

Trends in pediatric strabismus surgery in the new millennium: Influence of funding and perceived benefits of surgery

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ABSTRACT •

Objective: The rate of strabismus surgery was previously reported to be decreasing in the United Kingdom and Ontario. Data on the influence of government funding on surgical trends and recent population trends for surgery in pediatric patients in Canada are limited. This study aims to analyze the trend in pediatric strabismus procedures in Ontario from 2000 to 2013.

Design: A population based, retrospective data analysis.

Methods: An analysis of the yearly volume of strabismus procedures in the pediatric population of Ontario was performed, subdivided by number of muscles repaired and repeat procedures. The number of ophthalmologists performing strabismus surgery on the pediatric population was analyzed, subdivided by high- and low-volume surgeons and career stage.

Results: From 2000 to 2013, per 100,000 pediatric population, the number of total strabismus surgeries in Ontario increased 38.1%; rates of single-muscle surgery increased 12.8%, 2-muscle surgery increased 24.2%, and surgery of ≥ 3 muscles increased 135.4%. Repeat procedures increased 263.1% from 2000 to 2013 and represented 28.5% of all surgeries in 2013. The number of high-volume surgeons increased 33.3%, whereas low-volume surgeons decreased 61.4% during the same time span.

Conclusion: The number of pediatric strabismus procedures in Ontario has increased since 2000, and the practice has become increasingly subspecialized. This is likely due to changes in health care funding and increased parental and physician awareness of the functional and psychosocial benefits of strabismus surgery.

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The rate of strabismus surgery has been shown to be declining across public and private health care systems.^{1–6} The yearly number of strabismus procedures decreased 26.1% between 1994 and 2000 in Ontario and 41.2% between 1989 and 2000 in England and Wales, with both far exceeding the decrease in birth rate.¹ In the United States, a 13% decline in the number of muscle surgeries was seen from the 1970s to the 1990s for individuals < 15 years of age.² These decreases have been explained, in part, by a decline in the severity of strabismus, advances in treatment of associated refractive error, and improved surgical outcomes as a result of subspecialization.^{1,3,4–7} Although recent data have addressed the surgical subspecialization of strabismus, there is a paucity of data describing the extent of surgical care for the pediatric population, and no data are available on the influence of government funding and physician remuneration for strabismus repair.^{1,7} Indeed, a previous publication from Ontario did not consider the influences that health care funding in a single-payer system has on strabismus surgery.¹

The amount of funding provided by the national Medicare system is a direct determinant for health care systems and health outcomes.^{8,9} The recession in the 1990s caused health care costs to rise above incoming

federal revenue and led to significant health expenditure restraints and increased wait times for medical and surgical services.⁸ However, to our knowledge, the outcomes of increased government funding on strabismus surgery have not been examined in a pediatric population.

In addition to changes in funding, there also has been an increased awareness of quality-of-life (QoL) improvement and psychosocial benefits of strabismus repair in children.^{10–14} This also may have influenced strabismus surgery trends. Hence, the aim of this study was to update and provide a comprehensive analysis of the current trends in pediatric strabismus surgery at a population level, considering changes in health care funding, physician remuneration, and perspectives regarding the psychosocial benefits of strabismus repair.

METHODS

A retrospective population-based study in Ontario was conducted, compiling data from a centralized database for patients ages ≤ 17 years, termed the *pediatric population*. All residents in Ontario are insured through a government-funded Ontario Health Insurance Plan (OHIP). Approved OHIP claims from April 1, 2000 to March 31,

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<http://dx.doi.org/10.1016/j.jcjo.2016.11.014>

ISSN 0008-4182/16

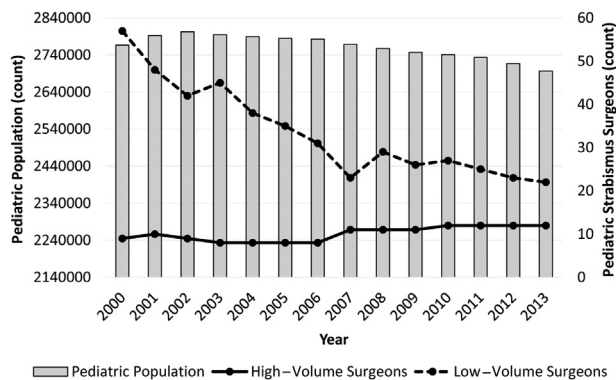


Fig. 1—Total pediatric population and pediatric strabismus surgeons in Ontario from 2000 to 2013. Pediatric population defined as persons living in Ontario and 17 years of age or younger. High-volume and low-volume strabismus surgeons were defined as ophthalmologists performing >50 or ≤ 50 strabismus surgeries on pediatric patients per year, respectively.

2014 were obtained from IntelliHEALTH Ontario, a knowledge repository that is compiled and maintained by the Ontario Ministry of Health and Long Term Care (Health Analyst's Toolkit. Toronto, Canada; 2012).¹⁵ Because OHIP is the sole payer for all insured services, this database includes data for all strabismus operations.

The following services of interest, with billing code in parenthesis, were considered only for the pediatric population:

- Single-muscle surgery (E159),
- Two-muscle surgery (E158),
- Three or more muscle surgery (E162).
- Add-on code for repeat procedures (E952).

Multiple codes billed on the same day for the same patient were included to capture single-, double-, or triple-muscle surgery combined with repeat operations (E159 + E952, E158 + E952, E162 + E952).

Yearly population data were accessed for all persons ages ≤ 17 years in Ontario and sourced from the Ontario Ministry of Finance and Statistics Canada. Surgeons were defined as *high volume* if they performed ≥ 50 strabismus surgeries per year on patients ages ≤ 17 years (minimum 1–2 cases per week). Ophthalmologists were classified according to their career stage; we considered surgeons to be early career if it had been <10 years since their graduation from medical school, mid-career if 10 to 45 years since graduation and surgeons were <60 years of age, and late-career if >45 years since graduation or surgeons were >60 years of age.¹⁶

To provide a 23-year perspective on funding for strabismus surgery, we included data on remuneration from 1991 (earliest available year) to 2013, sourced from the Ontario Ministry of Health and Long Term Care. This period also included data not discussed for strabismus

operations in Ontario from 1994 to 2000.¹ All descriptive statistics were obtained using Software Package for the Statistical Sciences 22.0 (SPSS Inc, Armonk, N.Y.)

RESULTS

The total pediatric population in Ontario reached 2,802,648 in 2002 and decreased 3.78% to 2,696,705 by the end of 2013. The number of high-volume pediatric strabismus surgeons increased 37.5% from 8 in 2000 to 11 in 2013. Low-volume pediatric strabismus surgeons (<50 procedures per year) decreased 61.8%, from 58 in 2000 to 23 in 2013 (Fig. 1).

The number of low-volume surgeons in their mid and late careers decreased 68.3% and 54.5%, respectively, from 41 and 11 surgeons in 2000 to 13 and 5 in 2013. There were a few early-career low-volume surgeons; this number remained stable during the study period. The number of mid-career high-volume surgeons increased 50% from 6 in 2000 to 9 in 2013. The number of late-career high-volume surgeons remained stable. There were no high-volume strabismus surgeons in their early career.

Overall, high-volume surgeons performed the majority of strabismus surgeries (75.4% in 2000), and this proportion increased to 87.9% of all surgeries in 2013. In 2013, 11 high-volume surgeons performed 1516 surgeries (137.8 procedures per surgeon), and 21 low-volume surgeons performed 208 surgeries (9.9 procedures per surgeon).

The proportion of all strabismus surgeries in 2013 was as follows: the majority (60.9%) were 2-muscle surgeries, followed by ≥ 3 -muscle surgery (24.5%) and single-muscle surgery (14.6%) (Fig. 2). In contrast, ≥ 3 -muscle surgery was the least common procedure in 2000 (14.4%).

Figure 3 illustrates the yearly number of procedures in total and per 100 000 pediatric population. The number of all procedures per 100 000 pediatric population increased by 38.1% from 2000 to 2013 (from 46.9

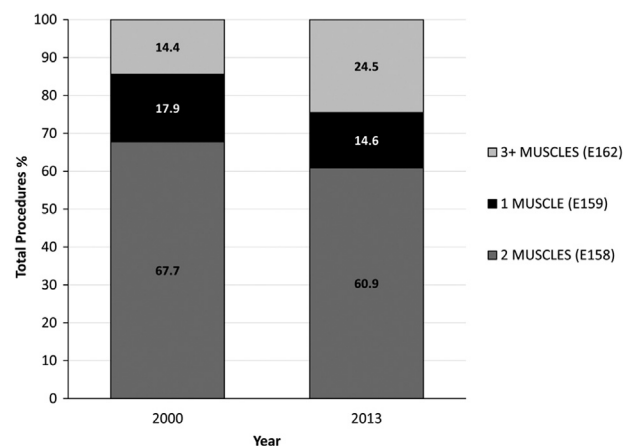


Fig. 2—Proportion of total pediatric strabismus procedures in Ontario in the 2000 and 2013 fiscal years. The stacked bar graph shows the proportion of all strabismus procedures performed in the 2000 and 2013 fiscal years.

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