Surgical simulation in Canadian ophthalmology programs: a nationwide questionnaire

Surgical simulation allows learners a safe and practical alternative without the risks associated with operating on actual patients. Currently, several different types of virtual and nonvirtual simulation models are available for ophthalmic surgical training. The most common virtual models include the EyeSi and iSight simulators. Nonvirtual models include animal, cadaver, and inanimate models.

Although simulation models are currently being used for training, there remains a lack of literature showing how programs in Canada use simulators and if simulators are used to ensure competency. A survey of ophthalmology program directors in the United States focusing on virtual simulators found that 23% of programs had access to a virtual simulator; the cost was the main barrier to their use as perceived by program directors, who otherwise viewed them as a helpful tool.[1] Rubrics tailored to teaching and assessing ophthalmic surgery using simulation models have been developed, although it remains unclear how widely used they are.[2,3] Measuring the impact of simulation-based learning programs will allow for the development and improvement of these teaching tools as the transition to competency-based education occurs in Canada. Thus the purpose of this study is to describe the current use of surgical simulation models in Canadian ophthalmology residency training programs.

Ethics approval was obtained from the Research Ethics Board at the University of Alberta (Pro00086331). An online questionnaire was distributed to all Canadian ophthalmology residency program directors via email between September 2019 and April 2020. The survey was created by a focus group consisting of 2 ophthalmology residents and reviewed by 2 staff ophthalmologists. The survey was administered using the SurveyMonkey platform (Momentive, Waterford, NY). The 20-item questionnaire consisted of multiple-choice, select-all-that-apply, and free-comment questions. Data were collected electronically using SurveyMonkey. Basic descriptive statistics were used to analyze all survey results. All data were assessed using SPSS Statistics, version 24 (IBM Copr, Armonk, NY).

Table 1—Access to simulation materials

What types of surgical simulation models do residents have access to for cataract surgery?

Animal	80%	Pig eyes, cow eyes
Cadaver	67%	Eye bank, human donor
Inanimate	80%	Philips Studio, SimulEye, Bioniko, Kitaro, grapes, plastic model, simulation eyes produced by 3D printing
Virtual	53%	EyeSi, iSight

When available, for each type of surgical simulation model, who has access to the simulation materials?

Material	Medical students	Residents	Clinical fellows	Research fellows	Staff ophthalmologists
Animal	17%	100%	67%	8%	92%
Cadaver	8%	92%	58%	8%	83%
Inanimate	8%	92%	67%	8%	83%
Virtual	20%	80%	60%	10%	70%

When do trainees have access to surgical simulation training modalities?

Material	Only during organized activity (i.e., a wet lab)	During specified hours (i.e., 9 AM–5 PM)	24/7 access
Animal	33%	17%	50%
Cadaver	45%	0%	45%
Inanimate	17%	8%	67%
Virtual	0%	0%	80%

Other than cataract surgery, what kind(s) of surgery can residents practice on simulation models?

Material	Glaucoma	Vitreoretinal surgery	Oculoplastic	Strabismus	Cornea	Laser (i.e., LPI, laser retinopexy, SLT)
Animal	58%	25%	42%	17%	83%	0%
Cadaver	50%	17%	8%	42%	83%	0%
Inanimate	42%	25%	8%	75%	42%	25%
Virtual	8%	42%	0%	0%	8%	0%

How often are simulation models used to formally teach surgical techniques (i.e., wet labs, virtual workshops)?

Material	1–3 times during the entire residency	1–3 times per year	4–7 times per year	8–12 times per year	12+ times per year
Animal	8%	42%	8%	8%	17%
Cadaver	8%	42%	17%	8%	0%
Inanimate	0%	67%	11%	0%	0%
Virtual	11%	22%	11%	11%	11%

LPI = laser peripheral iridotomy; SLT = selective laser trabeculoplasty

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Table 2—Evaluation using simulation models

How is surgical simulation incorporated into the educational curriculum?

Material	Not formally incorporated	An optional part of the curriculum	A required part of the curriculum
Animal	17%	17%	50%
Cadaver	25%	0%	58%
Inanimate	17%	0%	67%
Virtual	8%	17%	33%

Examples provided:
Structured wet labs—adapted for each residency year, specific rotation a resident is on
Formal wet lab curriculum
EyeSi simulation module—expected that residents spend time working in the wet lab alone
Informal wet labs

Are residents' surgical skills evaluated using surgical simulation strategies?

Animal	42%
Cadaver	42%
Inanimate	33%
Virtual	33%

Examples provided:
Wet lab examination; evaluation during supervised wet labs
EyeSi curriculum with objectives specific to each year
Reports generated by EyeSi
Simulator skills section on mock oral examination

Are there any requirements for simulation training before working on human patients?

Animal	17%
Cadaver	7%
Inanimate	20%
Virtual	38%

Examples provided:
Expected to attend all wet lab sessions
Observed wet lab session with a focus on specific tasks
Completion of certain EyeSi modules
Work through cataract modules on their own

Program directors or their proxies representing all 15 Canadian residency programs registered in the Canadian Resident Matching Service responded to the survey. The survey showed that surgical simulation models are widely used within Canadian ophthalmology residency programs; all programs offer access to at least 1 type of model. The most frequently used models are animal and inanimate models, though cadaver and virtual models are available to most programs (Table 1). In addition to structured teaching such as wet labs, these models are available for residents to practice surgical skills independently. Beyond cataract surgery, simulation models are also used for subspecialty procedures within cornea, glaucoma, and strabismus. A minority of programs used simulation models to evaluate residents (i.e., wet lab examinations, virtual simulator curriculum, and reports), and an even smaller subsection had work requirements on simulation models before working on patients (i.e., observed performance in wet lab, mandatory sessions completed; Table 2).

Participants were asked about the strengths and weaknesses of simulation models. Perceived strengths of simulation models included the opportunity for residents to gain initial surgical experience, develop depth perception and muscle memory, and become familiar with equipment such as the microscope and steps of the procedure. Simulation models also help build confidence in a safe, low-stress environment, allow repetition of the procedures and steps as often as needed, and facilitate learning of advanced techniques or subspecialty procedures that may otherwise be difficult to teach in the operating room. The perceived weaknesses include the fact that the models do not replicate the environment, stress, and exact tissue feel in the operating room. Additionally, models are only available for a subset of procedures that an ophthalmologist in training is required to learn. Cost of initial investment and ongoing maintenance and the time commitment needed to supervise and ensure that residents are practicing the correct technique also were perceived disadvantages of simulation models.

Our study is the first to outline the current use of surgical simulation models in Canada, with representative samples from each residency program; additionally, we gained insights on the attitudes of program directors about these models. A similar investigation in the future with a focus on the learners' perspective and after implementation of competency-based medical education would be beneficial.

Simulation teaching strategies may play an increasingly important role in surgical training in the post-COVID-19 era with potentially decreased surgical exposure for trainees and with the implementation of competency-based medical education. The competency-by-design model will require clear direction for surgical simulation models and their role in ensuring competency. Understanding the role of simulation models could allow development of an informed and practical standardized surgical teaching curriculum that may include the use of simulation methods in the evaluation and prerequisite training of residents before they operate on patients.

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Footnotes and Disclosure

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