

Cataract Surgery Quality and Capacity

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Abstract

Cataract surgery is the most common operation performed in most developed countries, including Canada. Nuanced, evidence-driven policies are needed to ensure appropriate access to this sight-saving operation while maintaining the highest standards in quality of care. The Vision Health Services Research Program at Queen's University, in partnership with members of the Ontario Provincial Vision Task Force, has developed evidence to inform policies aimed at optimizing both access and quality across the eye care spectrum.

The Issue

In most developed countries, including Canada, cataract surgery is the most common operation performed (Cullen et al. 2009; Hatch et al. 2012; Lafortune et al. 2012; OECD 2013). This procedure greatly improves patient-reported quality of life and independence while decreasing the risk of falls and the need for home-care services (Lamoureux et al. 2011). Because the development of cataract is highly correlated with advancing age, the demand for cataract surgery is rapidly growing worldwide. In particular, projections suggest a doubling of the need for cataract surgery in Ontario in the next 20 years (Hatch et al. 2012). As a result, nuanced, evidence-driven policies are needed to ensure appropriate access to this sight-saving operation while maintaining the highest standards in quality of care.

The Response and Key Findings

The Vision Health Services Research Program at Queen's University, in partnership with members of the Ontario Provincial Vision Task Force, has helped generate evidence to inform issues pertinent to both access and quality in cataract surgical care – cornerstones of the vision care system. The development of policy directions has involved multiple stakeholders in addition to the task force, including the Provincial Cataract Surgery Quality-Based Procedures Expert Panel, the Eye Physicians and Surgeons of Ontario and the province's Local Integrated Health Networks (LHINs).

Access to cataract surgery

Ensuring appropriate access to cataract surgery is a complex issue. In Ontario, as elsewhere, two important determinants are the funding provided to institutions for surgical cases and the availability of surgeons (Campbell and El-Defrawy 2016). In an important step, the Ontario Provincial Vision Task Force engaged with regional healthcare administrations to develop a cataract capacity plan that highlights the impact of funding shortfalls on cataract surgery wait times and provides recommendations regarding the appropriate numbers of cases.

However, even where funding for appropriate surgical volumes is available, there is a fundamental need for adequate numbers of surgeons. Our research has helped in demonstrating that the stagnant surgeon numbers in Ontario limit the system's ability to provide additional cataract surgery without poaching from other important aspects of surgical and medical eye care. Fortunately, our research has also been able to help identify existing capacity among recent graduates who, as a group, were hit hardest by the significant surgical volume limits introduced in Ontario in 2007 (Campbell et al. 2017a). In particular, we conducted a population-based study to evaluate the impact of health system resource constraints on recent ophthalmology graduates and established surgeons.

In Ontario, the number of cataract operations per quarter increased steadily from about 12,000 to 36,000 cases between 1994 and 2006 and levelled off at approximately 36,000 cases between 2007 and 2013. During this latter period, the mean number of cataract operations per quarter performed by recent graduates declined sharply to a low of 36.6 cases, from a high of 147.3 cases between 1994 and 2006.

Logistic regression modelling confirmed the significant effect of provincial cataract volume constraints on recent graduates (Figure 1). Recent graduates were 5.24 (95% confidence interval [CI]: 2.15, 12.76) times more likely to fall within the lowest quartile for cataract surgical volume during the period of zero growth in total provincial cataract volume than in the preceding period. Similarly, recent

graduates were 2.30 (95% CI: 1.07, 4.92) times more likely to fall within the lowest quartile for operating room days during the period of zero growth in total provincial cataract volume than in the preceding period. In contrast, similar effects were not observed among established surgeons. Finally, to verify the specificity of our findings, we confirmed that the observed effects were specific to cataract surgery and did not occur for clinic-based aspects of care that are not volume controlled.

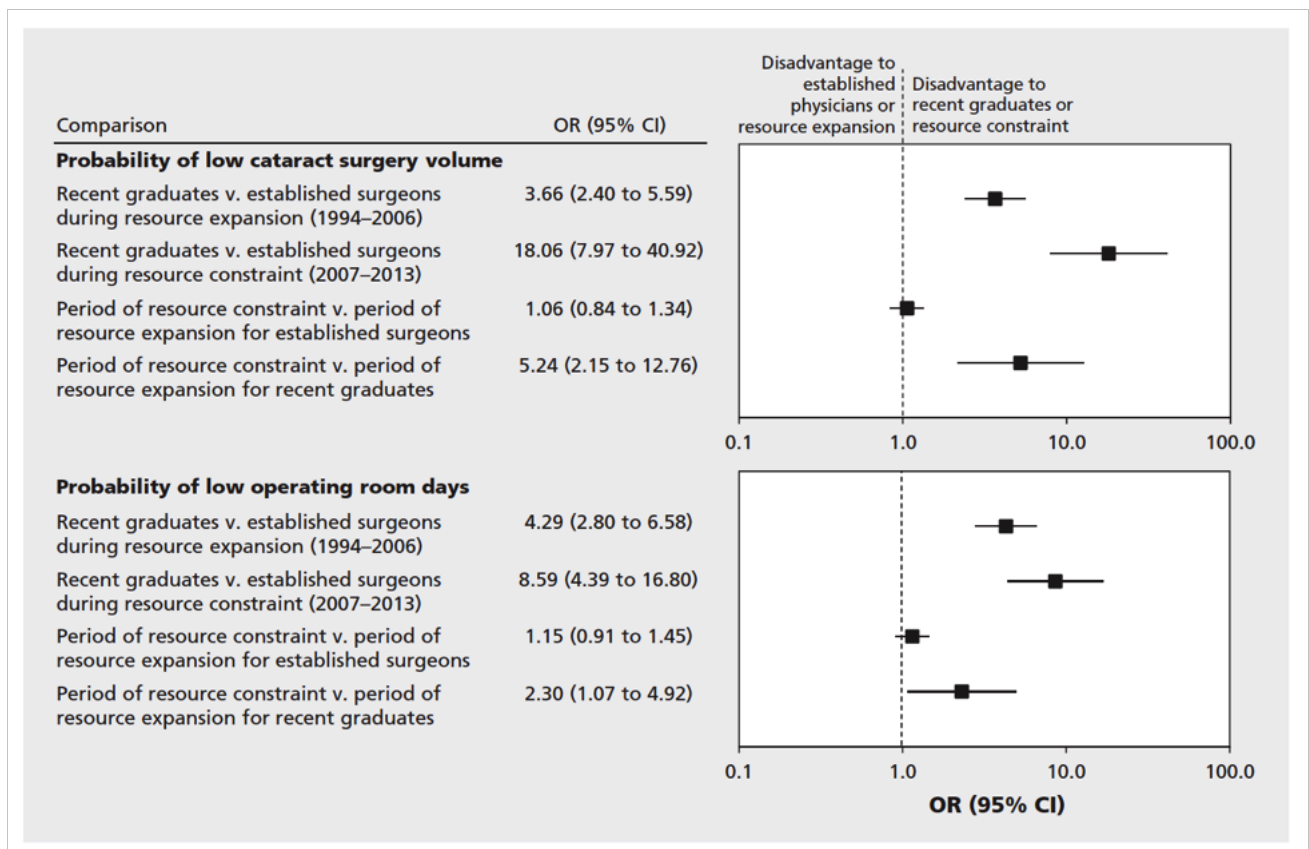
In response, the Ontario Provincial Vision Task Force, in partnership with the Ministry of Health and Long-Term Care and the LHINs, developed new evidence-based policies linking funding for additional cataract cases to the hiring of recent graduates (Office of the Auditor General of Ontario 2018). This requirement aims to simultaneously address multiple issues, including system sustainability, the lack of operating room time for recent graduates and growing wait times for surgery.

At the same time, the initiative aims to avoid the unintended consequences associated with diverting health human resources away from vital aspects of eye care other than cataract surgery.

Quality of cataract surgery

The Provincial Vision Task Force and its associated Cataract Expert Committee have created guidelines outlining high-quality clinical care processes (Ontario Ministry of Health and Long-Term Care 2018). Overall, our research has demonstrated excellent outcomes for patients undergoing cataract surgery in Ontario, with adverse event rates among the lowest reported worldwide (Campbell et al. 2017b, 2019). To further support the quality agenda, our research program investigated surgeon-level factors that may influence the quality of cataract surgery, including surgeon career stage, surgical volume and diversity of practice. Here we outline our investigations into the impact of surgeon career stage on surgical outcomes.

FIGURE 1. Effect of career stage and time period on probability of low cataract surgery volume and low number of operating room days among cataract surgeons in Ontario



CI = confidence interval; OR = odds ratio.

Note: The figure represents an analysis of 233 established surgeons and 88 recent graduates who were exclusively cataract surgeons. Low cataract surgery volume = lowest quartile for annual number of cataract cases. Low number of operating room days = lowest quartile for annual number of operating room days. The plot uses a logarithmic scale.

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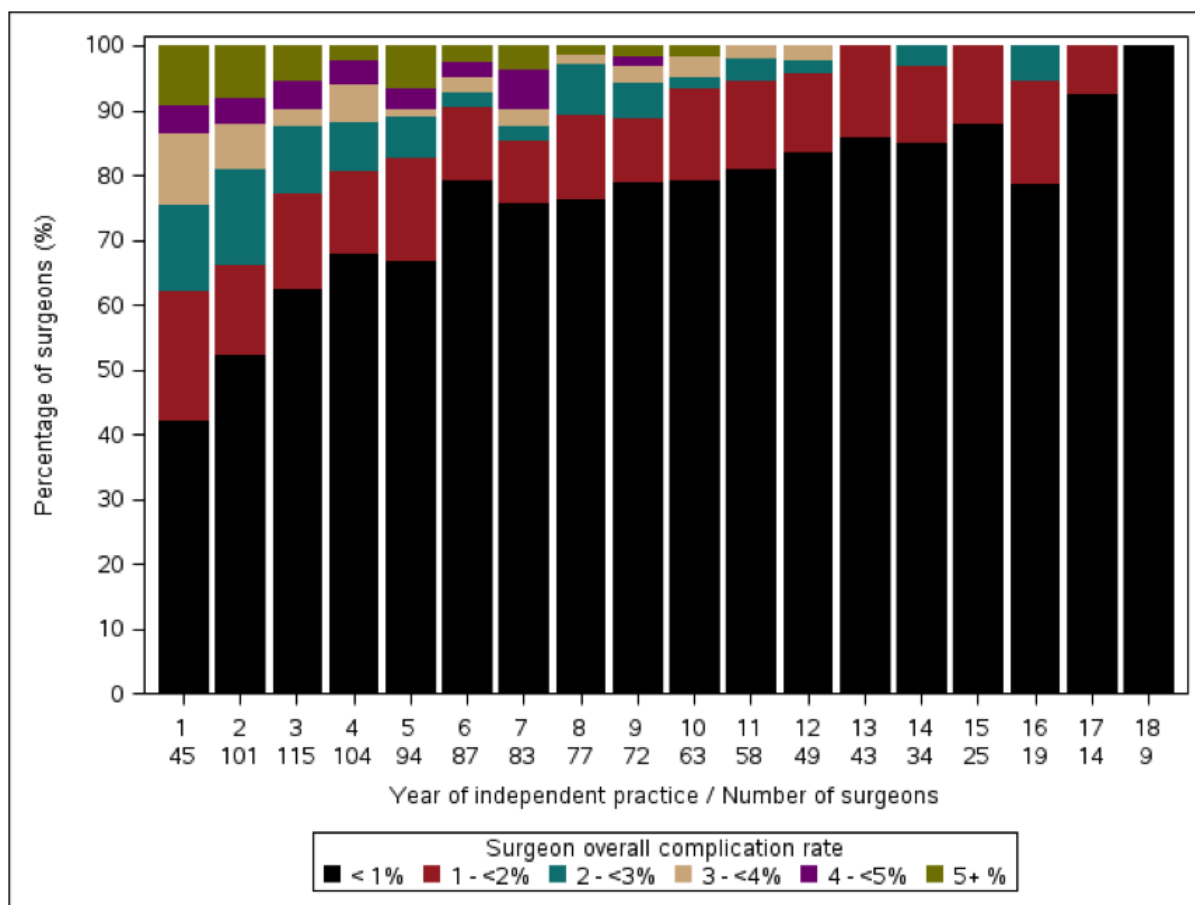
Previous research has suggested that newly graduating surgeons may lack some aspects of technical proficiency (Bell et al. 2009; Binenbaum and Volpe 2006; Hampton 2015; Rodrigues et al. 2013; Sachdeva et al. 2014). A number of issues may contribute to gaps in surgical education, including hospital efficiency pressures, training period limits and trainee work-hour restrictions (Arrighi and Hebert 2014; Bell 2007; Rodrigues et al. 2013; Sachdeva et al. 2007, 2014; Simpson et al. 2011; Tooke 2013). As a result, surgical outcomes among surgeons during the early phases of their careers may have an important effect on overall system quality of care.

We conducted a population-based, retrospective study of all cataract cases in Ontario from 1997 to 2013 to investigate the association between early surgeon career stage and the risk of adverse events in cataract surgery (Campbell et al. 2017b). We linked a number of databases to study four important

complications of cataract surgery: posterior capsule rupture, dropped lens fragments, retinal detachment and suspected endophthalmitis. Analyses controlled for patient-, surgeon- and institution-level covariates.

Among the 144 surgeons commencing practice during the study period, the effect of years in surgical practice on the distribution of surgeon adverse event rates is shown in Figure 2. High complication rates were much more likely during early-career stages and became less common with increasing years in practice. Indeed, during their first year of practice, surgeons were nine times more likely to have high complication rates ($\geq 2\%$) than surgeons in their tenth year (odds ratio [OR]: 9.3; 95% CI: 2.7, 31.9). Notably, surgeon complication rates were also more variable at earlier career stages, with many recent graduates achieving very low complication rates, whereas others had much higher adverse event rates.

FIGURE 2. Bar graph showing the effect of surgeon’s number of years of independent practice on overall adverse cataract surgical event rates in Ontario



Note: Stacked bars represent the distribution of complication rates among surgeons and display the change in this distribution with increasing years of independent practice. Numbers on the X axis represent year of independent practice (top row) and number of surgeons in the study for each year of experience (bottom row).

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Multilevel logistic regression was used to further quantify the effect of years of practice on the risk of cataract complications while controlling for patient-level covariates, institution type, surgeon case volume and calendar year. Each additional year of surgeon practice was associated with a 10% decrease in the risk that patients would experience a surgical complication (OR: 0.90 per year of practice; 95% CI: 0.87, 0.94).

In summary, in this population-based study, we found that cataract surgical adverse events are significantly more likely among surgeons at early-career stages. Ongoing innovations in surgical training and early-career monitoring and mentoring could contribute to the quality of surgical care and improve patient outcomes.

In addition to the potential quality issues at early surgeon career stages, evidence suggests that in some circumstances, the quality of care provided by physicians may decrease during the late-career phase (Blasier 2009; Choudhry et al. 2005; Hartz et al. 1999; Norcini et al. 2000; O'Neill et al. 2000; Tsugawa et al. 2017). However, evidence regarding the technical proficiency of surgeons at later career stages is inconclusive (Blasier 2009; Chai et al. 2010; Choudhry et al. 2005; Hartz et al. 1999; O'Neill et al. 2000; Prystowsky 2005; Prystowsky et al. 2002; Waljee et al. 2006). To address this issue, we conducted a population-based study to evaluate the effect of late surgeon career stage on the risk of cataract surgical complications (Campbell et al. 2019). Early-, mid- and late-career stages were defined, respectively, as fewer than 15 years, 15–25 years and more than 25 years since the conclusion of undergraduate medical training.

Multilevel logistic regression was used to evaluate the association between late surgeon career stage and the risk of surgical complications, adjusting for patient, surgeon and institution covariates (Urbach and Austin 2005). We found that surgeons in their late-career stage performed approximately one third of the cataract operations in Ontario and did not have an increased risk of surgical adverse events (OR vs. mid-career: 1.06; 95% CI: 0.85, 1.32). Overall, our results demonstrated that late-career cataract surgeons perform a substantial proportion of cataract operations and provide high-quality care.

Summary

Population-based research has provided unique insights into the cataract surgical system in Ontario. From a systems perspective, this research has helped stakeholders capitalize on opportunities to link funding to key health human resource issues to address both access and quality across the eye care spectrum. Cataract surgery is a cornerstone of the eye care system, and through evidence-based decision-making and multistakeholder engagement, the Ontario system continues to evolve in an effort to meet the burgeoning needs of the population. **HQ**

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