct validity of anterior segment antitremor and forceps surgical simulator training modules: attending versus resident surgeon performance. *J Cataract Refract Surg* 2008;34:980–5.
19. Feudner EM, Engle C, Neuhann IM, Petermeier K, Bartz-Schmidt KU, Szurman P. Virtual reality training improves wet-lab performance of capsulorhexis: results of a randomized, controlled study. *Graefes Arch Clin Exp Ophthalmol* 2009;247:955–63.
20. Khalifa YM, Bogorad D, Gibson V, Peifer J, Nussbaum J. Virtual reality in ophthalmology training. *Surv Ophthalmol* 2006;51:259–73.
21. Oetting TA. Surgical competency in residents. *Curr Opin Ophthalmol* 2009;20:56–60.
22. Binenbaum G, Volpe NJ. Ophthalmology resident surgical competency: a national survey. *Ophthalmology* 2006;113:1237–44.
23. Gibson A, Boulton MG, Watson MP, Moseley MJ, Murray PI, Fielder AR. The first cut is the deepest: basic surgical training in ophthalmology. *Eye* 2005;19:1264–70.
24. Watson MP, Boulton MG, Gibson AR, Murray PI, Moseley MJ, Fielder AR. The state of basic surgical training in the UK, ophthalmology as a case example. *J R Soc Med* 2004;97:174–8.
25. Randleman JR, Wolfe JD, Woodward M, Lynn MJ, Cherwek DH, Srivastava SK. The resident surgeon phacoemulsification learning curve. *Arch Ophthalmol* 2007;125:1215–9.
26. Accreditation Council for Graduate Medical Education. Ophthalmology resident operative minimum requirements. Available at: http://www.acgme.org/acWebsite/RRC_240/240_MinimumsOperativeTable.pdf. Accessed February 28, 2009.
27. Accreditation Council for Graduate Medical Education. ACGME outcome project. General competencies. Available at: http://www.acgme.org/outcome/comp/refList.asp. Accessed February 28, 2009.

28. Okada AA. International guidelines: all for one and one for all? *Arch Ophthalmol* 2003;121:1043–4.
29. Tso MO, Abbott R, Spivey B. International guidelines: all for one and one for all? *Arch Ophthalmol* 2004;122:1090–1.
30. Lee AG, Pelton RW, Koch DD. Designing an optimum rotation schedule for an ophthalmology residency. *Acad Med* 1997;72:564.
31. Lee AG, Koch DD. A standardized curriculum and evaluation system for an ophthalmology residency. *Acad Med* 1998;73:447–8.
32. Lee AG. Benchmarks for ranking and improving ophthalmology residency programs. *Arch Ophthalmol* 2001;119:1395–6.
33. Lee AG. The new competencies and their impact on resident training in ophthalmology. *Surv Ophthalmol* 2003;48:651–62.
34. Lee AG, Carter KD. Managing the new mandate in resident education: a blueprint for translating a national mandate into local compliance. *Ophthalmology* 2004;111:1807–12.
35. Breslin CW. Our vision of vision health: the National Coalition for Vision Health. *Can J Ophthalmol* 2007;42:790–1.
36. Royal College of Physicians and Surgeons of Canada. Safeguarding the quality of the educational continuum and medical workforce in Canada's complex health care system. Available at: http://rcpsc.medical.org/publicpolicy/Statement_on_Complexity_e.pdf. Accessed February 28, 2009.

Keywords: ophthalmology, residency, curriculum, licensing, education