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Competency-based medical education in ophthalmology residency training

Aishwarya Sundaram, PGY-4

Competency-based medical education (CBME) is an educational approach to medical training, where program defined objectives are administered and trainees are evaluated through pre-set outcomes, which are associated with milestones.[1] The main shift under CBME is that assessments are completed daily, and these multiple assessments are used to help guide the learner towards meeting their milestone. This compares with conventional evaluations that take place in the end of a rotation. In recent years, CBME has quickly become the standard for all residency programs in Canada. Currently, all Canadian ophthalmology programs are expected to transition to CBME by 2020/2021.

In their timely article in this issue, Wentzell et al. summarize the literature on CBME as it relates to ophthalmology in Canada and the United States, and they review the experience of the first ophthalmology program to transition to CBME.[2] The review was conducted using articles that related to CBME and ophthalmology from Pubmed, Medline (via Ovid), Embase, and Google Scholar. The article reports on the history of CBME in ophthalmology, implementation, implementation barriers, assessment methods, surgical skills assessment, assessing other competencies, and finally reviews the experience of the Queen's University ophthalmology program. Below are the highlights of their findings in each category:

- **CBME in ophthalmology:** The International Council of Ophthalmology (ICO) published a position paper on core competencies in 2006.[3] A subsequent article looking at Canadian resident perceptions of achieving the ICO competencies found that overall residents were satisfied with their clinical, surgical and non-clinical areas of training. However, residents felt that there was insufficient exposure to low-vision rehabilitation, refraction and glasses prescription, neuro-ophthalmology, extracapsular cataract surgery, refractive surgery, orbital surgery, and practice management training.
- **Implementation:** The review found 6 articles on CBME implementation. The University of Iowa and the International CBME Collaborators have developed tools and guiding principles for implementation. The highlights of these principles include developing population specific curriculum objectives, assessing and role modeling competencies, balancing patient safety with learning, stakeholder transparency, effective and efficient evaluation modalities, trainee promotion using competencies, faculty development and collaboration.
- **Implementation barriers:** The most common barriers encountered with the implementation of CBME have been logistical concerns in a time-based training system, administrative resource limitations for the implementation of CBME, and lack of faculty support for the development of CBME resources.
- **Assessment methods:** Various assessment methods have been proposed, including written and oral examinations, 360-degree evaluations, portfolios of learning documentation, direct observations, structured checklists, journal clubs, an ICO-based essential competencies, global evaluation form with an expand score range and stratification, ophthalmic laser curriculum, deliberate practice with feedback and simulation, and self-reflection.
- **Surgical skills assessment:** The review found nine articles on surgical skills assessments. Multiple articles have developed tools for assessing surgical skills, including measurements for intraocular cataract surgery with direct observation. Articles have also emphasized the benefits of using the wet lab for cataract training as a first step.
- **Assessing other competencies:** Tools that have been suggested for assessing non-knowledge-based areas of CanMEDS competencies include 360-degree evaluations from patients, on call evaluations and OSCEs.

Arguably, one of the most interesting parts of the article is the opportunity to learn from the experience of Queen's transition to CBME. As Queen's transitioned to CBME, entrustable professional activities (EPAs) were created using resident feedback and currently, residents are given daily feedback on their EPAs. Furthermore, each resident is assigned an academic advisor for guiding learning milestones on a regular basis. In addition to the EPAs used for clinical assessments, an adaptation of the Ottawa Surgical Competency Operating Room Evaluation is used to assess surgical competency. Although, the evaluation methods have changed, it is interesting to note that the program structure has not changed

significantly to pre-CBME. While there are significant commitments required from both faculty and residents for completing the evaluations and for developing individualized learning milestones, the program has been "reasonably well received."[2] While Queen's experiences highlight the growing pains of being the first program to transition to CBME, the transition is likely going to be a multiyear process that requires further resources to be developed.

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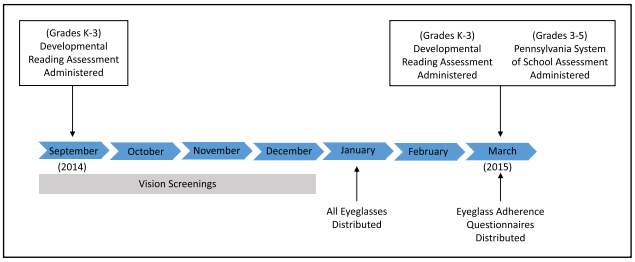

Refractive error and school performance in children: a commentary

Matthew D. Benson, PGY-4

Literacy in primary school is not only a predictor of scholastic success in early childhood but it is also one of the main factors that forecasts the successful completion of secondary school.[1,2] The rate of literacy in early childhood is a product of several important components that include socioeconomic status and other demographic factors. A recent report highlighted that 12% of grade 8 students do not meet baseline expectations for reading in Canada, with this number reaching as high as 18% in some provinces.[3] Consequently, research that seeks to understand contributing factors is needed in order to develop effective strategies to improve literacy rates in Canada and worldwide.

In this issue, Hark et al. examined the effects of eyeglasses on children's performance on standardized tests in reading and math.[4] The authors retrospectively studied 4523 children who had participated in a vision-screening program at the Wills Eye Hospital in Philadelphia, USA. Briefly, this program identified children in kindergarten to grade 5 who had reduced visual acuity. An eyecare provider subsequently performed a manifest refraction to determine whether refractive correction was possible. If there was improvement, glasses were provided to the child, free of charge. These children were compared to those who either passed the vision screen or who did not pass and whose parents did not consent to their child receiving glasses. Scores on a standardized reading test for children in kindergarten to grade 3 were compared between groups before and after the first group received glasses. In addition, a standardized exam was delivered to students in grades 3 to 5 to assess reading and math abilities after glasses were prescribed.

Despite the limitation of retrospectively analyzing de-identified data that prevents comparing the same student before and after intervention, Hark et al. describe several valuable findings. First, 11% of the students in the screening program required glasses. This is not an insignificant number and highlights the importance of eye exams in school-aged children. Second, a significantly higher proportion of students maintained satisfactory reading performance after glasses were introduced compared to the other group of students. While causation cannot be truly ascertained, an association between refractive correction and maintaining reading performance can be postulated. There wasn't, however, an improved score on the follow-up standardized reading test when glasses were prescribed for children who initially scored below what is considered satisfactory. As hypothesized by the authors, this may not be entirely surprising given that there are numerous factors that affect literacy—visual acuity is only one of them. Finally, two-thirds of the students who were prescribed glasses wore them more than 75% of the time; these students likely behaved this way due to a perceived vision benefit. This is, in a way, a "patient-reported outcome" and is very valuable, especially when analyzing heterogeneous data where real benefits may not be statistically uncovered.

In summary, Hark et al. has provided insight into the importance of addressing uncorrected vision in children. A vision-screening program, such as the one at the Wills Eye Hospital, can both identify those who would benefit from eyeglasses and positively affect school performance in children.

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Ocular and facial injuries sustained by goaltenders in the National Hockey League: a preventable problem

Jenny Qian, PGY-1

Head and facial injuries represent the most common types of injuries sustained by both minor and major league hockey players.[1,2] Ocular and peri-orbital injuries are of particular concern given their sight-threatening nature. Previous studies reported that within 10 seasons of the National Hockey League (NHL), such injuries resulted in 1,120 missed games and an economic loss of more than $33 million.[3] Half-visors are now mandatory for players with less than 25 games of NHL experience.[4] They have been shown to reduce the likelihood of eye and orbital injuries,[5] yet significant ocular injuries still occur due to inconsistent use, improper wear, and rule exemption for more senior players.[3] In contrast, all NHL goaltenders are required to don full facial protection. However, there is variation in the design of the cages that offer this facial protection. In this issue, Keshen et al. retrospectively report eye and orbital injuries sustained by NHL goaltenders within a 5-season period.[6]

Among NHL goaltenders who played at least one game in the 2014-2015 to 2018-2019 NHL seasons, there were a total of 5 in-game eye, orbital, or facial injuries reported on web-based sports injury websites. This represented an incidence of injury of 4.07 per 10 000 athlete exposures, an average of 1 NHL game missed as a result of injury, and a total economic loss of $335 937.[6]

Ocular injuries within the NHL noted during the late 1970s accelerated the transition for goaltenders to use full facemasks and the move towards their mandatory use.[1] In North America, there are currently 3 cage design styles available for goaltender masks: certified grid, certified cat-eye, and noncertified cat-eye masks. Both certified grid and certified cat-eye styles are approved by the Canadian Standards Association and the Hockey Equipment Certification Council (HECC) for use at the minor level.[7] They are designed such that they do not allow the passage of pucks or parts of sticks. However, noncertified cat-eye cages feature wider gaps that allow for the passage of parts of sticks and are the style used by the majority of NHL goaltenders. All 5 cases of ocular injuries occurred in players wearing the noncertified cat-eye masks.[6] Given that Canadian junior hockey leagues, many of which are feeder programs into the NHL, mandate the use of certified cage styles for goaltenders and are the styles that offer greater protection, the question arises as to why NHL goaltenders prefer using the noncertified facemasks. In fact, 100% (93/93) of NHL goaltenders in the 2018-2019 season used this latter style.[6] Their preference can be presumed to be related to improved sight lines associated with the wider gaps in the cages. However, with the increased risk of ocular and facial injury associated with the noncertified design, a need for more stringent regulations regarding certified goaltender facemasks in the NHL is warranted. To be successful, this is a push that would need to be supported by the professional hockey leagues themselves. In the past, the NHL has been reluctant to release the actual incidence and mechanisms of eye injuries to an independent ophthalmology review panel[8] and this study by Keshen et al. only report injuries searchable on the web. The true incidence of NHL goaltender eye injuries may very well be higher than what is reported in this issue. While the NHL has previously stated their players are reluctant to have mandated equipment that may impair game performance,[8] player safety should be a top priority and implementation of legislation to ensure this should be strongly considered by the league.

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Prevalence and impact of eye disease in an urban homeless and marginally housed population

Gareth Mercer, PGY-3

In my first year of training, I was called to assess a patient with an orbital floor fracture. During our encounter the patient disclosed that he was living on the street, that he had been assaulted and his glasses were broken. At the end of my exam, feeling proud of my efforts to deliver empathetic and culturally sensitive care, I was glad to tell him that he did not have any serious ocular trauma. I was humbled when he reminded me that without glasses he could barely see (his presenting visual acuity was in the severe visual impairment range.) He asked me if I knew anywhere that he could get his glasses replaced at low cost. I had no advice to offer.

It is estimated that at least 235,000 people experience homelessness in Canada each year.[1] Homeless people suffer higher rates of premature mortality and morbidity than the general population.[2] Addressing homelessness is considered a public health priority.[3] Many of the drivers of early mortality among homeless people, including higher rates of unintentional injury and infectious disease, and poorer control of chronic systemic conditions like diabetes and cardiovascular disease,[2] likely predispose this group to excess ocular morbidity as well. Furthermore, individual risk factors for becoming homeless, such as mental illness and problematic substance-use,[4] would be expected to make it more challenging to access ophthalmologic care and adhere to treatments for chronic ocular conditions.

In their article in this issue, Jiang et al. help to shed light on the ocular health needs of a sample of urban Canadian homeless people.[5] Among their sample of 143 adults randomly selected from 10 male and mixed-sex shelters in Toronto, they found 35% had a presenting visual acuity of worse than 20/40 in the better-seeing eye. This equates to an age-standardized prevalence 4x higher than for the general Canadian population. Uncorrected refractive error was, by far, the most significant cause of visual impairment, affecting 45% of participants. Cataract and glaucoma suspect were the most common non-refractive conditions identified, each affecting 10% of participants. Among the 43% of participants requiring referral for an ocular condition, 3% required urgent referral and 8% required ophthalmology specialist assessment.

Documenting the unmet eye health needs among this population demands action. As individual eye care providers working with homeless patients we ought to: foster positive interpersonal relationships by demonstrating empathy, respecting personal dignity and building trust; learn about the range programs and services available to homeless people in our communities; and develop strategies to improve treatment adherence and decrease losses to follow-up.[6] At the health systems level we should work to ensure effective linkages between outpatient ophthalmology services and emergency departments and primary health care programs tailored to homeless people. We ought also to participate in research into optimal models of care delivery for this population, and advocate for social policies to end homelessness.[6,7]

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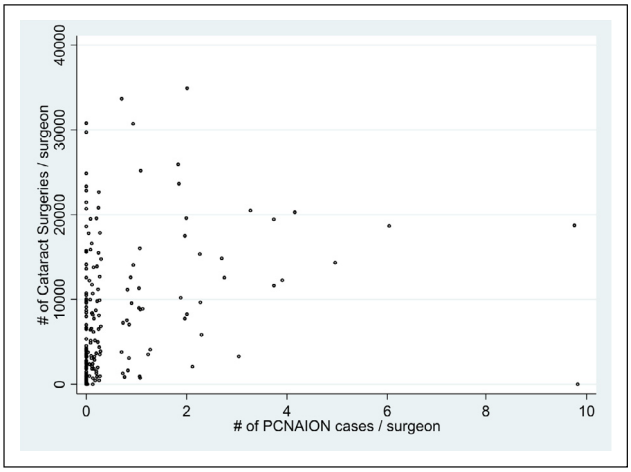

NAION after cataract surgery: How common is it really?

Laura Donaldson, PGY-5

Non-arteritic anterior ischemic optic neuropathy (NAION) is the most common optic neuropathy in older patients and is thought to be caused by hypoperfusion of the optic disc, supplied by the posterior ciliary arteries. It has been suggested that intraocular surgery and specifically clear corneal incision cataract surgery with phacoemulsification may precipitate this condition. Possible mechanisms include decreased ocular perfusion pressure due to transient increases in intraocular pressure or systemic hypotension peri-operatively, and release of pro-inflammatory mediators. In this issue, a meta-analysis by Edsel Ing and colleagues addresses the question: how common is NAION in the post-cataract-surgery patient?[1]

The authors anonymously surveyed Canadian cataract surgeons, asking them to estimate the total number of cases of cataract extraction with clear corneal incisions and phacoemulsification under topical anaesthesia performed as the primary surgeon. They were then asked to recall any events of NAION within 1 year of surgery, defined as abrupt onset vision loss with disc edema, relative afferent pupillary defect and visual field defect within 1 year. A random effects meta-analysis was then used to estimate the mean incidence of post-cataract-surgery NAION (PCNAION).

One hundred eighty-two surgeons responded, with a total estimated 1,499,694 surgeries performed in their careers. Forty-eight surgeons reported at least one case of PCNAION, with a total of 107 cases for all surgeons. The majority of events (82/182 or 77%) occurred within the first three weeks after surgery. The overall incidence of PCNAION was estimated to be 2.8 per 100,000 surgeries in the first post-operative year.

Though a retrospective survey is subject to potential bias including sampling, response, and recall bias, in this work it was an efficient method of capturing the relatively rare event of PCNAION and an impressive sample size was reached. The authors concluded that PCNAION is infrequent, and does not appear to occur at a notably higher rate than NAION in the general population, estimated at 2.3-10.2 cases per 100,000.[2,3] The conclusion of the current study is in agreement with a previous work by Moradi et al.[4] who also reported that PCNAION incidence was similar to that of the general population. An interesting difference is that the current study reported a high proportion of cases in the immediate post-operative period, while Moradi et al. reported fewer early cases. In 39% of PCNAION cases, surgeons surveyed reported an elevated intraocular pressure within the first three post-operative days, lending support to the hypothesis that decreased ocular perfusion pressure is important in early onset PCNAION. A bias towards reporting cases occurring soon after cataract surgery may also be expected in the current study as patients often remain under the care of their surgeon only for the first several weeks before being discharged. An episode of vision loss occurring months after cataract surgery may thus be more likely to be seen by a different physician, such as through an emergency department or on-call referral.

There is no specific diagnostic code for NAION in Ontario, nor is there a standardized electronic medical record that would allow the incidence of PCNAION to be estimated through billing codes. A study published this year by a group in Korea,[5] where this information is accessible, found that a retrospective cohort of 40,356 patients who had undergone cataract surgery had a 10-year incidence probability of PCNAION of 0.70%, compared to 0.27% in a matched control cohort. Notably, most cases of PCNAION in this study actually occurred more than 1 year post-operatively. This long delay is difficult to explain mechanistically and calls into doubt whether there is a causative link. Cases occurring more than one year post-operatively were not included in the present study, so it remains to be determined whether the long-term risk of NAION post-cataract extraction is increased.

The informed consent process for any surgical procedure should involve discussion of the most common and most serious risks involved. Although the incidence of PCNAION is low and may not be increased compared to age-matched controls, it may be prudent to discuss this condition with certain patients due to the risk of permanent vision loss and the lack of effective treatment. This may include patients with a crowded optic disc ("disc at risk") or a history of NAION in the fellow eye. Modifiable risk factors including obstructive sleep apnea, elevated intraocular pressure, systemic hypotension and anemia[6] should be identified pre-operatively and optimized. Post-operative intraocular pressure spikes should be promptly treated, particularly given the evidence from the current work that many cases of PCNAION are associated with high IOP and occur soon after surgery.

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