

## Impact of COVID-19 pandemic on cataract surgical volume: A North Indian experience

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**Purpose:** To analyze the impact of the pandemic on trends in cataract surgical volume in 2020 in a high-volume tertiary care academic center in North India. **Methods:** The monthly cataract surgical volume for a large, high-volume, tertiary care academic center in North India was obtained from January 2018 through December 2020. Based on historical trends, we used time-series forecasting, probability sensitivity analysis, and linear regression models to estimate what the expected monthly cataract volume should have been from March 2020 onward. **Results:** In 2020, we expected to perform 7500 cases (assuming historical trends) but performed only 2500 cases (33% of the expected volume). The remaining 5000 cases (67% cases) constituted the “fixed” backlog. Assuming the ramp-up in cataract surgical volume starts in January 2021, results of the Monte Carlo simulation revealed that for our system, it would take on average 5 months (May 2021) under the optimistic scenario and 10 months (October 2021) under the ambivalent scenario to reach pre-pandemic expected surgical volume. There would be a collective backlog of 5500 cases under the optimistic scenario (8.8 months’ worth of cases) and a collective backlog of 6900 cases under the ambivalent scenario (11 months’ worth of cases). **Conclusion:** An intuitive approach and out-of-the-box solutions are required by the government and private institutes’ collaborative efforts to help mitigate the disruptions caused by the pandemic and lessen the backlog without causing provider burnout.

**Key words:** Cataract, India, Monte Carlo simulation, surgery backlog, time-series forecasting

Cataracts are a significant cause of blindness and visual impairment in developing countries, and with a rapidly aging population, they are a challenge to handle. According to the World Health Organization (WHO), cataract is the leading cause of blindness all over the world, especially in low and middle-income countries.<sup>[1-3]</sup> Cataract accounts for 50%–80% of bilateral blindness in India.<sup>[4,5]</sup> COVID-19 pandemic resulted in a significant disruption in health systems worldwide in their ability to provide elective care such as cataract surgeries. The result has been a large-scale deferment of cataract surgeries after the Government of India guidelines recommended postponement of all nonessential elective surgical procedures. Delaying elective cataract surgeries can majorly affect the quality of life and increase the risk of falls and accidents in the elderly.<sup>[6,7]</sup> The CovidSurg Collaborative study projected that 28,404,603 surgical procedures would be canceled or postponed across the world in 190 countries in the preliminary 3 months of the COVID-19 pandemic, including 37.7% of cancer surgeries and 81.7% of other surgeries.<sup>[6]</sup>

This study aimed to evaluate 1) the impact of the pandemic on trends in cataract surgical volume in 2020 in a high-volume

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Received: 02-May-2021  
Accepted: 01-Sep-2021

Revision: 20-Aug-2021  
Published: 26-Nov-2021

tertiary care academic center in North India, 2) analyze ramp-up scenarios and the time it would take to get back to performing pre-COVID-19 case volumes, and 3) calculate the resulting backlog from surgical disruptions as a result of the pandemic.

### Methods

The monthly cataract surgical volume for a large, high-volume, tertiary care academic center in North India was obtained from January 2018 through December 2020. The study adhered to the tenets of the Declaration of Helsinki and institutional review board approval was obtained. Based on historical trends, we used time-series forecasting, probability sensitivity analysis, and linear regression models to estimate what the expected monthly cataract volume should have been from March 2020 onward had the pandemic not occurred.

To model the ramp-up in surgical volume starting in January 2021, we used a Monte Carlo simulation of a Gompertz recovery model as previously described.<sup>[8,9]</sup> We modeled an optimistic and ambivalent ramp-up scenario based on arbitrary growth constants (0.7 and 0.3, respectively).

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**Cite this article as:** Gupta PC, Aggarwal S, Jain P, Jugran D, Sharma M, Pandav SS, *et al.* Impact of COVID-19 pandemic on cataract surgical volume: A North Indian experience. Indian J Ophthalmol 2021;69:3648-50.

#### Access this article online

**Website:**  
www.ijo.in

**DOI:**  
10.4103/ijo.IJO\_1069\_21

#### Quick Response Code:



The primary study outcome was the time required to reach pre-pandemic steady-state surgical volume assuming the surgical ramp-up begins in January 2021. The secondary study outcome was to investigate the cumulative backlog that would result from surgical slow-down in 2020 and 2021.

For all analyses, Monte Carlo simulations were performed with 10,000 runs. Stata 15.0/SE was used for analysis.

## Results

### Cataract case volume in 2020

Prior to the pandemic, an average of 625 cataract cases were performed each month at our institution. As the pandemic started to affect India in March 2020, the number of cataract cases fell to 495 (20% reduction). In April and May 2020, no cases were performed due to government-mandated elective surgical shut-down. From June 2020 through October 2020, only 257 cases were performed. In November 2020, we started to slowly increase surgical volume and performed 145 cases, and performed 263 cases in December 2020.

Collectively, for 2020, we expected to perform 7500 cases (assuming historical trends) but performed only 2500 cases (33% of the expected volume). The remaining 5000 cases (67% cases) constituted the “fixed” backlog.

### Timing of ramp-up

Assuming the ramp-up in cataract surgical volume starts in January 2021 due to a combination of the decline in the pandemic cases and the increasing availability of the vaccine, the results of the Monte Carlo simulation revealed that it would take on average 5 months (May 2021) for our system under the optimistic scenario and 10 months (October 2021) under the ambivalent scenario to reach the pre-pandemic expected surgical volume [Fig. 1].

### Total backlog

As a result of the culmination of the fixed backlog (approximately 5000 cases that should have been done in 2020 but were not) and the additional dynamic backlog (cases that should be

done in 2021 but cannot be accomplished while the system is still ramping up and not functioning at 100% capacity), there would be a collective backlog of 5500 cases under the optimistic scenario (8.8 months’ worth of cases) and a collective backlog of 6900 cases under the ambivalent scenario (11 months’ worth of cases).

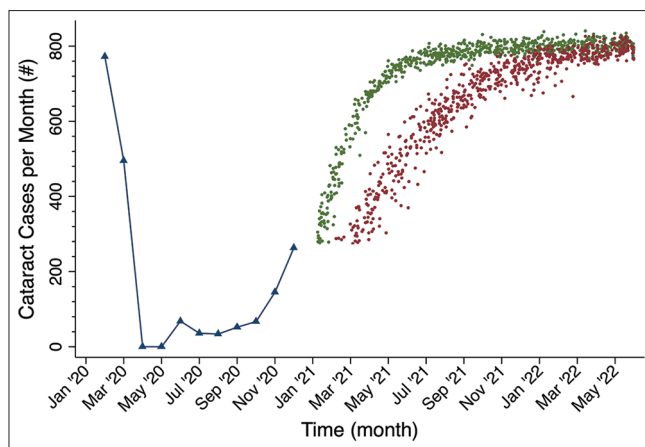
## Discussion

The pandemic has presented us with a myriad cluster of challenges. With this study, we explored the effect of elective-surgery postponement on cataract surgery practice and its ensuing resurgence after the COVID-19 pandemic control.

The COVID-19 pandemic is proposed to have a long-lasting effect on the number of cataract surgeries carried out globally, with the government jurisdictions ramping down nonelective and nonemergent surgical procedures.<sup>[10]</sup> Its effect may be predominant in developing countries like India, considering its vast aging population with increased life expectancy and the tremendous cataract surgery backlog that is growing annually.<sup>[5,11,12]</sup> As this pandemic scenario is unprecedented, there is no data from India to help predict how long and to what extent the health care surgery volume will improve. We are speculating that it may take approximately 5 months and 10 months in the optimistic and ambivalent settings, respectively, to reach the pre-pandemic level of the forecasted surgical load. This information would assist cataract surgeons and administrators in preparing for the ensuing struggles of overcoming the backlog as well as dealing with the new cases that will be added.

The cataract surgical coverage is less in India already,<sup>[11]</sup> and to add to that the effects of the pandemic, we assume that after lifting elective surgery suspension, it will be extremely difficult to return to the pre-pandemic surgical volumes, considering the delays in manufacturing drugs/intraocular lenses and personal protective equipment and transport disruptions.<sup>[13,14]</sup> Considering the resurgence of coronavirus cases in what is deemed the “second wave,” it may further delay the recuperation to fully functional pre-COVID-19 levels. As a part of adversity mitigation, it becomes imperative to start preparing for rescue measures now.

This study offers a mathematical projection of how long it will take to return to pre-pandemic cataract surgery volumes and the amount of surgical cataract backlog that will be formed over a period of time. These data will aid physicians, payers, and policymakers in planning for post-pandemic revival. To increase the cataract surgical rate, proactive planning and efficiency are required in the form of increasing the number of hours spent by a surgeon in the operation theater, keeping adequate spacing between procedures. Late evenings and weekends should also be utilized to ramp up the surgeries. Surgeons, nursing staff, and paramedical staff should be allotted duties on a rotational basis to mitigate workplace fatigue and undue physical and psychological stress. Retired surgeons and nursing staff can be redeployed to help tide over the backlog and serve in a capacity without compromising their personal safety.<sup>[15-17]</sup> Experienced surgeons should operate the maximum number of patients to decrease the time spent per patient and lessen the number of complications, thereby avoiding second surgery. The junior residents or trainees should be trained predominantly in the wet lab as they might take longer to operate as compared to their experienced seniors.



**Figure 1:** Monte Carlo simulation analysis of cataract surgeries per month in a large health system in North India. Blue connected line represents the actual volume of cases performed each month in 2020. Green curve represents the optimistic ramp-up scenario. Red curve represents the ambivalent ramp-up scenario, assuming surgical ramp-up starts in January 2021

Unutilized operating rooms should be made functional. Topical anesthesia should be preferred to peribulbar/retrobulbar blocks to increase efficiency. The daycare nature of cataract surgery can help to eliminate bed occupancy and staff-related bottlenecks. Immediate sequential bilateral cataract surgery (ISBCS) can be promoted to decrease the recurring costs.<sup>[18]</sup> Telemedicine services should be utilized for follow-up visits, which should be spaced out adequately.<sup>[7,19]</sup> Postoperative visits can be deferred/omitted in nonglaucomatous patients after uneventful surgery.<sup>[9,20]</sup>

A shortcoming of the study is that in estimating the backlog, we presumed that the demand for elective surgery would be akin to that anticipated pre-pandemic. However, the requirement for elective cataract procedures may be affected by patient-related causes such as health insurance, employee status, financial considerations, fear of hospitals, and travel opportunities, which could prove to be stifling for patient eagerness in undergoing surgeries in the time to come. Moreover, the hospitals are restricting the number of surgical cases in accordance with the social distancing norms mandated by the government, which would further add to the backlog. The second shortcoming is not considering the season or the festival status of the region, which might influence the patient's decision to go under the knife. The last and most critical limitation is not taking into account the future waves of COVID-19. The second wave of the pandemic has already started, and if it continues in a manner similar to the first wave, the backlog would be further increased.

## Conclusion

We conclude that a buildup is unavoidable even if the manufacturing/transport process resumes promptly to the pre-pandemic amounts due to the addition of new cases. Thus, to decrease the gap between the backlog of cases, a significant increase in production is imperative, considering the supply disruptions. Considering the COVID-19 crisis is again looming on us, it is a wake-up call for both the caregivers and administrators alike. There is a need to reorganize the provision of ophthalmic care to lessen the backlog of cataracts. Telemedicine, artificial intelligence, and ISBCS may also help in boosting eye care and aid in curtailing the buildup of cataracts in a country like India.

An intuitive approach and out-of-the-box solutions are required by the government and private institutes' collaborative efforts to help mitigate the disruptions caused by the pandemic and lessen the backlog without causing provider burnout.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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