

A comparison of ophthalmic training in six English-speaking countries

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Abstract

Objective: To compare key characteristics of ophthalmology training programs in six different English-speaking countries: Australia, New Zealand, Canada, Ireland, the United Kingdom, and the United States. *Methods:* The main features examined were career pathway, duration of training, surgical training, governing bodies, and examination structure. Seven ophthalmologists with personal knowledge of all six systems contributed. Data were collected from the literature, online resources, and personal experience. *Results:* Several differences were highlighted, including length of training (ranging from 4 to 9 years after medical school), number of surgical procedures such as cataracts (ranging from minimum 86 to approximately 600), and structure of fellowship training. *Conclusions:* As trainees increasingly seek international experience to enhance their knowledge and skills, the similarities and differences between training programs in different countries have become more relevant. Some of these differences may reflect differing needs of different patient populations and different healthcare delivery systems across the globe. However, these differences should also prompt educators to more carefully scrutinize their own training system and search for potential improvements.

Introduction

Like other industries, healthcare is gradually globalizing. This manifests in many ways, including exchange of trainees, medical tourism, and increased international research collaborations. Ophthalmic training differs significantly between countries, and it is likely that different training structures have relative strengths and weaknesses. As international training fellowships and collaborations are becoming more common, it would be helpful to summarize key features of ophthalmic training in different countries. This has the immediate practical benefit of better informing both trainees and host institutions of what to expect from a particular training system. In addition, international comparisons may yield learning points that could better inform the future structure of ophthalmic training worldwide.

In this study, we sought to explore ophthalmic training structures in a selection of English speaking countries. Given the common language, there is significant international exchange of trainees between these countries. Although there are over sixty sovereign states in which English is an official language, six are regarded as majority English speaking; Australia, Canada, Ireland, New Zealand, the United Kingdom and the United States (collectively termed the Anglosphere). These are the focus of this study.

Methods

The following key data were collected for each training system: general career pathway including medical school; duration of ophthalmic training; expected numbers of cataract operations; regulatory body governing training; examination structure. As the authors have trained in the relevant systems, additional informative insights were also provided. As training in Australia and New Zealand falls under the rubric of one system, a combined description was provided for these countries.

Results

See Table 1 for a comparison of key features of the different systems, also described below.

Training in Australia and New Zealand

Career Pathway and Duration of Training

Training can be divided into medical school, pre-vocational training and vocational training. In Australia, half of medical schools conform to the North American model (at least a three-year undergraduate degree plus a four-year post-graduate degree), which was largely shaped by the Flexner Report in 1910,¹ while the remainder offer a UK-style six-year undergraduate medical degree. This is followed by pre-vocational training, which the Royal Australian & New Zealand College of Ophthalmologists (RANZCO) stipulates is a minimum of two years, spent in a variety of medical subspecialties in accredited hospitals (all in Australia and New Zealand). Ophthalmic specialist training is a minimum of five years, the first four of which are spent undertaking core ophthalmic surgical training. The fifth and final year may

be spent undertaking further general ophthalmology training, sub-specialty training, or research.

At the end of the fifth year, trainees can apply to become Fellows of the Royal Australian and New Zealand College of Ophthalmologists and are eligible for the Australian Health Practitioners Registration Authority's (AHPRA) specialist register. In practice, many trainees subsequently elect to undertake further sub-specialty training. In 2012, a total of 813 ophthalmologists were in active employment within the Australian workforce (3.58 ophthalmologists per 100,000).^{2,3}

Surgical Training

Surgical experience commences in the first year of ophthalmology training. RANZCO lists the procedures which trainees should be able to perform independently at the end of training, those in which they should have participated, and those of which they should have reasonable knowledge. RANZCO does not provide guidance with respect to minimum numbers of procedures required, but does stipulate that a minimum of fifty intraocular procedures should be performed over the first two years of training. It is the authors' experience that most trainees have completed several hundred cataract surgeries by the completion of training.

Governing Bodies and Examination Structure

The Royal Australian and New Zealand College of Ophthalmologists (RANZCO) oversees accreditation of training programs, exam administration, and admission of trained ophthalmologists as "Fellows" of RANZCO (FRANZCO). Work-based assessment consists of monthly Theatre Performance Assessments and quarterly Supervisor Assessments. Additionally, trainees are required to submit a Clinical Curriculum Performance Standard (CCPS) spreadsheet quarterly in order to track and highlight areas to be addressed during subsequent training. A practical examination is administered in the first eighteen months of ophthalmology training (Table 1). Trainees also undertake 2 written exams in pathology and clinical ophthalmology in their third and fourth year, respectively (Table 1). Trainees who are unable to pass these examinations in three attempts are referred to the RANZCO progression committee for remediation.

Training in Canada

Career Pathway and Duration of Training

The majority of Canadian medical schools require an undergraduate degree prior to admission, based on the Flexner report.^{1,4} Candidates apply to ophthalmology residency in the final year of medical school. There are currently 1,137 ophthalmologists in training and in practice in Canada, resulting in a ratio of 33 ophthalmologist and ophthalmology trainees per million.⁵ In 2015, there were 67 applicants for a total of 39 Ophthalmology residency positions offered by 15 accredited ophthalmology programs, a ratio of 1.7 applicant per position.⁶

All programs start with a foundation year of general medical and surgical rotations followed by four years of dedicated clinical ophthalmology. All programs in the country send their residents during the last six weeks of their first year to the Toronto Ophthalmology Residency Introductory Course (TORIC), an intensive and primarily didactic introduction to ophthalmic anatomy, physiology, pathology, and examination techniques.

Of the 15 Canadian ophthalmology training programs, 12 offer fellowship training in 1-10 subspecialties: cornea, glaucoma, low vision, medical retina, neuro-ophthalmology, ocular genetics, ocular oncology, orbit/oculoplastic surgery, pediatric ophthalmology, and vitreoretinal surgery. These are typically 1 year in duration, although there are some 2-year vitreoretinal programs. According to one study, approximately 62% of Canadian residents seek fellowship training, and 22% intend to remain in Canada for training⁷. The most popular choices were retina, anterior segment/cataract, and cornea.

Surgical Training

While surgical exposure is attained early, dedicated surgical rotations are scheduled in the final two years of training. The Royal College of Physicians and Surgeons of Canada (RCPSC) does not require minimum surgical numbers, but does require competency, to be assessed by the individual training programs, in the following areas: cataract, glaucoma, strabismus, enucleation, eyelid, lacrimal, ocular surface (including pterygium and conjunctiva), and ocular trauma.⁸ A recent national questionnaire, filled by a total of 73 residents (53.6% response rate), revealed an average number (standard deviation) of 341(150) cataract surgeries for graduating residents, 6(7) trabeculectomies and 48(17) strabismus surgeries (presented at the 75th annual meeting of the Canadian Ophthalmological Society, June 2012).

Governing Bodies and Examination Structure

Residency programs across Canada are regulated by the RCPSC through a standardized accreditation process every six years.⁹ The training objectives of all programs must adhere to the CanMEDS (Canadian Medical Education Directives for Specialists) organizational framework, against which the trainees, instructors, and the programs are evaluated. The CanMEDS evaluation categories include Medical Expert, Communicator, Collaborator, Manager, Health Advocate, Scholar, and Professional.¹⁰

Trainees are evaluated by their programs according to clinical rotation feedback and oral examinations. Most programs require the annual Ophthalmic Knowledge Assessment Program (OKAP) exam, administered by the American Academy of Ophthalmology. In the final year of residency, trainees are required to complete a multiple-choice and an oral examination (Table 1). Successful completion of the examinations, an accredited residency program, and a scholarly project are prerequisite for Royal College certification in ophthalmology.⁸ Candidates may attempt the examination a total of three times, after which a review committee will recommend additional training and a final opportunity to pass. Candidates scoring at least two standard deviations below the failure threshold present to the review committee after a single attempt.¹¹

Training in Ireland

Career Pathway and Duration of Training

As in the United Kingdom (see below), most students complete a five-year undergraduate medical degree after secondary education, although some universities offer a four-year course. Ophthalmology training in Ireland is broadly categorized into basic surgical training and higher surgical training. Basic Ophthalmology Training is a three-year program providing broad-based initial training in ophthalmology¹² and occurring after completion of a twelve-month mandatory internship or equivalent.¹³ Following successful completion, candidates can apply to either Medical Ophthalmic Specialist Training (MST) or Higher Ophthalmic Surgical Training (HST).

MST consists of three six-month rotations framed around three core subspecialties: medical retina, glaucoma, and pediatric ophthalmology. Medical Ophthalmic Specialists can take up a post as a community ophthalmologist, a hospital-based ophthalmologist or set up private practice as an independent practitioner.

HST consists of 5 years after Basic Ophthalmology Training and provides exposure to all the subspecialties on a rotational basis. After completion of HST, most individuals complete a further fellowship in their subspecialty of interest before becoming independent consultants.

Surgical Training

The aim of higher ophthalmic surgical training is to equip trainees with skills in cataract surgery as well as anterior segment surgery (corneal transplant), glaucoma (trabeculectomy), strabismus, orbit (enucleations), vitreoretinal surgery (retinal detachment repair), nasolacrimal and oculoplastic surgery. At present, there is no well-defined number of procedures that need to be accomplished in order to successfully complete higher surgical training, but the authors' impression is that the expected number of cases closely follows that of UK trainees.

Governing Body and Examination Structure

To successfully complete Basic Ophthalmology Training, trainees must pass the Member of the Royal College of Surgeons in Ireland Exam (MRCSI), involving 3 parts: part 1 written (basic sciences and optics), part 2 written (clinical knowledge) and part 2 clinical (clinical skills and competence). In addition, during Basic Ophthalmology Training, all trainees have a formal appraisal every six months consisting of a face-to-face interview during which workplace based assessments and clinical performance are reviewed. On completion of the Basic Ophthalmology Training, a Certificate of Completion of Basic Surgical Training is awarded, (CCBST) which is a requirement for entry to either Medical Ophthalmic Specialist Training or Higher Surgical Training.

For Medical Ophthalmic Specialist Training, the European Board of Ophthalmology Diploma is the formal exit requirement for the Certificate of Completion of Specialist Training (CCST). This allows the trainee to be on the specialist registrar of the Medical Council and indicates achievement of the standards of competence to practice independently. For trainees who undertake the HST, assessments are also made on a 6-monthly basis in which surgical progress and competence are assessed. The Fellowship of the Royal College of Surgeons in Ireland (FRCSI) is the exit appraisal for the HST program. The

FRCSI examination is taken in the final year of training and tests competence to practice as an independent consultant in ophthalmic surgery.

Training in the United Kingdom

Career Pathway and Duration of Training

Students enter medical school typically at age 18 after completion of secondary education. The medical degree lasts 5 years. For those who have already completed an undergraduate degree, an accelerated four-year course is offered at some medical schools. Following graduation, newly qualified doctors enter a two-year “Foundation programme”, consisting of 4-month blocks in a range of specialties. In their second foundation year, doctors can apply for ophthalmic specialist training (OST). In 2014, there were 353 applications for 82 posts, or a ratio of 4.3 applicants per post.¹⁴ OST lasts seven years in total, culminating in a Certificate of Completion of Training (CCT). The seventh year is termed the Trainee Selected Component (TSC) and usually involves advanced training in a subspecialty of choice.

More recently, a separate, additional Medical Ophthalmology training programme has been established. Individuals with experience in general medicine (to the level of being awarded Membership of the Royal College of Physicians, MRCP) are eligible to apply. This training programme is shorter and does not include formal surgical training.

Surgical Training

Ophthalmic training in the United Kingdom is coordinated by the Royal College of Ophthalmologists.¹⁵ Trainees start learning the steps of cataract surgery in their first year, after completing a three-day microsurgical skills course organised by the Royal College. Trainees are expected to have completed 50 cataract procedures (phacoemulsification) by the end of their second year. By the end of training trainees are expected to have completed 350 cataract operations although in the authors’ experience most have completed significantly more (see Table 2 for additional surgical requirements).

Governing Body and Examination Structure

The Royal College of Ophthalmology (RCOphth) is the professional body for ophthalmologists in the UK and sets the curriculum and examination schedule, maintains the electronic portfolio, and sponsors educational courses for trainees. A three-day microsurgical skills and basic phacoemulsification course is compulsory prior to commencing intraocular surgery. In addition, all practicing medical doctors in the UK must be registered with the General Medical Council (GMC), which sets standards and guidelines for practicing

physicians, awards the CCT, awards registration, license to practice and revalidation, and maintains the specialist register.

During each year of training, trainees have to complete a range of workplace-based assessments with their seniors. These include case-based discussions, case histories, and observed procedures. Trainees undergo an “Annual Review of Competence and Progression” (ARCP) at which their progress is reviewed and any problems are highlighted. Trainees also must pass three formal examinations (Table 1). Passing these examinations entitles the trainee to Fellowship of the Royal College of Ophthalmologists (FRCOphth), which is required for completion of training, and for appointment as a consultant in the National Health Service of the United Kingdom.

Training in the United States

Career Pathway and Duration of Training

Earning a medical doctorate in the United States typically requires four years of medical school following a four-year bachelor’s degree. In 2015, 644 medical students applied for 465 available ophthalmology residency positions at 116 programs.¹⁶ Prior to ophthalmology training, residents must complete a one-year internship in internal medicine, general surgery, or a “transitional” program, which combines rotations in multiple specialties. There are several ophthalmology basic science courses lasting ≥ 4 weeks that are broadly similar to the Canadian TORIC (e.g. University of Texas in Houston, Columbia University, the Bay Area Ophthalmology Consortium with Stanford University, and Harvard University with Colby College (the Lancaster course)), although many residents do not attend such a course. Following internship, the trainee completes three years of ophthalmology residency. Graduates can choose a career in comprehensive ophthalmology or pursue fellowship training lasting 1-2 years in vitreoretinal surgery, medical retina, glaucoma, cornea, advanced anterior segment, pediatrics, neuro-ophthalmology, oculoplastics, uveitis, oncology, or ocular pathology. A growing number of graduates are choosing fellowship, doubling in number over the last 15 years to 64% of graduates in 2014.¹⁷ Upon completion of training, a wide variety of practice settings are available, including private vs. academic, small vs. large group, hospital employers, and urban vs. rural settings.

Surgical Training

Most programs save the bulk of the surgical experience for the final year of training. First and second year residents perform surgery to varying degrees and with varying independence. Residents must complete a minimum of 86 cataract surgeries prior to graduation,¹⁸ and additional minimum surgical requirements are listed in Table 2, although many programs greatly exceed these minimums. On average, residents graduating in 2014 had performed 164 cataract surgeries.¹⁹

Governing Body and Examination Structure

The Accreditation Council for Graduate Medical Education (ACGME) reviews programs annually using online data in the Accreditation Data System, and with a site visit every 10 years, to assess compliance with requirements regulating all aspects of training. As ACGME jurisdiction does not extend to fellowship training, the Association of University Professors of Ophthalmology Fellowship Compliance Committee outlines a voluntary compliance system to standardize fellowship training and provide quality assurance.²⁰

Resident evaluation is required semi-annually based on achievement of very specific milestones defined by the ACGME.²¹ The milestones are categorized by six core competencies set forth by the ACGME as integral to training: patient care, medical knowledge, systems-based practice, practice-based learning and improvement, professionalism, and interpersonal and communication skills.

Almost all medical schools require the Medical College Admissions Test (MCAT) for admission. Once in medical school, a passing score on all three parts of the United States Medical Licensing Exam (USMLE) is required for licensing in all fifty states. Ophthalmology residents take the annual OKAP exam, and residency graduates are eligible for the written and oral board exams (pass rate 76% and 81% respectively in 2015)²² (Table 1). Board exams and completion of an ACGME-accredited residency program are required for American Board of Ophthalmology (ABO) certification, which is not required to practice ophthalmology but is nearly universally pursued.

Discussion

This study highlights several important similarities and differences between ophthalmology training programs in six English-speaking countries. The length of training varies widely, ranging from 4+ years of post-medical school training in the United States to 9+ years in the United Kingdom. This difference is also reflected in the number of surgeries performed during training: residents in the US complete a minimum of eighty-six cataracts prior to graduation, while residents in the UK must complete a minimum of 350. The average number of cataracts performed is also lower in the US than the other countries, even when accounting for length of training. There are likely other unknown contributing factors, possibly including differences in government-funded vs. privatized healthcare. For example, in our experience US residents have highly variable numbers of cataract surgeries, and those residents with the highest number are in a government hospital setting, such as a Veterans Affairs hospital or a county hospital. In these settings there is a strong government-funded mission to train residents and fellows with less pressure for time- and cost-efficiency than non-government teaching institutions, where comparatively more surgeries are performed by the attending with the resident assisting. In countries with universal federally-funded healthcare, there may be more consistent opportunities for trainees to be primary surgeons.

Differences in training duration should also be considered in the context of number of hours worked.²³ In Europe, working hours are limited by the 48-hour week imposed by the

European Working Time Directive whereas the typical American trainee works approximately 60 hours a week.²⁴

Ireland and the UK are unique in offering a shorter “medical” vs. a longer “surgical” track. Training in the UK includes a year of subspecialty fellowship training by default, which is also true in Australia and New Zealand. In Canada, Ireland, and the United States, subspecialization is optional and separate from residency training. This suggests that the prevalence and the role of the “comprehensive ophthalmologist,” who sees and treats a broad range of ophthalmic disorders and refers to a subspecialist when necessary, may vary between countries.

All six countries share in common the pre-ophthalmology internship or foundation year, which trains future ophthalmologists in general medicine and/or surgery. Canada, Ireland, and the United States require one year of internship, while Australia, New Zealand, and the UK require two years. Canada is unique in providing an introductory course (TORIC) in the last 6 weeks of their foundation year to all ophthalmology trainees to prepare them for ophthalmology residency. Each country has a unique examination schedule and structure. All include written exams; Canada and the US also include oral exams, while New Zealand, Australia, Ireland, and the UK include practical exams.

With the current growing globalization of healthcare, more trainees are seeking international experiences.^{24,25} In addition, innovations and reform in healthcare delivery and medical education are occurring internationally.²⁶ Not surprisingly, these trends are inspiring educators to take notice of the global landscape as they seek to reform their own programs to benefit the future of ophthalmology.²⁶ The differences in training programs should inspire us to question aspects of our education that we may otherwise take for granted. Evaluating the benefits and pitfalls of training structures in other countries should inform our decisions at home.

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Table 1. Comparison of Key Characteristics in Ophthalmology Training Programs in Six English-Speaking Countries.

		Australia/ New Zealand	Canada	Ireland	United Kingdom	United States
Training Duration (years)	Post-high school	13-14+	11-13+	11-15+	15+	11-12+
	Post-med school	7+	5+	5.5-9+	9+	4+
Pre-ophthalmology		2 years	1 year	1 year	2 years	1 year
Surgical Training		50 intraocular procedures required in first 2 years; no minimum required for graduation but often several hundred cataracts	No minimum number required for graduation; average >340 cataracts	No minimum required for graduation, but expectation of >300 cases	Minimum 350 cataracts for graduation; most complete more	Minimum 86 cataracts for graduation; most complete more
Subspecialization		Final year of training is a fellowship year, and many complete additional fellowship	Optional after residency	All choose MST vs. HST. HST graduates often complete additional fellowship	Final year of training is a fellowship year, and some complete additional fellowship	64% pursue fellowship (optional) after residency
Governing Bodies		RANZCO and AHPRA	RCPSC	MRCSI, FRCSI	RCO, GMC	ACGME, AUPO FCC, ABO
Examinations		1. First 18 months: OBCK (practical) and ophthalmic science (4 written and practical) 2. 3 rd yr: ophthalmic pathology (written) 3. 4 th yr: RACE (written & practical)	1. All yrs: In-house evaluations, OKAP (written) 2. Final yr: RCPSC certification exam (written, oral)	1. First 3 yrs: In-house semi-annual appraisals. 2. 3 rd yr: MRCSI (written, practical) 3. HST trainees: FRCSI exam (written)	1. All yrs: In-house annual assessments and ARCP evaluation. 2. 2 nd yr: FRCOphth 1 (written) 3. 3 rd yr: Refraction Certification (practical) 4. Before completion: FRCOphth 2 (written, practical)	1. All yrs: In-house semi-annual assessments, annual OKAP (written) 2. After graduation: ABO boards (written, oral)

RANZCO= Royal Australian & New Zealand College of Ophthalmologists, AHPRA= Australian Health Practitioners Registration Authority, OBCK= Ophthalmic Basic Competencies and Knowledge Exam, RACE= RANZCO Advanced Clinical Examination, RCPSC= Royal College of Physicians and Surgeons of Canada, OKAP= Ophthalmic Knowledge Assessment Program, MST= Medical Ophthalmic Specialist Training, HST= Higher Ophthalmic Surgical Training, MRCSI= Member of the Royal College of Surgeons in Ireland, FRCSI= Fellowship of the Royal College of Surgeons in Ireland, RCO= Royal College of Ophthalmologists, GMC= General Medical Council, ARCP= Annual Review of Competence and Progression, FRCOphth= Fellowship of the Royal College of Ophthalmologists, ACGME= Accreditation Council for Graduate Medical Education, AUPO FCC= Association of University Professors of Ophthalmology Fellowship Compliance Committee, ABO= American Board of Ophthalmology

Table 2. Minimum Surgical and Procedural Requirements for Graduating Ophthalmology Residents in the UK and US.

Procedure	UK²⁷	US¹⁸
Cataract	350 (surg)	86 (surg)
YAG Capsulotomy	---	5 (surg)
Retina Lasers	40 (surg)	10 (surg)
Keratoplasty	6 (assist)	5 (assist)
Pterygium/conjunctival and other cornea	---	3 (surg)
Keratorefractive Surgery	---	6 (assist)
Strabismus	20 (surg)	10 (surg)
Glaucoma filtering/shunting procedures		5 (surg)
Laser Trabeculoplasty	30 (surg)	5 (surg)
Laser iridotomy		4 (surg)
Retina/vitreous	20 (assist)	10 (assist)
Oculoplastic and orbital total		28 (surg)
Eyelid laceration	40 (surg)	3 (surg)
Chalazia excision		3 (surg)
Ptosis	3 (assist)	3 (surg; ptosis or bleph)
Globe trauma	---	4 (surg)

For each procedure, minimum number required for graduation is listed together with whether the trainee must be the surgeon or can be the assistant in parentheses. Australia, New Zealand, Canada, and Ireland are not included because there are no required minimums. YAG= yttrium aluminium garnet, UK= United Kingdom, US= United States, --- = no minimum requirement. In addition to the minimum requirements above, UK trainees are required to be assessed twice for a range of other procedures including the following: temporal artery biopsy, operating on ocular and adnexal trauma, procedures for ocular surface protection, lateral canthotomy/cantholysis, biopsy of ocular and adnexal tissue, and enucleation or evisceration.