

Regional trends in ophthalmic surgical wait times in Ontario, Canada

We have previously demonstrated the unmet demand for ophthalmic surgeries in Ontario between 2010 and 2020.¹ Our findings suggested that with approximately 478 ophthalmologists in Ontario as of 2018,² there is 1 ophthalmologist for every 123 patients on the surgical wait list.¹ Herein we aim to report the trends in wait times for ophthalmic surgical specialties across different geographic regions in Ontario.

This population-based retrospective cohort study used data from the Ontario Health Wait Times Information System database between January 2010 and February 2022.³ This database captures wait-time information from adult, nonemergent surgeries performed in publicly funded Ontario hospitals. Wait time is defined as the time (in days) from the surgeon's decision to operate to the time of surgery. The Wait Times Information System captures monthly wait-time data for the following nonemergent ophthalmic subspecialty procedures: cataract, glaucoma, cornea, vitreoretinal, oculoplastic, and adult strabismus surgery. This data set is further stratified by the geographic region of the operating surgeon. In Ontario, these regions are referred to as *local health integration networks*, which represent the subdivision of health care delivery across the province. Ethics approval for the conduct of this study was obtained from the University of Toronto Research Ethics Board (RIS Protocol Number 41582).

The Mann–Kendall test was used to determine whether there were statistically significant increases or decreases in wait time throughout the study period. It is a non-parametric test that can detect linear or non-linear trends by aggregating and analyzing the signs of the differences in values between data measured at different points in time. The Theil–Sen estimator, also referred to as *Sen's slope*, was used to compute the wait-time rates of change, along with their corresponding 95% CIs.^{4,5} This is a non-parametric method of estimating a linear trend by computing the slope for all pairs of data and selecting the median. Both methods were included in this analysis to further validate results and ensure both linear and non-linear trends were detected.⁶ Scatterplots were illustrated for different combinations of procedure and geographic stratifications of wait times throughout the study period, and nonlinear trend lines were generated for each using the nonparametric locally estimated scatterplot smoothing (LOESS) regression method.⁷ As a sensitivity analysis, the reliability of the Theil–Sen estimator was assessed against the univariate least-squares regression. All analyses were conducted using R version 3.5.0 (R Foundation for Statistical Computing, Vienna, Austria) with an a priori specified significance level of

$p = 0.05$ (two-tailed). To correct for multiple comparisons between the different local health integration networks and procedure types, the Bonferroni correction was applied.

Over the study period, the mean wait time for non-emergency ophthalmic surgery in Ontario increased from 58.78 days (SD 58.50 days) in 2010 to 111.13 days (SD 123.97 days) in 2022. With regard to the rate of change in wait times between geographic regions, the greatest increases over the last decade were noted for Waterloo Wellington, followed by South East and North Simcoe Muskoka, whereas the smallest increases in wait times were noted in Central West, followed by Hamilton Niagara and Central East (Fig. 1). All regions, except for Central West, experienced increased overall wait times, and every region demonstrated statistically significant trends with Bonferroni correction using the Mann–Kendall test. The greatest increase in wait times in the province over the decade was noted for cataract surgeries (+5.37 days/year), whereas the smallest change was noted in vitreoretinal surgery (+0.52 days/year; Fig. 2). Cornea (−2.90 days/year) was the only subspecialty with a provincial wait time that showed a decreasing trend over the study period. All specialties demonstrated a statistically significant trend with Bonferroni correction using the Mann–Kendall test. Least squares regression illustrated consistent findings to the Sen's slopes results.

The findings from this study suggest that there was an increasing trend in wait times in the province of Ontario between 2010 and 2022 for the majority of regions and ophthalmic surgical specialties. Following the surgical disruptions with the COVID-19 pandemic, the wait times in ophthalmic surgery are projected to increase further if no

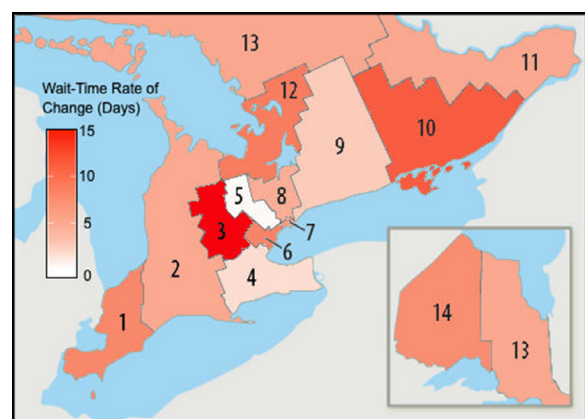


Fig. 1—Rates of change in wait time for all adult ophthalmic surgeries in local health integration network regions in Ontario between 2010 and 2022. Erie St. Clair (1), South West (2), Waterloo Wellington (3), Hamilton Niagara Haldimand Brant (4), Central West (5), Mississauga Halton (6), Toronto Central (7), Central (8), Central East (9), South East (10), Champlain (11), North Simcoe Muskoka (12), North East (13), and North West (14).

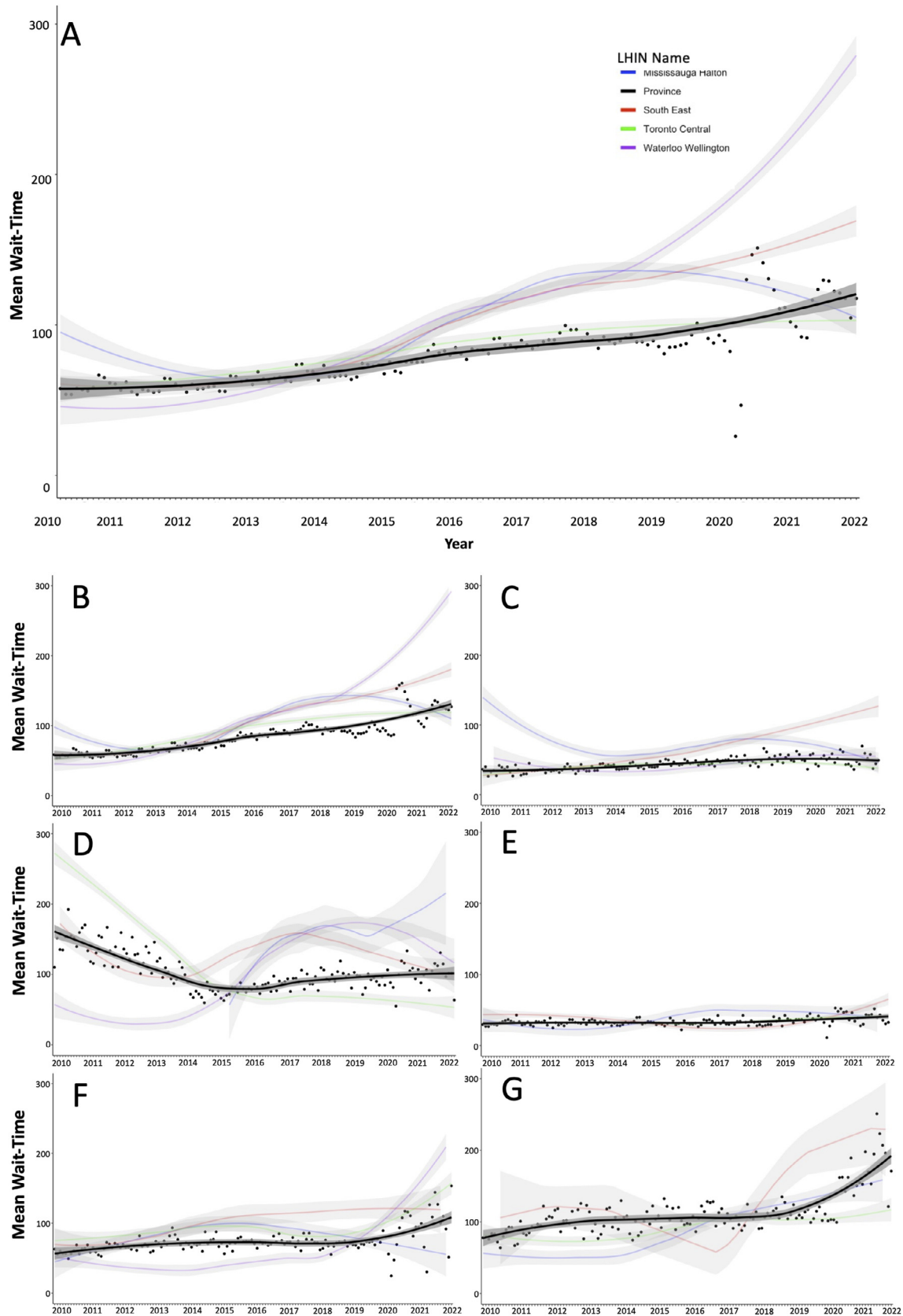


Fig. 2—Scatterplots of trends in monthly wait times for all adult ophthalmic surgical subspecialties (A) and cataract (B), glaucoma (C), cornea (D), vitreoretinal (E), oculoplastic (F), and strabismus (G) surgery with geographic stratifications in Ontario between 2010 and 2022 using the locally estimated scatterplot smoothing (LOESS) regression. The LOESS curves depict changing wait times with surrounding 95% CI (the shaded regions surrounding the curves). Data points (in black) are shown only for overall provincial wait times.

recovery strategies are implemented.⁸ Previous regional studies of Ontario have shown that areas with the highest wait times may not have a proportional high rate of cataract surgery.⁹ These results have important implications for regional ophthalmic surgical subspecialty resource planning in Ontario and other publicly funded health systems.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.jcjo.2022.10.014](https://doi.org/10.1016/j.jcjo.2022.10.014).

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Footnotes and Disclosure

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