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Title: The ophthalmic surgical backlog caused by the COVID-19 pandemic: a population-based and microsimulation modelling study

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Reviewer 1: [Name withheld]

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General comments (author response in bold)

1. Please explain what is mean by “hospital resource constraints for ophthalmic surgery”. Are you referring to numbers of OR room/time provided? How do you set up the “specific constraints”?

Thank you for your review of our manuscript.

Hospital resource constraints is referring to the number of maximum surgeries performed per month (based on numbers of OR room/time provided) that are captured through admin data. The model used this data on operating room and resource availabilities based on current hospital set up to determine the volume of surgeries allowable each month. Prior to the pandemic Ontario operated at a 100% capacity for surgical cases in Ontario. This health system model which uses decision-analytic tools, can forecast health care utilization, patient outcomes over time, dynamic resource constraints, queuing and priority setting, and the consequences of resource constraints. Based on availability of resources per day (monthly number of resources divided across the days), patients on the wait list in the model will then undergo surgery. This additional detail has been incorporated in the manuscript.

On each day, a fixed number of procedures were available informed by the number of procedures completed per month in Ontario based on real administrative data. (page 6, lines 30 - 31)

2. Please discuss the limitation of selection bias by using only downtown academic centers which likely provides a skewed number of emergencies, especially subspecialty care, compared to community hospitals. Alternatively, add representative community hospitals in Ontario to the simulation model.

Please see our response to the Editor’s Comments on page 2 of the response letter (comment #2).

Briefly, the vast majority of data used in the model was from across Ontario. For the urgent cases only, we used four different centres from the Greater Toronto Area to estimate the model parameters. There is a degree of variability in the probability of urgent cases is incorporated in the probabilistic sensitivity analysis, which varies each of the model parameters simultaneously in 50 different variations for 240,000 patients

each time. This was done to account for variations across community and academic hospitals in Ontario. Based on the standard deviations reported for the wait times and the clustering of the various scenarios presented in Figure 3 for the number of patients on the wait list, the small variations in the model parameters did not alter the main study findings.

Based on your suggestions, we have also acknowledged this in the limitations section of the manuscript.

Data for urgent cases was based on tertiary care centres in the Greater Toronto Area, which likely provides a skewed number of emergencies. (page 12, lines 3 - 4)

3. It is clinically more meaningful to separate out reversible vs. irreversible causes of vision loss instead of drawing conclusion on impact to patients with delay to care with worsening outcome all in one category.

Thank you for your comments. We completely agree that this would be more interesting and relevant, however, there is currently no established database that captures “reversible vs irreversible.” The notion of urgent as described by the Vision Task Force Guidelines referenced in this manuscript, refers to urgent cases as irreversible. The semi-urgent cases that do not get treated based on the target wait times will then progress to urgent based irreversibility of vision impairment. As such, the concept of irreversible and reversible is inherent in the categorization of urgent, semi-urgent and non-urgent. We followed the current standard methods by Ontario Health for categorization of ophthalmic surgical cases (urgent, semi-urgent and non-urgent) for this model. There are no other ophthalmology surgical administrative data available that utilize other categorizations for determining priority/urgency.

Based on your suggestions, we have added in the methods section that urgent cases refer to irreversible causes of vision loss, in order to further clarify these concepts for our readers.

All surgical cases in Ontario are standardized into priority levels 1 to 4 (with 1 being the most urgent and irreversible causes of vision loss) with associated maximum surgical wait time targets. These priority level definitions for wait times reflect the need to accelerate care that minimizes impact of disability on patients and are accepted by the federal, provincial, and territorial ministers of health. (page 5, lines 37 - 42)

We have also outlined in Supplemental Table 1, the provincial definitions of emergency/urgent cases based on irreversibility of vision impairment for each of the subspecialty surgery types.

4. The second last paragraph of page 11, starting with “The projections of required resources...”, makes suggestions on number of OR days that to be added to make up the backlog. These recommendations appear without unclear and without evidence on how these conclusions are drawn. Suggest removing this paragraph.

Thank you for your comment. These are meant to be only discussion points on how some of the suggested study findings for addressing the surgical backlog may be incorporated in practice. These are potential options to provide context for the readers on how the ramp ups may occur, but we acknowledge that there are other possible variations.

Based on your suggestions, we have revised this section to point out that these are only suggestions for recovery planning.

To provide context, a ramp-up of 34% in surgical volumes may be equivalent to utilizing a typical 8-hour day or a 40-hour week with an additional 2 hours added to 2 working weekdays as well as one full weekend workday for surgical cases. (page 11, lines 12 - 15)

5. Page 11 last sentence starting with “As such, more long-term approaches such as increase accessibility...” is another conclusion drawn without evidence from the data that this is the solution to the backlog. Please remove statements in the conclusion/discussion like these.

Thank you for your comments. We have removed this section as suggested.

6. Page 12 first paragraph, please indicate that your assumptions can both underestimate and overestimate and list conditions of how it can go to each direction.

Thank you for this suggestion. We have incorporated these additional details in the limitations section of the manuscript.

Although we aimed to capture the population growth rates of 1.3-1.4% when estimating the number of patients presenting for each subspecialty surgery based on historical data, we did not take into consideration other factors such as aging population and evolving changes in the healthcare needs over time, which could underestimate the backlog. This model also assumed that all reported historical surgical volumes were appropriately indicated for surgery, which may not always hold true depending on variations in practice patterns, which could overestimate the backlog. (page 11, lines 47 - 55)

7. It is unclear how eFigure 2 adds any additional information.

Thank you for your comment. This figure is depicting the group of patients on the waitlist at the start of the pandemic in March 2020 and the number of patients from that cohort who are still waiting to undergo surgery within one year after the pandemic.

This figure also provides further validity for the predictions and forecasting of the model by showing how each of the individual cases are triaged in the model.

We think the figure adds value but can be deleted from the supplemental files if preferred.