# ONTARIO HEALTH TECHNOLOGY ASSESSMENT SERIES

## Minimally Invasive Glaucoma Surgery: A Budget Impact Analysis and Evaluation of Patients' Experiences, Preferences, and Values

### KEY MESSAGES

#### *What Is This Report About?*

Glaucoma is a condition in which the eye's drainage system does not work properly, leading to increased pressure in the eye. This increased pressure causes progressive damage to the optic nerve and can lead to vision loss or irreversible blindness.

People with mild glaucoma typically rely on medication (eye drops) or laser therapy to reduce this pressure. People with advanced glaucoma may receive a more invasive treatment called filtration surgery. Minimally invasive glaucoma surgery (MIGS) is the newest group of surgical procedures that aim to reduce pressure in the eye and slow the progression of glaucoma. It can be done at the same time as cataract surgery (a surgery to remove a cloudy eye lens), and may be safer than more invasive surgeries for glaucoma.

This report evaluated the budget impact of publicly funding MIGS for adults with glaucoma and looked at the experiences, preferences, and values of adults with glaucoma.

#### *What Did This Report Find?*

We estimate that publicly funding MIGS for adults with glaucoma in Ontario over the next 5 years would cost about $1 million (in year 1) to $18 million (in year 5) annually with slow uptake, or about $6 million (in year 1) to $70 million (in year 5) annually with fast uptake.

People with glaucoma reported that avoiding blindness was their main priority. Those who underwent MIGS procedures found them to be generally successful and beneficial, with minimal side effects and recovery time needed.



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## ABSTRACT

### Background

Glaucoma is a condition that causes progressive damage to the optic nerve, which can lead to visual impairment and irreversible blindness. There is a spectrum of current treatments for glaucoma that aim to reduce intraocular pressure (IOP), including pharmacotherapy (eye drops), laser therapy, and the more invasive option of filtration surgery. A new class of treatments called minimally invasive glaucoma surgery (MIGS) may reduce IOP and offer a better safety profile than more invasive procedures. We conducted a budget impact analysis of MIGS for adults with glaucoma from the perspective of the Ontario Ministry of Health and Long-Term Care. We also conducted interviews with people with glaucoma and family members of people with glaucoma to determine patient preferences and values surrounding glaucoma and its treatment options, including MIGS. We completed this work to complement a health technology assessment conducted in collaboration with the Canadian Agency for Drugs and Technologies in Health (CADTH).

### Methods

We analyzed the budget impact of publicly funding MIGS in adults with glaucoma in Ontario. We derived costs from the collaborative health technology assessment.[1] We assumed MIGS may be used in three subgroups: (1) MIGS in combination with cataract surgery as a replacement for cataract surgery alone in people with mild to moderate glaucoma; (2) MIGS alone as a replacement for other glaucoma treatments in people with mild to moderate glaucoma; and (3) MIGS (alone or in combination with cataract surgery) to replace filtration surgery (alone or in combination with cataract surgery) in people with advanced to severe glaucoma. We estimated the budget impact over 5 years for two possible uptake scenarios: a slow rate of uptake and a fast rate of uptake. To contextualize the lived experience of glaucoma and treatments for glaucoma, we also interviewed people with glaucoma and family members of people with glaucoma, some of whom had experience with surgical procedures such as MIGS and some of whom did not.

### Results

Assuming a slow uptake scenario, the annual budget impact of publicly funding MIGS in Ontario over the next 5 years ranges from $1 million in year 1 to $18 million in year 5. Assuming a fast uptake scenario, the annual budget impact of publicly funding MIGS in Ontario over the next 5 years ranges from $6 million in year 1 to $70 million in year 5. The budget impact varies depending on the proportion of people in each of the three subgroups described above. Introducing a new MIGS billing code may reduce the overall expenditures. Interview participants felt that less invasive surgical procedures, such as MIGS, could control glaucoma progression with minimal side effects and recovery time needed.

### Conclusions

We estimate that publicly funding MIGS in Ontario would result in additional costs over the next 5 years; however, this may depend on the populations using MIGS and if uptake is restricted or controlled. For the people with glaucoma we spoke with, avoiding blindness was their paramount concern, and MIGS was perceived as an effective treatment option with minimal side effects and recovery time required.

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## OBJECTIVE

Health Quality Ontario collaborated with the Canadian Agency for Drugs and Technologies in Health (CADTH)[1] to complete a health technology assessment to evaluate the clinical effectiveness, safety, cost-effectiveness, patient perspectives and experiences, ethical issues, and implementation issues around minimally invasive glaucoma surgery (MIGS) devices and procedures for adults with glaucoma. As part of this evaluation, Health Quality Ontario completed a budget impact evaluation of MIGS for adults with glaucoma in Ontario and an analysis and evaluation of the experiences, preferences, and values of adults with glaucoma.

## BACKGROUND

### Health Condition

Glaucoma is a condition that causes progressive damage to the optic nerve that can lead to visual impairment and potentially to irreversible blindness.[2-4] Risk factors include elevated intraocular pressure (IOP), increasing age, family history of glaucoma, race, and comorbidities, such as diabetes, hypertension, and hypothyroidism.[4-6] An IOP higher than normal can damage the optic nerve.[2,7] IOP is the most important and the only modifiable risk factor for glaucoma.[4,8] With every 1 mm Hg increase in IOP, there is a 10% higher risk for both the development and progression of the condition.[9]

### Clinical Need and Target Population

It was estimated in 2002/03 that glaucoma affected approximately 400,000 Canadians.[10] Open-angle glaucoma is the most common form of the condition.[5,11] It occurs when the Schlemm's canal, including trabecular meshwork (responsible for draining fluid from the eye), is anatomically open but working suboptimally. Angle-closure glaucoma occurs when the Schlemm's canal is anatomically blocked.[8]

### Current Treatment Options

Treatment for glaucoma aims to lower IOP. There is a spectrum of current treatments for glaucoma that includes pharmacotherapy (eye drops), laser therapy, and the more invasive option of filtration surgery.[12,13] All current treatments have their challenges. Pharmacotherapy challenges include ineffective use,[14,15] local and systemic side effects,[16] and lifetime costs.[17] Laser therapy can be associated with ocular discomfort, IOP spikes, and the need for repeat procedures.[18,19] Lastly, filtration surgery, while generally effective, can carry potentially dangerous intra- and postoperative complications.[5,12,20,21]

### Health Technology Under Review

Minimally invasive glaucoma surgery (MIGS) is the newest surgical option to treat glaucoma. MIGS intends to lower IOP by improving the outflow of eye fluid from either inside or outside the eye, with limited dissection of the sclera (the white part of the eye) and no manipulation of the conjunctiva (the membrane that lines the sclera and the inner surface of the eyelids).[22-24] Its safety profile may be better than that of more invasive procedures.[25] MIGS procedures are conducted by ophthalmologists, most commonly glaucoma surgeons or specialists.

MIGS is generally indicated for mild to moderate glaucoma, and while it can be a standalone procedure, it is often performed with cataract surgery.[12,17,25]

## Regulatory Information

There are currently 11 MIGS devices approved by Health Canada (Appendix 1, Table A1). However, one device (CyPass Micro-Stent) was voluntarily withdrawn from the global market by the manufacturer due to unpublished 5-year safety data.[26,27]

The different surgical approaches and associated MIGS devices or procedures are as follows:

- Reducing aqueous production (endoscopic cyclophotocoagulation)
- Increasing trabecular outflow by bypassing the trabecular meshwork using one of the following:
    - Tissue ablation or removal (Trabectome and Kahook Dual Blade)
    - A device (iStent, iStent inject, or Hydrus Microstent)
    - Through a 360º suture (gonioscopy-assisted transluminal trabeculectomy [GATT])
- Increasing uveoscleral outflow via suprachoroidal space (CyPass Micro-Stent)
- Creating a subconjunctival pathway for filtration (XEN 45 Gel Stent, XEN 63 Gel Stent, and XEN 140 Gel Stent)

## Ontario Context

Currently in Ontario, MIGS devices and procedures are not publicly funded, and a small number of facilities provide MIGS. To our knowledge, device costs are primarily covered by each centre, although some patients may pay for some or all device costs. In Ontario, there are no physician fee codes that are specific for MIGS procedures, but physicians can use more generic fee codes to receive payment for MIGS from the Ontario Health Insurance Plan (OHIP). Currently, people with glaucoma have access to publicly funded annual eye exams.[28] Alternative treatments for glaucoma are publicly funded through OHIP (e.g., medication for those covered by the Ontario Drug Benefit program and surgery) or covered by private insurance plans (e.g., medication for those not covered by the Ontario Drug Benefit program). High quality care for glaucoma has recently been outlined by Health Quality Ontario in a quality standard.[29]

## Expert Consultation

We engaged with ophthalmologists to help inform our understanding of aspects of the health technology and our methodologies and to contextualize the evidence.

## SUMMARY OF THE HEALTH TECHNOLOGY ASSESSMENT CONDUCTED IN COLLABORATION WITH CADTH

This report is complemented by a health technology assessment we conducted in collaboration with the Canadian Agency for Drugs and Technologies in Health (CADTH).[1] The collaborative health technology assessment included a clinical evidence review, economic evaluation, patient perspectives and experiences review, ethics analysis, and implementation issues analysis. We briefly summarize the methods and results from the health technology assessment below.

### Clinical Evidence Review

The clinical evidence review analyzed the comparative clinical effectiveness and safety of minimally invasive glaucoma surgery (MIGS), with or without cataract surgery, to alternative treatments, with or without cataract surgery.[1] A systematic review of primary studies was conducted, and databases were searched from January 1, 2000, to November 2017. Regular alerts were also established to update the search until the final collaborative health technology assessment was published (January 4th, 2019).[1] The overall quality of evidence for each outcome was assessed by using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) framework.[30] Outcomes of interest included quality of life, intraocular pressure (IOP) reduction, number of medications, visual field and acuity, and adverse events.

Thirty-two studies in 35 publications were included.[1] Based on very low-quality evidence, there was uncertainty around the comparative clinical effectiveness and safety of MIGS versus pharmacotherapy, laser therapy, different MIGS procedures (i.e., one type of MIGS vs. another), or filtration surgery. Based on some high-quality evidence, the clinical effectiveness of MIGS in combination with cataract surgery improved intraocular pressure compared to cataract surgery alone. However, there was insufficient evidence for the comparative clinical effectiveness and safety of MIGS in combination with cataract surgery versus different MIGS procedures in combination with cataract surgery and for filtration surgery in combination with cataract surgery. Most reported adverse events were considered minor in all treatment groups. However, when major adverse events were observed, between-group differences were uncertain.

### Economic Evaluation

The primary economic evaluation sought to understand the cost-effectiveness of MIGS as a class (with or without cataract surgery) compared with alternative treatments.[1] Five comparisons were used to evaluate MIGS versus various classes of therapy: pharmacotherapy, cataract surgery alone, laser therapy, filtration surgery, and combined cataract and filtration surgeries. CADTH used a Markov model to examine how MIGS and alternatives affect glaucoma progression, quality of life, and costs over a lifetime horizon. The analyses were conducted using a Canadian public health payer perspective. Clinical inputs were derived from the clinical evidence review and the published literature. Costs were derived from various published sources and informed by clinical expert opinion. A sensitivity analysis was conducted using costs specific to Ontario.

The results of the economic evaluation using Ontario costs showed that cost-effectiveness depended on the specific comparison.[1] In some instances, the analyses showed MIGS may be cost-effective (e.g., MIGS vs. medication had an incremental cost-effectiveness ratio [ICER] of $14,120/quality-adjusted life-year [QALY] and MIGS in combination with cataract surgery vs. cataract surgery alone had an ICER of $65,873/QALY). However, probabilistic sensitivity and scenario analyses showed there was significant uncertainty in these results. In other instances,

it was unlikely to be cost-effective (e.g., MIGS vs. laser therapy and MIGS vs. filtration surgery). Consistently, the total difference in QALYs between MIGS and alternatives was small (ranging from −0.048 QALYs to 0.039 QALYs). The cost differences were also small (ranging from −$2,016 to $1,687). The authors highlighted that results should be interpreted with caution due to limited follow-up in the included studies, low quality of the clinical evidence, and variability in costs.

## Ethical Issues Analysis

Ethical concerns were identified through a literature search and the results of CADTH's clinical, economic, patients' perspectives, and implementation analyses.[1] The ethical and social issues relevant to the optimal use of MIGS in Canada were similar to issues that would be relevant to the optimal use of any new procedure where other treatment options exist, including equity of access (e.g., private vs. public payment, rural or remote areas vs. urban centres) and medical necessity.

## Environmental Scan and Implementation Issues Analysis

A literature review of the published and grey literature was conducted along with 21 key stakeholder interviews.[1] These were published as a standalone environmental scan[31] and an implementation issues analysis in the collaborative health technology assessment.[1] In several provinces, including Ontario, MIGS devices are not included in the Schedule of Benefits for Physician Services. Devices are paid for by individual facilities or privately by patients. This has led to several access issues and potential barriers to implementation: a lack of funding has limited the number of available devices and led to backlogs and wait lists; people may not be able to afford devices where paying privately is an option; people may not live in proximity to a glaucoma centre (especially in rural areas); and all types of MIGS devices may not be available at all glaucoma centres.

# BUDGET IMPACT ANALYSIS

## Research Question

What is the potential 5-year budget impact for the Ontario Ministry of Health and Long-Term Care of publicly funding minimally invasive glaucoma surgery (MIGS) for adults with glaucoma?

## Background

Our budget impact seeks to understand the cost implications of publicly funding MIGS in Ontario.

## Methods

### *Analytic Framework*

The budget impact of MIGS was estimated as the cost difference between two scenarios:

- The new scenario estimates the costs associated with publicly funding MIGS. In this scenario, we estimate the total number of people we expect to receive MIGS over the next 5 years with public funding. We then estimate the total resource use and cost expected among this population.

- The current scenario estimates the costs for the same number of people considered in our new scenario but assumes there is no public funding for MIGS. In this scenario, we assume some people may still receive MIGS (in current practice, a limited number of MIGS procedures are funded primarily through each centre's global budget), while the remainder will receive alternative therapies (i.e., pharmacotherapy, laser therapy, cataract surgery, and/or filtration surgery). We then estimate the total resource use and cost for this group of people.

We do not estimate the resource use and cost for people who would receive alternative (non-MIGS) therapies in both the new and current scenarios. This is because costs would cancel out and there are challenges in estimating which patients would get which treatment(s) (e.g., some people may receive multiple treatments over time, treatment selection may vary by severity).

Figure 1 shows the budget impact model schematic.

We conducted a reference case analysis and sensitivity analyses. Our reference case analysis represents the analysis with the most likely set of input parameters and model assumptions. In the sensitivity analyses, we explored how the results are affected by varying input parameters and model assumptions.

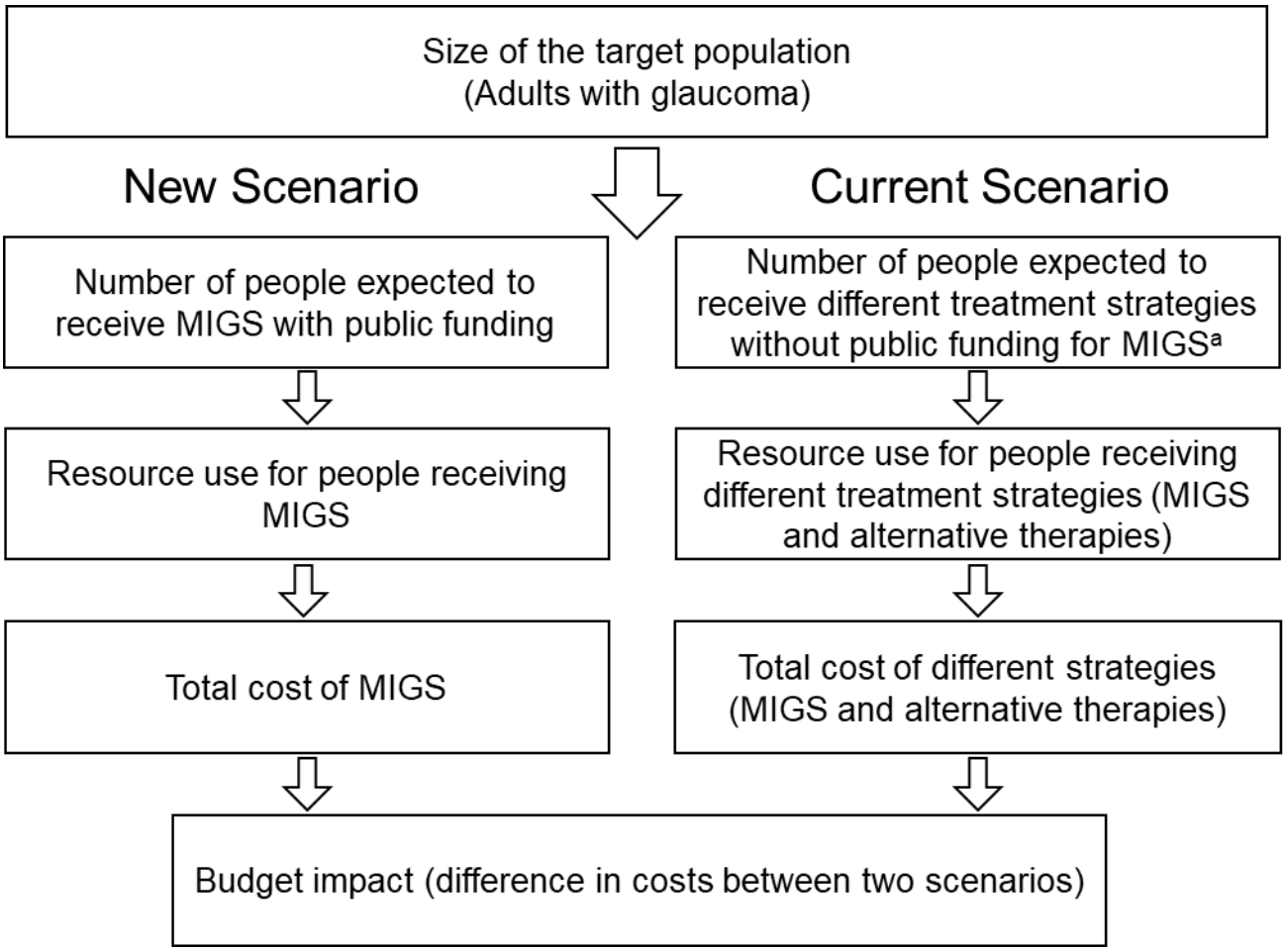


**Figure 1**: **Budget Impact Model Schematic**

[a]The number of people is the same as in the new scenario, but the distribution of treatments varies because there is no public funding for MIGS.

## *Key Assumptions*

Our budget impact analysis derives costs from the primary economic evaluation conducted by the Canadian Agency for Drugs and Technologies in Health (CADTH)[1]; thus, our analyses are subject to all assumptions of those analyses. Key assumptions from the primary economic analyses, along with assumptions specific to our budget impact analysis, are as follows:

- People experience a constant rate of glaucoma progression, regardless of severity
- Treatment effects of MIGS or alternatives on IOP and medication reduction are immediate and constant for the first 12 months. After 12 months, it is assumed that there will be a 10% decline annually in the treatment effect on IOP
- Progression of glaucoma (i.e., increasing visual field loss) is estimated using IOP
- Relative treatment efficacy does not vary with disease severity
- The costs of minor complications for all interventions (including medication) are assumed to last for 1 month
- Only people with open-angle glaucoma are eligible for MIGS. We tested this assumption in sensitivity analyses

- Approximately 50% of people would receive interventions in both eyes to treat bilateral glaucoma.
- MIGS-related physician fees are appropriately represented by the more generic fee codes suggested by experts. We conducted a sensitivity analysis that assumes the introduction of a new MIGS-specific billing code

### *Target Population*

Our target population of interest is adults diagnosed with glaucoma. We estimated the size of this population for the next 5 years.

Our methods are summarized below and in Table 1. Current Canadian glaucoma prevalence data are limited. In the absence of more recent estimates, we used the self-reported glaucoma population from the Canadian Community Health Survey (1994–2003)[10] to project the current number of adults with glaucoma in Canada. In this survey, approximately 409,000 Canadians over the age of 20 years reported having glaucoma (as diagnosed by a health care professional) in 2002/03. This number increased from 233,000 in 1994/95. We then used these data and population estimates from Statistics Canada (1994–2017)[32] to estimate the prevalence of adults with glaucoma in Canada. We assumed the prevalence was the same in Ontario and used Ontario population estimates[32] to calculate the total number of adults with glaucoma in Ontario. The total number of adults with glaucoma in Ontario was expected to range between 290,000 in 2019 and 323,000 in 2023. We looked at various other prevalence estimates in our sensitivity analyses.

In our reference case analysis, we assumed only those with open-angle glaucoma will be eligible for MIGS. We did this because several MIGS are indicated specifically for this type of glaucoma and because of the high prevalence of this population in the clinical literature.[1,33,34] We explored this assumption in a sensitivity analysis. Open-angle glaucoma makes up 74% of the total glaucoma population, based on a previous review.[11] Glaucoma is often bilateral; thus, we assume approximately 50% of people would receive interventions in both eyes. Bilateral interventions are accounted for through increasing the cost of the initial procedure.

Finally, we divided the target population based on the severity of glaucoma (mild to moderate or advanced to severe). While there are various methods for classifying glaucoma severity, we used the Hodapp–Parrish–Anderson grading scale, as determined by visual field state: (1) mild: 0 to −6 dB; (2) moderate: −6.01 to −12 dB; (3) advanced: −12.01 to −20 dB; and (4) severe/blindness: less than −20 dB. This is consistent with CADTH's primary economic evaluation.[1]

Although we were unable to find a Canadian study that reported proportions of severity using the Hodapp–Parrish–Anderson scale, Iskedjian et al[35] used similar visual field state cut-offs for glaucoma severity, with the only difference in the threshold between mild (0 to −5 dB) and moderate (−5.01 to −12 dB). However, this difference did not affect our calculations because we combined the mild and moderate categories for our analysis. The following proportions were derived and applied to our target population: 68% mild to moderate (0 to −12dB) and 32% advanced to severe (≥ 12 dB) glaucoma. A Swedish study by Heijl et al[36] also reported similar proportions.

**Table 1: Target Population Estimation[a]**

| | | | Target Population per Year of Analysis, Thousands | | | | |
|---|---|---|---|---|---|---|---|
| | 1994–2003 | 2004–2018 | Year 1 (2019) | Year 2 (2020) | Year 3 (2021) | Year 4 (2022) | Year 5 (2023) |
| Self-reported glaucoma in Canada[b] | 233–409 | 433–727 | 748 | 769 | 790 | 811 | 832 |
| Population Canada[c] | 21,082–23,399 | 24,039–28,909 | 29,287 | 29,631 | 29,975 | 30,319 | 30,663 |
| Prevalence Canada (%)[d] | 1.10–1.75 | 1.80–2.51 | 2.56 | 2.60 | 2.64 | 2.68 | 2.71 |
| Population Ontario[c] | 7,907–8,961 | 9,259–11,202 | 11,345 | 11,487 | 11,630 | 11,772 | 11,914 |
| Total people with glaucoma in Ontario[d] | 87–157 | 162–282 | 290 | 298 | 307 | 315 | 323 |
| Total people with open-angle glaucoma in Ontario[e] | 64–116 | 120–209 | 215 | 221 | 227 | 233 | 239 |
| Mild to moderate[f] | 44–79 | 82–142 | 156 | 150 | 154 | 159 | 162 |
| Advanced to severe[f] | 21–37 | 38–67 | 69 | 71 | 73 | 75 | 77 |

[a]Numbers may be off due to rounding.
[b]Among people ≥ 20 years old. Data from 1994–2003 based on the Canadian Community Health Survey (1994–2003)[10]; remaining years estimated using linear projection.
[c]Among people ≥ 20 years old. Data from 1994–2017 based on Statistics Canada[32]; remaining years estimated using linear projection.
[d]Calculation: self-reported glaucoma divided by the population in Canada.
[e]Calculation based on the assumption that 74% of glaucoma is open-angle glaucoma.[11]
[f]Calculation based on the assumption that 68% of open-angle glaucoma is mild to moderate and 32% is advanced to severe.[35]

## *Subgroups and Treatment Options*

There are several types of MIGS devices and procedures that are approved by Health Canada.[37] A short description of the device and their approach are summarized in Appendix 1, Table A1. The collaborative health technology assessment did not find sufficient clinical evidence to make conclusions about the comparative effectiveness or cost-effectiveness of various MIGS devices or procedures.[1] Instead, the authors reported the cost-effectiveness of MIGS, as a class of interventions compared against various other glaucoma treatments (Appendix 1, Table A1). In line with this, we estimate the budget impact of funding MIGS as a class of devices and procedures, in several subgroups. The subgroups are defined by the goal of treatment, severity of glaucoma, and the use of particular MIGS devices and procedures versus comparators. We based the subgroups on the clinical and economic evidence provided by the collaborative health technology assessment[1] and expert opinion. The subgroups are defined as follows:

1. In the first subgroup, we assumed MIGS is used in conjunction with cataract surgery for those with mild to moderate glaucoma. In this group, MIGS is intended to lower IOP, reduce pharmacotherapy use, and prolong time to glaucoma progression. Based on the clinical comparisons identified in CADTH's economic evaluation,[1] the MIGS devices included in this category were iStent, Hydrus Microstent, CyPass Micro-Stent, and endoscopic cyclophotocoagulation. We assumed the majority (approximately 70%) of MIGS would be done in this subgroup.

2. In the second subgroup, we assumed MIGS is used as standalone procedures in the mild to moderate glaucoma population. For people whose glaucoma is progressing quickly, MIGS may be used to slow glaucoma progression in place of other interventions such as pharmacotherapy, laser therapy, trabeculectomy, and glaucoma drainage devices. Based on the clinical comparisons identified in CADTH's economic evaluation,[1] the MIGS devices included in this category were Hydrus Microstent, iStent inject, trabectome, and XEN. We assumed that this group accounted for 20% of people who would receive MIGS.

3. In the third subgroup, we assumed MIGS is used in the advanced to severe glaucoma population. In this population, MIGS would be used as standalone procedures or in conjunction with cataract surgery in place of other interventions such as trabeculectomy or glaucoma drainage devices (alone or in combination with cataract surgery) to reduce IOP more dramatically. Based on the clinical comparisons identified in CADTH's economic evaluation[1] and expert opinion, the MIGS device and procedure included in this category were trabectome and endoscopic cyclophotocoagulation, respectively. We assumed that this group accounted for 10% of people who would receive MIGS and that half (5%) would be done as standalone procedures and half (5%) in conjunction with cataract surgery.

One MIGS device and one MIGS procedure—specifically, the Kahook Dual Blade and gonioscopy-assisted transluminal trabeculectomy—were not included in CADTH's economic evaluation[1] due to a lack of clinical evidence identified in the clinical evidence review. As a result, we could not include this device and procedure in our analyses. However, the prices of this device and procedure are within the range (or are less expensive) than other MIGS devices and procedures. Assuming similar efficacy and complication rates to those of the devices and procedures reviewed, we expect that our analyses also encompass the potential costs of the Kahook Dual Blade and gonioscopy-assisted transluminal trabeculectomy.

### *Current Intervention Mix, Uptake, and New Intervention Mix*

Estimating the current uptake of MIGS is difficult given there are no MIGS-specific codes in the Ontario Schedule of Benefits[38] or the Canadian Classification of Health Interventions[39]. We estimated the current uptake of MIGS based on consultations with centres offering MIGS in Ontario and MIGS manufacturers (annual N: approximately 1,500 MIGS procedures). As previously mentioned, we do not distinguish between types of MIGS device but divided uptake by subgroup. We assumed 70% (N = 1,050) of MIGS procedures are used in subgroup 1 (mild to moderate glaucoma; in conjunction with cataract surgery); 20% (N = 300) in subgroup 2 (mild to moderate glaucoma; standalone as a replacement for alternative therapy); and 10% (N = 150) in subgroup 3 (advanced to severe glaucoma; standalone or in conjunction with cataract surgery, as a replacement for alternative therapy). We also conducted sensitivity analyses assuming 100% of MIGS procedures will be used in each of the three subgroups. In subgroup 1, we limited the number of MIGS or comparators per year based on the total number of people in Ontario expected to have glaucoma and get cataract surgery (Appendix 1, Table A2). In subgroup 3, we limited the number of MIGS procedures or comparators per year based on the total number of people in Ontario expected to have filtration surgery (Appendix 1, Table A2).

In the current scenario, we assumed MIGS procedures in the first year of the analysis to be equivalent to current annual volumes. We translated this volume to an uptake rate based on the number of people with glaucoma (Table 2). In subsequent years, in the absence of targeted

public funding, we assumed the uptake rate would remain the same. By year 5 of our analysis, we expected total MIGS volumes to reach 1,674. We tested this assumption in sensitivity analyses. To be conservative, we did not remove people who have been treated from our eligible population. This is done to account for the potential to have multiple procedures over time. This is unlikely to strongly impact our results due to the large number of people who are eligible.

**Table 2: Current Scenario—Uptake and Volume of MIGS**

| | Year of Analysis | | | | |
|---|---|---|---|---|---|
| | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Total people with open-angle glaucoma, N | 214,528 | 220,724 | 226,926 | 233,133 | 239,345 |
| MIGS uptake, % | 0.70%[a] | 0.70% | 0.70% | 0.70% | 0.70% |
| MIGS, N | 1,500[b] | 1,543 | 1,587 | 1,630 | 1,674 |
| Proportion subgroup #1[c] | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| MIGS subgroup #1[c], N | 1,050 | 1,080 | 1,111 | 1,141 | 1,171 |
| Proportion subgroup #2[d] | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MIGS subgroup #2[d], N | 300 | 309 | 317 | 326 | 335 |
| Proportion subgroup #3[e] | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MIGS subgroup #3[e], N | 150 | 154 | 159 | 163 | 167 |

Abbreviations: MIGS, minimally invasive glaucoma surgery
[a]Calculation based on number of MIGS and total number of people with open-angle glaucoma.
[b]Based on manufacturer and expert input.
[c]In the first subgroup, MIGS is used in conjunction with cataract surgery for those with mild to moderate glaucoma. Based on CADTH's analyses[31] the types of MIGS included in this subgroup are iStent, Hydrus Microstent, CyPass Micro-Stent, and endoscopic cyclophotocoagulation.
[d]In the second subgroup, MIGS is used as standalone procedures in the mild to moderate glaucoma population. Based on CADTH's analyses[31] the types of MIGS included in this subgroup are Hydrus Microstent, iStent inject, trabectome, and XEN.
[e]In the third subgroup, MIGS is used in the advanced glaucoma population. Based on CADTH's analyses[31] the types of MIGS included in this subgroup are trabectome and endoscopic cyclophotocoagulation.

We looked at two uptake rates in our new scenario (public funding for MIGS): a slow uptake scenario and a fast uptake scenario (Table 3). In the slow uptake scenario, we assumed a limited number of MIGS procedures would be funded (2,000 per year) in the first 2 years. In the following years, we assumed a small amount of growth would occur (1% additional uptake per year). In the fast uptake scenario, we assumed MIGS uptake would increase rapidly with 2% to 15% of adults with glaucoma receiving MIGS over 5 years (Table 3). As mentioned previously, we limited the uptake of MIGS in subgroups 1 and 3, based on the annual expected numbers of cataract and filtration surgeries in this population.

**Table 3: New Scenario—Uptake and Volume of MIGS**

| | Year of Analysis | | | | |
|---|---|---|---|---|---|
| | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Total people with open-angle glaucoma, N | 214,528 | 220,724 | 226,926 | 233,133 | 239,345 |
| **Slow Uptake Scenario** | | | | | |
| Maximum MIGS uptake[a], % | 0.93% | 0.91% | 2.00% | 3.00% | 4.00% |
| Maximum MIGS[a], N | 2,000 | 2,000 | 4,539 | 6,994 | 9,574 |
| Proportion subgroup #1[b] | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| MIGS subgroup #1[b], N | 1,400 | 1,400 | 3,177 | 4,896 | 6,702 |
| Proportion subgroup #2[c] | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MIGS subgroup #2[c], N | 400 | 400 | 908 | 1,399 | 1,915 |
| Proportion subgroup #3[d] | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MIGS subgroup #3[d], N | 200 | 200 | 454 | 699 | 957 |
| **Fast Uptake Scenario** | | | | | |
| Maximum MIGS uptake[a], % | 2.00% | 5.25% | 8.50% | 11.75% | 15.00% |
| Maximum MIGS[a], N | 4,291 | 11,588 | 19,289 | 27,393 | 35,902 |
| Proportion subgroup #1[b] | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| MIGS subgroup #1[b], N | 3,003 | 8,112 | 13,502 | 19,175 | 22,928 |
| Proportion subgroup #2[c] | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| MIGS subgroup #2[c], N | 858 | 2,318 | 3,858 | 5,479 | 7,180 |
| Proportion subgroup #3[d] | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| MIGS subgroup #3[d], N | 429 | 1,159 | 1,929 | 2,739 | 3,590 |

Abbreviations: MIGS, minimally invasive glaucoma surgery
[a]Actual values may be lower, as the upper limit of MIGS in subgroups 1 and 3 are limited by the number of cataract and filtration surgeries, respectively.
[b]In the first subgroup, MIGS is used in conjunction with cataract surgery for those with mild to moderate glaucoma. The types of MIGS included are iStent, Hydrus Microstent, CyPass Micro-Stent, and endoscopic cyclophotocoagulation.
[c]In the second subgroup, MIGS is used as standalone procedures in the mild to moderate glaucoma population. The types of MIGS included are Hydrus Microstent, iStent inject, trabectome, and XEN.
[d]In the third subgroup, MIGS is used in the advanced glaucoma population. The types of MIGS included are trabectome and endoscopic cyclophotocoagulation.

## *Resources and Costs*

We derived the resources and costs used in our budget impact analysis from the economic models developed by CADTH.[1] Specifically, all of our costs are based on the Ontario-specific sensitivity analyses conducted by CADTH.

The costs considered by CADTH's economic evaluation are related to the following:

- Initial procedure (device costs, Ontario physician fees, operating room costs)
- Postoperative visits and adverse events
- Pharmacotherapy use and severity-specific resource use

All costs were reported in Canadian dollars and have been adjusted to 2018 costs using the Consumer Price Index for all items in Canada.[40] The key cost components and unit costs are

described below. Further details can be found in the health technology assessment conducted in collaboration with CADTH.[1]

## Initial Procedure Costs

Table 4 presents the relevant device costs. The costs of MIGS devices from CADTH's economic evaluation[1] were obtained from a Canadian costing study that compared MIGS to pharmacotherapy,[17] and from consultations with clinical experts (if costs were not provided in the literature). Two additional device costs are presented that were not included in CADTH's analyses due to a lack of clinical evidence.

As discussed in the environmental scan conducted by CADTH, the start-up costs for MIGS procedures are considered to be generally minimal or are covered by the manufacturers.[31] In their analysis, CADTH assumed the start-up costs to be negligible.

**Table 4: Costs of MIGS Devices**

| MIGS Device | Reference Case Value ($) | Source |
|---|---|---|
| 2 × iStent; iStent inject | 1,087 | CADTH (Iordanous, 2014[17]) |
| ECP | 218 | CADTH (Iordanous, 2014[17]) |
| Trabectome | 761 | CADTH (Iordanous, 2014[17]) |
| XEN45 | 1,087 | CADTH (Expert opinion) |
| Hydrus Microstent | 1,087 | CADTH (Expert opinion) |
| CyPass Micro-Stent | 1,150 | CADTH (Expert opinion) |
| Kahook Dual Blade[b] | 575 | Expert opinion |
| Gonioscopy-assisted transluminal trabeculectomy (GATT)[b] | NA, No device related costs | |

Abbreviations: ECP, endoscopic cyclophotocoagulation
[b]Not included in CADTH's economic evaluation[1] due to a lack of clinical evidence identified in the clinical evidence review. As a result, we could not include them in our analyses.

Physician fees are presented in Table 5. These fees were obtained by CADTH from the Ontario Schedule of Benefits.[38] Currently, there is no standard billing code for MIGS procedures in Ontario. As described in the collaborative health technology assessment,[1] other fee codes are being used to bill for MIGS instead. The codes used for MIGS may vary across the province, with some physicians including or excluding the code E136 (with intraocular implant of a seton). In our reference case analysis, should MIGS be publicly funded, we assumed the proxy codes would continue to be billed, and an equal amount would bill MIGS with or without E136. In a sensitivity analysis, we examined the impact of creating new billing codes specific to MIGS. Table 5 presents the list of Ontario physician billing codes for each procedure.

**Table 5: Physician Fees for Initial MIGS Procedures**

| Intervention | Surgical Fees | Source |
|---|---|---|
| Trabeculectomy | **E132:** Glaucoma filtering procedures ($550) + anesthetic fee | Schedule of Benefits[38] |
| Laser therapy | **E134:** Laser angle surgery ($206) | Schedule of Benefits[38] |
| Glaucoma drainage implant | **E136+E132:** Glaucoma filtering procedures with intraocular implant of seton ($840) + anesthetic fee | Schedule of Benefits[38] |
| Cataract surgery only | **E140:** Insertion of intraocular lens ($398) | Schedule of Benefits[38] |
| Trabeculectomy + cataract surgery | **E214+E950:** Glaucoma filtering procedure and cataract extraction with insertion of intraocular lens ($822) + anesthetic fee | Schedule of Benefits[38] |
| MIGS proxy A: | | Schedule of Benefits[38]; expert opinion |
| MIGS alone | **E132+E136** ($840) | |
| MIGS + cataract surgery | **E214+E950+E136** ($1112) | |
| MIGS proxy B: | | Schedule of Benefits[38]; expert opinion |
| MIGS alone | **E132** ($550) | |
| MIGS + cataract surgery | **E214+E950** ($822) | |
| MIGS with new Schedule of Benefits code | $400 | Expert opinion |

Abbreviations: MIGS, minimally invasive glaucoma surgery

Operating room costs were obtained from Ontario Case Costing Initiative (2016/17 day surgery).[41] Since operating room costs are not available for MIGS, the costs were estimated with reference to phacoemulsification, a type of cataract surgery. Further details on the operating room costs can be found in the collaborative health technology assessment.[1]

For people who are expected to receive two devices (to treat bilateral glaucoma), we assumed their initial procedure costs would be doubled. We assumed procedures would be conducted at separate times.

## Postoperative Visits and Complications

The CADTH economic evaluation included the costs of standard postoperative visits as well as adverse events related to MIGS and non-MIGS interventions. Adverse events were broken down into three categories: minor complications, major complications, and secondary surgical interventions. The number of adverse events varied in each of CADTH's models and were based on the clinical literature. Among people who received MIGS, minor complications occurred in 4% to 100% of cases, major complications occurred in 0% to 19% of cases, and secondary surgical interventions occurred in 0% to 2% of cases. Among people who received alternative treatments, minor complications occurred in 17% to 100% of cases, major complications occurred in 0% to 44% of cases, and secondary surgical interventions occurred in 0% to 7% of cases. For additional details on the types of adverse events, please refer to the collaborative health technology assessment.[1]

For all adverse events, CADTH assumed there would be two additional ophthalmologist consultations. In addition, 10% of major complications were assumed to require a surgical intervention.

### Pharmacotherapy Use and Severity-Specific Resource Use

Several costs were related to the relative efficacy of MIGS and alternatives. In CADTH's economic evaluation, this was based on two outcomes: (1) pharmacotherapy reduction, and (2) IOP reduction.[1]

#### *Pharmacotherapy Reduction*

CADTH's economic model assumed pharmacotherapy reduction would lead to cost savings (and similarly, increased pharmacotherapy use would lead to additional costs).[1] For instance, if people who had combined MIGS and cataract surgery required one fewer medication than those who had cataract surgery alone (Model 4 in CADTH's analysis), then the cost of one medication was applied to people who received cataract surgery alone in the model.

Pharmacotherapy costs were based on 2018 prices from the Ontario Drug Benefit Formulary,[42] accounting for 21% wastage[17] and weighted by the proportion of people in each drug class over total prescriptions.[43] The annual cost to receive medication ranged from $101 among people who are receiving one medication and $320 among people who are receiving three medications.

#### *Intraocular Pressure Reduction*

Cost-savings due to IOP reduction are indicated by slowed glaucoma progression, as defined by a patient's visual field test results. In CADTH's model, people are categorized as having mild, moderate, advanced, or severe glaucoma/blindness (or their glaucoma could progress to fall into one of these categories).[1] People with lower IOP were assumed to progress more slowly. Costs including ophthalmologist consultations, relevant tests (visual field test, optic disc imaging, and IOP measurement), low vision aids, rehabilitation, and specialist visits were modelled based on the severity of glaucoma. In other words, people with advanced glaucoma were expected to incur more costs than people with mild or moderate glaucoma.

In addition, it was assumed when people progressed to advanced stage glaucoma, they would receive a trabeculectomy to control their glaucoma. Subsequent treatments were only relevant to people who started with mild to moderate glaucoma (i.e., budget impact subgroups 1 and 2).

Further details on the pharmacotherapy and severity-specific costs can be found in the collaborative health technology assessment.[1]

#### *Per-Person Costs Used in the Budget Impact Analysis*

We derived undiscounted annual average per-person costs from CADTH economic models[1] to use in our budget impact analysis. CADTH's economic analyses grouped clinical studies based on the comparators and disease severity of study participants. In cases in which multiple clinical studies (often using various MIGS procedures or devices) were identified, they chose the most appropriate single study or set of studies to use in their reference case economic analyses, based on data availability and/or data quality. It is important to note that while comparisons were based on the data available, there is a lack of data on the optimal use of MIGS; hence, comparisons among clinically relevant alternatives and comparators may not be accurately reflected.

In the absence of such data, we use the same comparisons from each of the reference cases in CADTH's models to obtain costs.[1] However, our costs reflect Ontario costs, as obtained from CADTH's scenario analyses.[1] We derive the costs for people using MIGS and for those using alternative treatments. The costs vary for each subgroup as follows:

**Subgroup 1: MIGS in conjunction with cataract surgery, mild to moderate glaucoma**

- ***MIGS costs***
  - Costs are derived from the MIGS arm of Model 4 in CADTH's analysis.[1] Costs are based on Hydrus Microstent with cataract surgery
- ***Standard treatment costs***
  - Costs are derived from the cataract-only arm of Model 4 in CADTH's analysis[1]

**Subgroup 2: MIGS as a standalone procedure, mild to moderate glaucoma**

- ***MIGS costs***
  - Costs are derived from the MIGS arms of Models 1, 2 and 3a in CADTH's analysis.[1] We use the average cost of MIGS (2 × iStent inject, Hydrus Microstent, and trabectome) from the reference case of each relevant model
- ***Standard treatment costs***
  - Costs are derived from the comparator arms of Models 1, 2, and 3a in CADTH's analysis.[1] We use the average cost of the non-MIGS comparators (pharmacotherapy, laser therapy, and trabeculectomy) from the reference case of each relevant model

**Subgroup 3: MIGS as a standalone procedure or in conjunction with cataract, advanced to severe glaucoma**

- ***MIGS costs***
  - Costs are derived from the MIGS arms of Models 3b and 5 in CADTH's analysis.[1] We use the average cost of MIGS (endoscopic cyclophotocoagulation alone and trabectome with cataract surgery) from the reference case of each relevant model
- ***Standard treatment costs***
  - Costs are derived from the comparator arms of Models 3b and 5 in CADTH's analysis.[1] We use the average cost of the non-MIGS comparators (drainage device alone and trabeculectomy with cataract surgery) from the reference case of each relevant model

The per-person costs used in our reference case budget impact analysis can be found in Table 6. Per-person cost breakdowns for MIGS and the comparator in each subgroup can be found in Appendix 1, Table A3. These costs include adjusted initial procedure costs reflecting our assumption that 50% of people get bilateral interventions.

**Table 6: Annual Per-Person Cost—Reference Case**

| | Annual Per-Person Cost, $[a] | | | | |
|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| **Subgroup 1** | | | | | |
| MIGS[b] (+ cataract), Model 4 | 5,101 | 237 | 260 | 278 | 292 |
| Comparator (cataract alone), Model 4 | 2,194 | 277 | 297 | 312 | 322 |
| **Subgroup 2** | | | | | |
| MIGS[c], Model 1 | 4,257 | 360 | 364 | 366 | 367 |
| MIGS[d], Model 2 | 4,203 | 365 | 386 | 385 | 378 |
| MIGS[e], Model 3a | 3,861 | 465 | 453 | 441 | 429 |
| Comparator (pharmacotherapy), Model 1 | 592 | 566 | 558 | 547 | 535 |
| Comparator (laser therapy), Model 2 | 1,557 | 428 | 440 | 431 | 416 |
| Comparator (filtration surgery), Model 3a | 4,190 | 343 | 347 | 350 | 352 |
| Average MIGS | 4,107 | 397 | 401 | 397 | 391 |
| Average comparator | 2,113 | 446 | 448 | 443 | 434 |
| **Subgroup 3** | | | | | |
| MIGS[f], Model 3b | 2,989 | 319 | 327 | 334 | 341 |
| MIGS[g] (+ cataract), Model 5 | 4,856 | 354 | 353 | 350 | 347 |
| Comparator (filtration surgery), Model 3b | 6,111 | 308 | 316 | 323 | 330 |
| Comparator (filtration surgery + cataract), Model 5 | 4,665 | 301 | 304 | 305 | 306 |
| Average MIGS | 3,922 | 337 | 340 | 342 | 344 |
| Average comparator | 5,388 | 304 | 310 | 314 | 318 |

Abbreviations: MIGS, minimally invasive glaucoma surgery
[a]In 2018 Canadian dollars.
[b]MIGS in this model included Hydrus Microstent used in combination with cataract surgery.
[c]MIGS in this model included 2 × iStent inject.
[d]MIGS in this model included Hydrus Microstent.
[e]MIGS in this model included trabectome.
[f]MIGS in this model included endoscopic cyclophotocoagulation.
[g]MIGS in this model included trabectome and was used in combination with cataract surgery.

## *Analysis*

In the reference case analysis, we calculated the required budget to publicly fund MIGS in adults with open-angle glaucoma in Ontario. We did this by calculating the budget impact as the cost difference between our new scenario (public funding for MIGS) and the current scenario (no public funding for MIGS). Details on our method of calculating the budget impact are presented in Appendix 1. Total costs are presented along with cost breakdowns (including initial procedures with potential complications, pharmacotherapy, follow-up treatments, and severity-specific costs).

### Sensitivity Analyses

We conducted several scenario analyses, including:

- **Scenario 1: All Types of Glaucoma**
  In our reference case, we assumed MIGS procedures are used in people with open-angle glaucoma. In this scenario, we assumed all people with glaucoma would receive MIGS.
- **Scenario 2–4: Various Prevalence Estimates**
  We examined an upper and lower estimate of prevalence, based on the confidence intervals derived from the Canadian Community Health Survey (Appendix 1, Table A4). In addition, we looked at a scenario in which we assumed prevalence has not increased since 2002/03.
- **Scenario 5: Faster Uptake Rate, Current Scenario**
  In our reference case, we assumed that with no public funding, MIGS uptake will remain the same over the modelled time horizon. In this scenario analysis, we assumed there will be a small amount of growth over time (Appendix 1, Table A4).
- **Scenarios 6–9: Different Proportion of Uptake in Each Subgroup**
  In our reference case, we assumed 70%, 20%, and 10% of MIGS are done in subgroups 1, 2, and 3, respectively. In one scenario, we assumed 90%, 5%, and 5% of MIGS procedures are done in subgroups 1, 2, and 3, respectively. In other scenarios, we assumed 100% of MIGS procedures are done in each subgroup (1, 2, and 3).
- **Scenarios 10 and 11: Different Assumptions Around Bilateral Interventions**
  In our reference case, we assumed 50% of people will have interventions in both eyes to treat bilateral glaucoma. In scenarios 10 and 11, we assumed 100% and 0% of people have bilateral glaucoma, respectively. The per-person costs associated with this scenario can be found in Appendix 1, Table A5.
- **Scenario 12: Proposed New Physician Reimbursement Code**
  In our reference case, we assumed MIGS procedures are billed using proxy codes. In this scenario, we assumed a new MIGS billing code would be created at $400, based on clinical expert input. The per-person costs associated with this scenario can be found in Appendix 1, Table A5.

## Results

### *Reference Case*

The results from our reference case budget impact analysis using two new uptake scenarios (slow and fast) are presented in Table 7. These scenarios are estimated assuming 70% MIGS procedures would be done in subgroup 1 (MIGS in combination with cataract surgery to replace cataract surgery alone in people with mild to moderate glaucoma), 20% in subgroup 2 (MIGS alone to replace other glaucoma treatments in people with mild to moderate glaucoma) and 10% in subgroup 3 (MIGS alone or in combination with cataract surgery to replace filtration surgery alone or in combination with cataract surgery in people with advanced to severe glaucoma). It also assumes 50% of people would have interventions in both eyes to treat bilateral glaucoma.

Assuming slow uptake, the annual budget impact of publicly funding MIGS for adults with glaucoma in Ontario over 5 years ranges from about $1 million (in year 1) to about $18 million

(in year 5). Assuming fast uptake, the annual budget ranges from about $6 million (in year 1) to about $70 million (in year 5). The cost breakdowns for each of these scenarios are presented in Appendix 1, Table A6 and Table A7. Generally, the new scenario had higher initial procedural costs, but lower costs related to pharmacotherapy, compared to the current scenario.

**Table 7: Budget Impact Analysis Results—Reference Case**

| | Budget Impact, $ Million[a] | | | | | |
|---|---|---|---|---|---|---|
| **Scenario** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Total** |
| **Slow Uptake Scenario** | | | | | | |
| **Current Scenario (Not Publicly Funded)** | | | | | | |
| MIGS | 7.18 | 7.80 | 8.47 | 9.16 | 9.88 | 42.49 |
| Non-MIGS treatment[b] | 1.25 | 1.30 | 6.00 | 14.64 | 22.70 | 45.88 |
| Total | 8.43 | 9.10 | 14.47 | 23.80 | 32.58 | 88.37 |
| **New Scenario (Publicly Funded)** | | | | | | |
| MIGS | 9.57 | 10.13 | 22.86 | 35.94 | 50.35 | 128.85 |
| Non-MIGS treatment[b] | NA | NA | NA | NA | NA | NA |
| Total | 9.57 | 10.13 | 22.86 | 35.94 | 50.35 | 128.85 |
| **Budget Impact** | | | | | | |
| New scenario − current scenario | 1.14 | 1.03 | 8.40 | 12.14 | 17.77 | 40.48 |
| **Fast Uptake Scenario** | | | | | | |
| **Current Scenario (Not Publicly Funded)** | | | | | | |
| MIGS | 7.18 | 7.80 | 8.47 | 9.16 | 9.88 | 42.49 |
| Non-MIGS treatment[b] | 6.97 | 25.95 | 46.59 | 74.11 | 98.87 | 252.49 |
| Total | 14.14 | 33.76 | 55.05 | 83.27 | 108.75 | 294.98 |
| **New Scenario (Publicly Funded)** | | | | | | |
| MIGS | 20.53 | 56.64 | 96.79 | 141.20 | 178.82 | 493.97 |
| Non-MIGS treatment[b] | NA | NA | NA | NA | NA | NA |
| Total | 20.53 | 56.64 | 96.79 | 141.20 | 178.82 | 493.97 |
| **Budget Impact** | | | | | | |
| New scenario − current scenario | 6.38 | 22.88 | 41.74 | 57.92 | 70.06 | 198.99 |

Abbreviations: MIGS, minimally invasive glaucoma surgery; NA, not applicable
[a]In 2018 Canadian dollars.
[b]Non-MIGS alternatives include the comparators as described previously (i.e., cataract surgery alone, pharmacotherapy, laser therapy, filtration surgery, filtration surgery + cataract surgery).

## *Sensitivity Analysis*

The budget impact from each scenario analysis is presented in Table 8. Most had similar results to the reference case. Notably, when funding is restricted to specific subgroups, the budget impact changed. It was the highest for subgroup 1 (MIGS in combination with cataract surgery compared with cataract surgery alone) and led to cost savings when used in subgroup 3 (MIGS alone or combined with cataract surgery compared with filtration surgery alone or combined with cataract surgery). The budget impact was also reduced when using a new ($400) MIGS billing code.

**Table 8: Budget Impact Analysis Results—Scenario Analyses**

| Scenario | Budget Impact, $ Million[a] | | | | | |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| **Reference Case** | | | | | | |
| Slow uptake | 1.14 | 1.03 | 8.40 | 12.14 | 17.77 | 40.48 |
| Fast uptake | 6.38 | 22.88 | 41.74 | 57.92 | 70.06 | 198.99 |
| **Scenario 1: All Types Glaucoma** | | | | | | |
| Slow uptake | 1.14 | 1.03 | 12.05 | 17.71 | 25.33 | 57.25 |
| Fast uptake | 9.83 | 32.15 | 57.05 | 70.70 | 73.40 | 243.13 |
| **Scenario 2: Prevalence, Lower Estimate** | | | | | | |
| Slow uptake | 1.14 | 1.03 | 8.04 | 11.60 | 17.05 | 38.87 |
| Fast uptake | 6.04 | 21.97 | 40.26 | 55.86 | 69.83 | 193.95 |
| **Scenario 3: Prevalence, Upper Estimate** | | | | | | |
| Slow uptake | 1.14 | 1.03 | 8.73 | 12.64 | 18.40 | 41.95 |
| Fast uptake | 6.73 | 23.77 | 43.13 | 59.79 | 70.28 | 203.71 |
| **Scenario 4: Prevalence, Constant Over Time** | | | | | | |
| Slow uptake | 1.14 | 1.08 | 4.96 | 6.81 | 10.32 | 24.31 |
| Fast uptake | 3.28 | 14.32 | 27.10 | 36.74 | 48.13 | 129.56 |
| **Scenario 5: Current Scenario (No Public Funding), Increased Uptake Over Time** | | | | | | |
| Slow uptake | 1.14 | 0.02 | 7.30 | 8.99 | 13.48 | 30.92 |
| Fast uptake | 6.38 | 21.62 | 40.36 | 53.98 | 64.70 | 187.05 |
| **Scenario 6: MIGS Uptake, 90% Subgroup 1, 5% Subgroup 2, 5% Subgroup 3** | | | | | | |
| Slow uptake | 1.32 | 1.19 | 10.62 | 14.04 | 20.56 | 47.73 |
| Fast uptake | 7.38 | 26.45 | 49.18 | 61.86 | 61.33 | 206.20 |
| **Scenario 7: MIGS Uptake, 100% Subgroup 1** | | | | | | |
| Slow uptake | 1.45 | 1.31 | 11.90 | 15.45 | 22.62 | 52.73 |
| Fast uptake | 8.11 | 29.10 | 54.33 | 60.62 | 59.88 | 212.04 |
| **Scenario 8: MIGS Uptake, 100% Subgroup 2** | | | | | | |
| Slow uptake | 1.00 | 0.89 | 2.49 | 10.50 | 15.31 | 30.18 |
| Fast uptake | 5.56 | 19.89 | 31.32 | 49.89 | 65.56 | 172.23 |
| **Scenario 9: MIGS Uptake, 100% Subgroup 3** | | | | | | |
| Slow uptake | -0.73 | -0.65 | -3.56 | -3.64 | -3.73 | -12.32 |
| Fast uptake | -3.26 | -3.35 | -3.44 | -3.54 | -3.64 | -17.22 |
| **Scenario 10: 0% Bilateral** | | | | | | |
| Slow uptake | 0.76 | 0.67 | 5.66 | 7.98 | 11.64 | 26.72 |
| Fast uptake | 4.22 | 15.10 | 27.57 | 37.96 | 45.70 | 130.56 |
| **Scenario 11: 100% Bilateral** | | | | | | |
| Slow uptake | 1.53 | 1.38 | 11.13 | 16.30 | 23.89 | 54.23 |
| Fast uptake | 8.55 | 30.67 | 55.90 | 77.89 | 94.42 | 267.43 |
| **Scenario 12: New MIGS Billing Code ($400)** | | | | | | |
| Slow uptake | 0.26 | 0.14 | 6.39 | 9.04 | 13.53 | 29.35 |
| Fast uptake | 4.48 | 17.75 | 33.19 | 45.79 | 55.14 | 156.35 |

Abbreviations: MIGS, minimally invasive glaucoma surgery
[a]In 2018 Canadian dollars.

## Discussion

We conducted a budget impact analysis to estimate the costs of publicly funding MIGS for adults with glaucoma in Ontario. Our costs were derived from the economic evaluation conducted by CADTH as a part of a broader, optimal-use health technology assessment.[1] Similar to the health technology assessment conducted in collaboration with CADTH, we assessed MIGS as a class of devices due to the lack of data allowing comparisons between different MIGS. There is a lack of specific guidelines and clinical data to support when, or for whom, MIGS should be used.[31] In the absence of these data, we define several subgroups in our budget impact analysis to capture potential variation in the populations that receive MIGS and what current treatments MIGS may replace. In our reference case, we assumed most (70%) MIGS are currently used, and would continue to be used, in combination with cataract surgery to replace cataract surgery alone. Given this, we found that the annual budget impact of MIGS over the next 5 years would range from $1 million (in year 1) to $18 million (in year 5) under a slow uptake scenario, and would range from $6 million (in year 1) to $70 million (in year 5) under a fast uptake scenario.

The slow uptake scenario assumed a limited number of MIGS would be funded for the first two years and was based on a proposal from the Ontario Micro-Invasive Glaucoma Surgery Working Group (Robert Campbell, MD, written communication, December 4, 2018). We assumed after two years, there would be some increase in uptake. The fast uptake scenario assumed there would be less restriction on the number of MIGS available per year, and that uptake could occur quite rapidly in the province. We found that with a large number of eligible people, the budget impact could be very high.

Our sensitivity analyses highlight the variation in budget impact when MIGS are used in different subgroups or to replace different treatments that are currently available. As highlighted in CADTH's economic evaluation, MIGS is generally less expensive than filtration surgery.[1] Hence, when we assumed all MIGS procedures would be performed on people with more severe glaucoma and would replace filtration surgery, MIGS led to cost-savings. However, in most instances in CADTH's model,[1] including the Ontario-specific sensitivity analyses, MIGS was also less effective than filtration surgery. Therefore, the results from CADTH's cost-effectiveness analysis should be taken into consideration.

Scenario analyses also showed that introducing a new billing code in Ontario could reduce the budget impact. Currently in Ontario, MIGS is billed using proxy codes for procedures that may be more complex and time intensive.[1]

Our budget impact has several limitations, and the results should be interpreted accordingly. There is a lack of recent estimates on the prevalence of glaucoma in Ontario and Canada. In the absence of such data, we updated a previous analysis (1994–2003) of the Canadian Community Health Survey and projected prevalence to present (323,000 in 2019). Previous work in Ontario has estimated that the number of people on one or more glaucoma medication ranged from 152,633 in 2011/2012 to 182,119 in 2016/17. Based on linear extrapolation, this may increase to approximately 200,000 people in 2019 and 225,000 people by 2023. It is reasonable to expect that the total number of people with glaucoma would be higher to include people who do not use pharmacotherapy (i.e., those receiving laser or surgical treatments).

In addition, the lack of a fee code led to challenges in estimating the current uptake of MIGS. We based our current uptake estimation based on consultations with Ontario centres and manufacturers. We acknowledge that the number of MIGS in Ontario—both now and in the

future—may vary, and our budget impact was highly influenced by this. Introducing a new fee code would not only improve the ability to track MIGS uptake but could aid in the ability to collect real-world outcomes and (as mentioned previously) reduce the budget impact.

We derived our costs from CADTH's economic evaluation.[1] The assumptions and limitations of this analysis may impact our budget impact assessment. Firstly, the economic evaluation focused on patients with one intervention per eye and does not account for bilateral glaucoma. Conservatively, to account for this in our model, we assumed 50% of people with glaucoma would have two interventions (one in each eye) and thus, would have double the initial procedural costs. We recognize this is a simplification, and that there may be a delay between receiving interventions for the first and second eye. However, we chose this approach because we did not want to underestimate potential costs.

In addition, due to a lack of data comparing various MIGS devices identified from the literature, the economic evaluation was unable to capture the comparative effectiveness between various MIGS devices. CADTH used a specific study (or set of studies) as the reference case to model effectiveness for each comparison (MIGS vs. alternative treatments). Their sensitivity analyses showed there was variation based on the study and type of MIGS used. For instance, in the model comparing MIGS to filtration surgery, MIGS could range from being more expensive and less effective (based on a study assessing the iStent inject and trabeculectomy) to less expensive with very similar effectiveness (based on a study assessing XEN and trabeculectomy). Although we were unable to take these intricacies into account, this could have a major impact on the results. Additional data and guidance are needed to support the optimal use and funding of MIGS; particularly around clinically relevant populations and alternative treatments.

Finally, as also mentioned in the health technology assessment conducted in collaboration with CADTH,[1] we were limited by the availability of high-quality clinical data and detailed costing data. Studies used to derive effectiveness were generally of poor quality and had short follow-up. This may impact the costs used in our assessment and our budget impact estimates. There is also a need for detailed costing studies to better understand the true costs associated with MIGS.

Despite limitations, the reference case and scenario analyses in our budget impact analysis offer useful information on the potential cost to publicly fund MIGS for adults with glaucoma in Ontario. The actual budget impact of publicly funding MIGS will ultimately depend on the eligibility criteria applied (and hence the population in which it is used) and which alternative treatments it will replace.

## Conclusions

Assuming a slow uptake scenario, the annual budget impact of publicly funding MIGS in Ontario over the next 5 years ranges from $1 million in year 1 to $18 million in year 5. Assuming a fast uptake scenario, the annual budget impact of publicly funding MIGS in Ontario over the next 5 years ranges from $6 million in year 1 to $70 million in year 5. The budget impact varies depending on the proportion of people in each subgroup.

## PATIENT PREFERENCES AND VALUES

### Objective

The objective of this analysis was to explore the underlying preferences, values, needs, and priorities of those who have lived experience with glaucoma. The treatment focus was minimally invasive glaucoma surgery (MIGS) versus more invasive surgeries for the treatment of glaucoma.

### Background

Exploring patient preferences and values provides a unique source of information about people's experiences of a health condition and the health technologies or interventions used to manage or treat the health condition. It includes the impact of the condition and its treatment on the person with the health condition, their family and other caregivers, and the person's personal environment. Engagement also provides insights into how a health condition is managed by the province's health system.

The Canadian Agency for Drugs and Technologies in Health (CADTH) explored the published literature on patient perspectives and experiences of people with glaucoma, including people who had undergone MIGS procedures. Health Quality Ontario complemented this work by interviewing people with lived experience of glaucoma. Information shared from lived experience can also identify gaps or limitations in published research (e.g., outcomes important to those with lived experience that are not reflected in the literature).[44-46] Additionally, lived experience can provide information and perspectives on the ethical and social values implications of health technologies or interventions.

Because the needs, preferences, priorities, and values of those with lived experience in Ontario are not often adequately explored in published literature, we speak directly with people who live with a given health condition, including those with experience with the intervention we are exploring.

### Methods

#### *Engagement Plan*

The engagement plan for this report focused on consultation to examine the experiences of people with glaucoma and those of their families and other caregivers. We engaged people via phone interviews.

We used a qualitative interview, as this method of engagement allowed us to explore the meaning of central themes in the experiences of people with glaucoma, as well as those of their families and caregivers.[47] The sensitive nature of exploring people's experiences of a health condition and their quality of life are other factors that support our choice of an interview methodology.

#### *Participant Outreach*

We used an approach called purposive sampling,[48-51] which involves actively reaching out to people with direct experience of the health condition and health technology or intervention being reviewed. We approached a variety of partner organizations, including the Glaucoma Research

Society of Canada, to spread the word about this engagement activity and to contact people with glaucoma, family members, and caregivers, including those with experience of surgical treatments of glaucoma (including MIGS).

### Inclusion Criteria

We sought to speak with people with glaucoma, or their family members and caregivers. Participants did not need to have direct experience with glaucoma surgery or MIGS to participate.

### Exclusion Criteria

We did not set exclusion criteria.

### Participants

For this project, we spoke with 10 people in Ontario: eight people with glaucoma, and three family members of people with glaucoma (one person with glaucoma was also caring for a family member with glaucoma, and was interviewed as both a patient and a family member). Of these participants, four had experience with MIGS, three had experience with more invasive glaucoma surgeries, and three had experience with other glaucoma treatments.

## *Approach*

At the beginning of the interview, we explained the role of Health Quality Ontario, the purpose of this report, the risks of participation, and how participants' personal health information would be protected. We gave this information to participants both verbally and in a letter of information (Appendix 2). We then obtained participants' verbal consent before starting the interview. With participants' consent, we audio-recorded and then transcribed the interviews.

Interviews lasted approximately 15 to 60 minutes. The interview was loosely structured and consisted of a series of open-ended questions. Questions were based on a list developed by the Health Technology Assessment International Interest Group on Patient and Citizen Involvement in Health Technology Assessment.[52] Questions focused on the impact of glaucoma on the person's quality of life, their experiences with treatments for glaucoma, as well as the values and experiences that guided their decision-making. Where applicable, we spoke about their perceptions of the benefits or limitations of glaucoma surgeries, including MIGS procedures. See Appendix 3 for our interview guide.

## *Data Extraction and Analysis*

We used a modified version of a grounded-theory methodology to analyze interview transcripts. The grounded-theory approach allowed us to organize and compare information on experiences across participants. This method consists of a repetitive process of obtaining, documenting, and analyzing responses while simultaneously collecting, analyzing, and comparing information.[53,54] We used the qualitative data analysis software program NVivo[33] to identify and interpret patterns in the data. The patterns we identified allowed us to highlight the impact of glaucoma and treatments on the people with glaucoma we interviewed.

## Results

### *Diagnosis of Glaucoma*

Participants reported that glaucoma was often an unexpected diagnosis. It was frequently found during a routine eye exam with few, if any, accompanying symptoms. Interviewed participants did not necessarily have a family history glaucoma and so were unfamiliar with the disease and did not anticipate the diagnosis:

> *[I went] for a routine eye exam, and the optometrist told me that my pressures were very high, and I had what was called narrow-angle glaucoma, which is a medical emergency.*
>
> *We don't really think about our eyes, and I didn't either. I don't wear glasses or anything; I didn't have any reason to think I would have trouble.*

These results are consistent with CADTH's qualitative literature review, which found that "many patients described being first diagnosed in the context of an eye exam scheduled as part of routine eye care."[1]

Glaucoma was often unexpected due to its lack of symptoms. Most participants reported that symptoms were either not present prior to their diagnosis, or symptoms were mild and attributed to other causes, such as aging or regular vision changes. CADTH's qualitative literature review supports this observation, finding that patients "described experienced vision changes as a symptom of normal aging [and] did not interpret or perceive their vision changes as pathological."[1]

Participants reported no symptoms or just minor symptoms, including slight changes in vision, redness, a sense of fatigue around the eye, and slight pain:

> *It had kind of been bothering me. I am not a person [who] gets a lot of headaches, but I was kind of getting a headache in my eye.*
>
> *[It was] dark in my peripheral vision, mostly in my right [eye].*
>
> *My experience with the glaucoma was it was found out by accident … if I was having symptoms, I didn't really notice them … I found out accidentally about it.*

Some participants expressed frustration at the diagnosis of glaucoma or lamented that they had not sought treatment earlier:

> *I never felt there was an urgency at all, whereas I realize now, the earlier that it's detected, the better. Now, as far as I know, I don't think there is any vision loss, and they said that I was fairly young to be starting glaucoma. And I never knew of anyone in the family who had glaucoma. So it wasn't even on my radar.*

In CADTH's qualitative literature review, one study focusing on African Caribbean patients also found "that when participants were diagnosed, they expressed remorse at not being diagnosed earlier."[1] Additionally, the CADTH review found that anger and frustration at diagnosis could be present, particularly in younger patients facing many years of living with a chronic condition.[1] These results were not necessarily seen through the direct interviews because there were not

many people with glaucoma who were diagnosed at a young age among the interviewed participants.

### *Impact*

Participants reported that mild glaucoma generally had a minimal impact on the activities and daily lives of individuals. Symptoms were generally so mild or nonexistent that changes to daily routine were not necessary. However, with more severe glaucoma, some participants reported slight changes to activities, such as avoiding driving at night or needing to protect their eyes in bright light:

> *For him, the only impact so far is that, because he is losing some peripheral vision, we don't drive up to the cottage at night in the winter anymore.*

> *I wear sunglasses all the time because when I'm out in the sun or when I go in stores—and, you know, some of the bright lights in the ceiling—the bright light hurts my eyes; but I think that's because of my diagnosis of the open-angle glaucoma.*

From CADTH's literature review, participants in the studies tended to be more elderly and more likely to be past working age. This meant that most of the impacts reported for glaucoma centred around their home and social lives, rather than changes required for work.[1]

Despite a relatively mild impact on activities of daily living, there could be an emotional impact on people with glaucoma; especially as the condition grew more severe. CADTH's qualitative literature review reported on the "frustration and loss felt by individuals navigating new challenges faced by common and everyday tasks, such as reading, driving, or shopping."[1] Additionally, glaucoma was felt to be an "invisible" condition: "patients and family members reported that their families and coworkers were not aware that they had glaucoma."[1] In this way, the condition could be overlooked and ignored by others. Yet for many people with glaucoma, the disruptions and frustrations of the condition were not things they could simply overlook.

Participants reported that the largest impact of glaucoma was the emotional distress and fear of potentially losing their sight. The possibility of blindness was upsetting for many people with glaucoma, which could be challenging to reconcile with a condition that caused so few symptoms:

> *It's sort of like, "You don't have to worry; your pressure's a little bit higher." But then you realize, "Oh no, your pressure's going higher, [and] you might go blind. Let's do something about this." It's like the other [end of the spectrum] is very severe.*

> *I needed to do everything I could to save my sight.*

In CADTH's qualitative literature review, patients consistently equated glaucoma with blindness. Across studies, patients consistently expressed a fear of blindness and its potential impact: "fearing blindness was often connected to a patient's fears of being unable to engage in the world; a sense that the ability to live a life with meaning was dependent upon retaining vision."[1] In this way, patients' views on glaucoma were heavily shaped by pre-existing perceptions of what it means to be blind and influenced how patients would seek treatment. From interviews, this perspective was consistently expressed by participants when reporting on their decision-making for glaucoma treatment:

> *Well, number one is I want to keep my sight as long as I can, and if that's what I have to do, that's what I have to do. I am kind of that person; I mean, I cherish my sight … I want to keep it as long as I can.*

## *Glaucoma Treatment*

### Eye Drops

In both the qualitative literature[1] and the interviews, people with glaucoma reported that eye drops were the primary initial glaucoma treatment offered by their physicians. People with glaucoma were put on a regimen of eye drops with regular follow-up appointments to assess their glaucoma. Generally, participants reported that their eye drop protocol was simple and initially effective. However, participants admitted that compliance could be an issue and that the eye drop regimen tended to dictate their daily schedule:

> *The drops did rule my scheduling, and now I'm free of that, so it's really nice to go out and not have to worry, "Oh, I have to hurry up or I'll miss a drop."*

Additionally, some participants spoke of the challenges eye drops could have for those who were not physically capable of administering the drops due to lack of dexterity or mobility:

> *My aunt had glaucoma … and she just had a horrible time because … she had to put the eye drops in. It was difficult for her; she was an older woman at the time.*

> *Glaucoma is treatable with eye drops and stuff, but it can be very difficult to get people to comply with their medication because they can't see already, and they maybe have some arthritis or who knows what, and the new state-of-the-art kind of laser surgeries are not covered, [so] people struggle.*

CADTH's qualitative literature review corroborated these sentiments, finding that "advancing age and comorbidities such as Parkinson's, arthritis, and tremors also make taking drops more difficult for some,"[1] which could lead to frustration and non-compliance.

Some participants reported that eye drops could have mild side effects, which included redness in the eyes or eye irritation:

> *Eye drops led to dryness around my eyes, [the] skin around eyes, and irritation.*

> *It wasn't a pain, but there was irritation and [my eyes] were stinging, and it took a while to really get used to the eye drops. They didn't sting for long, but there was stinging when I first put them in and a little bit of irritation and a little bit of redness; but because they were the treatment of choice at that time, I was quite happy that the optical pressure would come down and that my eyes had a good change of stabilization.*

Other symptoms described in CADTH's literature review include watering eyes and long-term effects such as excessive eye lash growing or dry eyes.[1]

While eye drops were initially effective, participants reported that their glaucoma continued to worsen, which sometimes meant increasing the frequency or dose of their eye drops:

> *I had one prescription, and it was one [drop] in each eye each night. So that was no problem at all. I don't know how long in between that he wasn't happy with the pressure, so then he added another drop, and that was one twice a day, morning and night: one drop in each eye plus the one at night.*

The majority of those interviewed eventually found that eye drops were not sufficient to treat their glaucoma, and were eventually required to attempt other treatment options, such as laser surgery, MIGS, or more invasive surgeries:

> *So I did [drops] for a couple of weeks, and I went and saw [the physician], and the pressure had decreased but not enough. So that's when he [physician] started talking about surgery.*

However, the reported effectiveness of eye drops through interviews likely reflect a bias in the sampling of those interviewed, and do not reflect a wider medical consensus on the effectiveness of eye drops in treating glaucoma. The majority of those interviewed had received surgical intervention for glaucoma, meaning eye drop treatment had been ineffective.

Several patients expressed frustration at the potential cost associated with glaucoma treatments, including eye drops. These costs could result from required medications or multiple follow-up visits with health care practitioners, depending on the individual circumstances:

> *Now I get free basic eye exams, but if you do anything else like a retinal scan or some of these other things that are important to see the back of your eye, you have to pay for it. It's over $100 to pay for it, so it's prohibitive for a lot of people.*

> *When you're talking about barriers to care, financial is number one, and the access. Those two things. I think that if people have glaucoma, they should be receiving follow-ups; it should be funded.*

### Surgical Decision-Making

Following unsuccessful eye drop treatment for glaucoma, participants reported that laser surgery was often the next option presented by their physicians. If this was not successful, more invasive surgeries, such as a MIGS procedure or trabeculectomy, could be offered. People with glaucoma reported having undergone a variety of different procedures, depending on their personal health condition and guidance from their physician.

Contemplating eye surgery caused anxiety and fear, as reported by both direct interviews and through qualitative studies explored by CADTH.[1] Interviewees discussed a general fear of surgery, as well as a particular fear of having a procedure done to such a sensitive organ:

> *Well, I'll tell you the truth: when I was going to have the trabeculotomy done, I was very anxious because I had never had surgery in my life before.*

> *Especially the eyes—no one wants to have surgery on [their eyes].*

Despite these fears and anxieties, participants generally reported feeling confident and comfortable in their ultimate decision to undergo glaucoma surgery. Part of this confidence resulted from the perceived necessity of the procedure to prevent the feared blindness that could result from ongoing glaucoma. Participants viewed the surgery as the only way to assure

that they did not lose their eyesight, which they perceived to be essential to maintaining their current level of activity and quality of life:

> *With both of these surgeries, it means I have the opportunity to have my vision much longer. By having my vision much longer, it means that my individuality can remain. I don't have to be dependent on anyone. I can still live alone. I can still drive. I can be safe.*

The potential to avoid using eye drops was also expressed as a factor in the decision to undergo surgery:

> *It's quality of life. It's a lifestyle thing. If you can be released from putting eye drops in and then doing all this other stuff and your eyes really don't … [the drops] stabilize your eyes, but you really have to do that your whole life.*

Additionally, participants reported a high level of trust with their health care providers, which provided comfort in making the decision to undergo surgery. The collaborative health technology assessment echoed this emphasis on the trust between physician and patient shaping the patient's views of surgery.[1] Participants expressed that patients relied on their physicians for their expertise and trusted them to suggest the best course of treatment. Without that trust, the choice to undergo surgery would have been much more difficult:

> *It comes down to how much you trust your doctor, the surgeon, and what they're telling you.*

> *I wouldn't hesitate to go forward. I guess there's always a risk, but it's a risk—are you going to lose your sight totally if you don't do it … You put your trust in these people that they know what they're doing. That's the whole thing; you put your trust in their hands.*

> *Some of the committees that I'm on, they'll say, "Well, we give these options to our patients and they decide." I kind of say to them, "No. We're looking to you people to be the experts, and you're the ones that we feel have the knowledge, and we rely on your advice."*

> *I guess I'm sort of [in] that area where I listen to the options and weigh [them] against my situation and then I make a decision. I'm not really one to go a lot—I haven't at this point anyway—gone and done a lot of research on things. I tend to rely on their expertise.*

## Surgery

For those who underwent laser surgery, the procedure was described as fairly simple and quick. Participants related that it rarely took more than 30 minutes and the wait time to obtain this surgery was relatively short. Some participants reported having to undergo the procedure more than once before their physician was satisfied that it had been effective:

> *I guess they freeze your eye and it lasted—I think it was 30 seconds. It was just like this very intense light that went across your eye. That's all it was. It was nothing; I mean I've had a detached retina and that was a little more involved, I would say, but this was nothing compared to that.*

> *Then after I had the first round of laser surgery, I was going back and the pressure had not really improved a lot, so [the physician] did it a second time … I had it the second time, and that seems to have remedied my pressures in the average range now—normal range.*

Recovery from this surgery was also reported as being relatively easy. Participants spoke of mild irritation or side effects from the surgery, which did not last more than a few days:

> *The first time I had [laser surgery], my eye wasn't sore at all. The second time, my eye was really sore. I had to go back the next day, and he gave me some drops just to fix it—to help it—and that cleared it up within a couple of days. It was really non-invasive, and it was quick.*

> *I think I walked out of the office. I might have worn sunglasses when I was outside, but other than that, I don't remember anything. Maybe it ached a little bit for a while, but it wasn't anything major.*

Participants who underwent more invasive surgical procedures had a more difficult time with recovery. These types of procedures were described as being longer, more stressful, and resulting in greater side effects:

> *She just had [a trabeculectomy] done this year and that was a lot more invasive … She works, and she was off work for six weeks, and she had to have both her eyes done—but it was a case where everything else hadn't worked. It was sort of the last-ditch effort to remedy the problem.*

> *And I was always in pain, so then had the [more invasive] glaucoma surgery … I could say that the surgery was successful, [but] my eye did not recover well.*

Participants who had experienced a MIGS procedure were able to describe it. However, those who had the MIGS procedure done did not also have a more invasive trabeculectomy done, so they were unable to speak to any differences or similarities in the procedures. In general, participants described MIGS procedures as smooth and successful:

> *So, [the doctor] did that for my left eye and the pressure did go down following that … there was no problem after the surgery. Then he did the right eye and put the drain in and I had no problems following the surgery on that either.*

> *For the drain device that was put in, I … was less anxious and I was really aware of what was going on. And in the last one that was done in May, I felt very comfortable … They make you feel very comfortable in the OR [operating room] because you are not unconscious or anything.*

> *Yes … When you think of invasive surgery and everything, it really was, I think, a very smooth technique. I had freezing—topical freezing or whatever—in my eye, so I didn't feel anything, but I was awake during the whole thing and there were no problems.*

Other participants reflected on the benefits they observed from the MIGS procedure in their daily lives. Some of these benefits included the return of daily activities previously enjoyed.

Another benefit expressed was the mental and emotional relief of avoiding the blindness that could be a consequence of untreated glaucoma:

> *I don't have the redness, I don't have the soreness, I don't have the aching. My eyes don't tire as easily. I've been able to start reading again. Reading is one of the things I've really enjoyed in my life, so the surgery—I know it's too soon to tell, because it's just been a month since I've had my right eye done and a couple of months since my left eye, but life has improved in regards to being able to do more visual things.*

> *I think what I'm saying is I can [be] more productive [in] the community and [in] society in general, because I've had this surgery and I don't have the fear … at the beginning I had a fear of blindness and depending on others and also the anxiety of being a burden on others.*

Participants did not comment on any improvement of visual acuity or in their visual field, which can be symptoms of glaucoma.

## Discussion

Patient values and preferences surrounding glaucoma and treatment options such as MIGS were obtained through two approaches. First, CADTH conducted a qualitative literature analysis, which included people who had undergone MIGS procedures.[1] Second, to complement this analysis, Health Quality Ontario conducted interviews to gather lived-experience perspectives from people with glaucoma who may or may not have undergone a MIGS procedure.

The lived-experience information gathered through interviews greatly overlapped and complemented the data gathered by CADTH's qualitative literature analysis. Each source described glaucoma as a fairly unknown condition. Diagnosis was often surprising and unexpected, with asymptomatic patients typically diagnosed through routine eye examinations. Additionally, glaucoma diagnoses could be emotionally distressing because of glaucoma's lack of symptoms and potential for serious adverse consequences, including blindness.

The key factor in patients' decision-making regarding their treatment for glaucoma was the patient–physician relationship. This was clear from both CADTH's qualitative review[1] and patient interviews. Perhaps due to the somewhat unknown nature and symptoms associated with glaucoma, patients felt this trusting relationship was essential to develop comfort in making the decision to undergo surgery.

The perceived effectiveness of certain types of treatments for glaucoma was likely skewed due to the participation bias in those who agreed to be interviewed. These participants had either had a glaucoma surgery (either a MIGS procedure or a more invasive procedure) or were waiting for surgery. Therefore, front-line treatments for glaucoma (such as eye drops) had been unsuccessful.

The costs associated with ongoing glaucoma treatment were raised by a few participants as a barrier to care. Additionally, some surgical procedures had wait times that could impact an individual's quality of life as they waited for a procedure to treat their glaucoma.

## Conclusions

Participants reported that glaucoma was often asymptomatic and its diagnosis unexpected. Pharmacotherapy treatment could be challenging, and patients relied on their trust of their physician to determine if surgery was necessary to avoid potential adverse consequences, such as blindness. Those who underwent MIGS procedures found them to be generally successful and beneficial, with minimal side effects and recovery time needed.

## CONCLUSIONS OF THE REPORT

Assuming a slow-uptake scenario, the annual budget impact of publicly funding minimally invasive glaucoma surgery (MIGS) for adults with glaucoma over the next 5 years in Ontario ranges from $1 million in year 1 to $18 million in year 5. Assuming a fast-uptake scenario, the annual budget impact ranges from $6 million in year 1 to $70 million in year 5. The budget impact varies depending on the proportion of people in each subgroup. For people with glaucoma, avoiding blindness is paramount. MIGS was perceived as an effective treatment option with minimal recovery time required.

## ABBREVIATIONS

| | |
|---|---|
| **CADTH** | Canadian Agency for Drugs and Technologies in Health |
| **GRADE** | Grading of Recommendations Assessment, Development, and Evaluation |
| **ICER** | Incremental cost-effectiveness ratio |
| **IOP** | Intraocular pressure |
| **MIGS** | Minimally invasive glaucoma surgery |
| **QALY** | Quality-adjusted life-year |

## GLOSSARY

| | |
|---|---|
| **Adverse event** | Any unexpected problem that happens during treatment, regardless of the cause or severity. |
| **Budget impact analysis** | A budget impact analysis estimates the financial impact of adopting a new intervention on a health care budget (i.e., its affordability). It is based on predictions of how changes in the intervention mix impact the level of health care spending for a specific population. Budget impact analyses are typically conducted for a short-term period (e.g. 5 years) and compare the costs associated with the current scenario (i.e., the mix of interventions presently available) with those associated with future scenarios (i.e., the mix of interventions with the new intervention introduced) for the chosen population. |
| **Cost-effective** | An intervention is considered cost-effective when it provides additional benefits, compared with relevant alternatives, at an additional cost that is acceptable to a decision-maker based on the maximum willingness-to-pay value. |
| **Cost-effectiveness analysis** | Used broadly, "cost-effectiveness analysis" may refer to an economic evaluation used to compare the benefits of two or more interventions relative to their costs. It may encompass several types of analyses (e.g., cost-effectiveness analysis, cost–utility analysis). Used more specifically, "cost-effectiveness analysis" may refer to a specific type of economic evaluation in which the main outcome measure is the incremental cost per natural unit of health (e.g., life-years, symptom-free days) gained. |
| **Cost–utility analysis** | A cost-utility analysis is a type economic evaluation used to compare the benefits of two or more interventions relative to their costs. The benefits are measured using health-related quality-of-life measures, which capture both the quality and quantity of life. In a cost–utility analysis, the main outcome measure is typically the incremental cost per quality-adjusted life-year (QALY) gained. |
| **Incremental cost-effectiveness ratio (ICER)** | The incremental cost-effectiveness ratio is a summary measure that determines the additional cost per additional unit of benefit. It is obtained by dividing the incremental cost by the incremental effectiveness. The incremental cost-effectiveness ratio is typically measured as cost per life-year gained or cost per quality-adjusted life-year gained. |
| **Markov model** | A Markov model is a type of decision-analytic model used in economic evaluations to estimate the costs and health outcomes (e.g., quality-adjusted life-years gained) associated with using the interventions of interest. Markov models are useful for clinical problems that involve events of interest that may recur over time (e.g., stroke). A Markov |

| | |
|---|---|
| | model consists of mutually exclusive, exhaustive health states. Patients remain in any given state for a certain period of time before moving to another state based on transition probabilities. The health states and events modelled may be associated with specific costs and health outcomes. |
| **Quality-adjusted life-year (QALY)** | The quality-adjusted life-year is a generic health outcome measure commonly used in cost–utility analyses to reflect the quantity and quality of life-years lived. The life-years lived are adjusted for quality of life using individual or societal preferences (i.e., utility values) for having a particular health status (i.e., being in a particular health state). One year of perfect health is represented as one quality-adjusted life-year. |
| **Reference case (in a cost-effectiveness analysis)** | The reference case is a preferred set of methods and principles that provide the guidelines for economic evaluations. Its purpose is to standardize the approach of conducting and reporting economic evaluations, so that results can be compared across studies. |
| **Scenario analysis** | A scenario analysis is an approach used to explore uncertainty in the results of an economic evaluation. It is done by observing the potential impact of different scenarios on the cost-effectiveness of an intervention. For instance, scenario analyses will include varying structural assumptions from the reference case. |
| **Sensitivity analysis** | Every evaluation contains some degree of uncertainty. Study results can vary depending on the values taken by key parameters. Sensitivity analysis is a method that allows estimates for each parameter to be varied to show the effect on study results. The various types of sensitivity analyses include deterministic, probabilistic, and scenario. |
| **Utility** | Utilities represent health state preference values, which characterize individuals' preferences for different health states. Typically, utility values are anchored between 0 (death) and 1 (perfect health). In some scoring systems, a negative utility value indicates a state of health that is valued as being worse than death. Utility values can be aggregated over time to derive quality-adjusted life-years, a common outcome measurement of economic evaluations. |

# APPENDICES

## Appendix 1: Budget Impact Analysis

### *Details on Budget Impact Analysis Calculations*

We calculated our budget impact as the difference in annual total costs between our new scenario (public funding for MIGS) and our current scenario (no public funding for MIGS).

We calculated the costs for scenario as follows:

***Total Cost in New Scenario*:** We calculated the annual costs for 2019 by multiplying the total volume of people expected to get MIGS in 2019 by the relevant first-year treatment costs (see Table 4, Table 7, and Equation A1). We calculated annual costs for subsequent years using the ongoing costs of the 2019 cohort and the costs of the new cohort expected in respective years (Equations A2 to A5). We did this for each of the subgroups and added them together.

***Total Cost in Current Scenario*:** In this scenario, we include only the number of people who, if there were public funding, would have gotten MIGS in the new scenario. However, in this scenario, we assumed there is a mix of people who would get MIGS and non-MIGS treatments (as some people would get MIGS through funding from hospital global budgets, and others would receive other publicly funded treatments). We calculated the annual costs for 2019 by multiplying the total volume of these people expected in 2019 by the relevant first-year treatment costs (see Table 3, Table 7, and Equation A1). We calculated annual costs for subsequent years using the ongoing costs of the 2019 cohort and the costs of the new cohort expected in respective years (Equations A2 to A5). We did this for each of the subgroups and added them together.

Note: The costs derived from the collaborative health technology assessment[1] consider mortality, so calculations are based on the total number of people (alive or dead) in the cohort.

**Equation A1**
$$2019\ \text{Total Costs} = \text{Volumes}_{2019} \times \text{Cost}_{Y1}$$

**Equation A2**
$$2020\ \text{Total Costs} = (\text{Volumes}_{2019} \times \text{Cost}_{Y2}) + (\text{Volumes}_{2020} \times \text{Cost}_{Y1})$$

**Equation A3**
$$2021\ \text{Total Costs} = (\text{Volumes}_{2019} \times \text{Cost}_{Y3}) + (\text{Volumes}_{2020} \times \text{Cost}_{Y2}) + (\text{Volumes}_{2021} \times \text{Cost}_{Y1})$$

**Equation A4**
$$2022\ \text{Total Costs} = (\text{Volumes}_{2019} \times \text{Cost}_{Y4}) + (\text{Volumes}_{2020} \times \text{Cost}_{Y3}) + (\text{Volumes}_{2021} \times \text{Cost}_{Y2}) + (\text{Volumes}_{2022} \times \text{Cost}_{Y1})$$

**Equation A5**
$$2023\ \text{Total Costs} = (\text{Volumes}_{2019} \times \text{Cost}_{Y5}) + (\text{Volumes}_{2020} \times \text{Cost}_{Y4}) + (\text{Volumes}_{2021} \times \text{Cost}_{Y3}) + (\text{Volumes}_{2022} \times \text{Cost}_{Y2}) + (\text{Volumes}_{2023} \times \text{Cost}_{Y1})$$

**Table A1: MIGS Devices Currently Approved by Health Canada**

| Device/Procedure[37] | Mechanism[a] | Included in CADTH Primary Economic Evaluation? |
|---|---|---|
| Endoscopic cyclophotocoagulation (ECP) | Using tissue ablation to reduce aqueous fluid production, thereby relieving intraocular pressure | Yes, comparisons included:<br>• ECP vs. surgery (glaucoma drainage device)<br>• ECP + cataract surgery vs. cataract surgery alone<br>• ECP + cataract surgery vs. surgery (trabeculectomy) + cataract surgery |
| Trabectome[a] | Using tissue ablation/removal to bypass the trabecular meshwork, this increases trabecular outflow and relieves intraocular pressure | Yes, comparisons included:<br>• Trabectome vs. surgery (trabeculectomy)<br>• Trabectome + cataract surgery vs. surgery (trabeculectomy) + cataract surgery |
| Kahook Dual Blade | Using tissue ablation/removal to bypass the trabecular meshwork, this increases trabecular outflow and relieves intraocular pressure | No[b] |
| iStent (first generation),<br>iStent inject (second generation) | Using a device to bypass the trabecular meshwork, thereby increasing trabecular outflow and relieving intraocular pressure | Yes, comparisons included:<br>• 2 × iStent inject vs. pharmacotherapy alone<br>• 2 × iStent vs. pharmacotherapy alone<br>• 2 × iStent + cataract surgery vs. cataract surgery alone<br>• iStent + cataract surgery vs. cataract surgery alone<br>• 2 × iStent inject vs. surgery (trabeculectomy) |
| Hydrus Microstent | Using a device to bypass the trabecular meshwork, thereby increasing trabecular outflow and relieving intraocular pressure | Yes, comparisons included:<br>• Hydrus Microstent vs. laser therapy (selective laser trabeculectomy)<br>• Hydrus Microstent + cataract surgery vs. cataract surgery alone |
| Gonioscopy-assisted transluminal trabeculectomy (GATT) | Using 360º suture to bypass the trabecular meshwork, thereby increasing trabecular outflow and relieving intraocular pressure | No[c] |
| CyPass Micro-Stent[d] | Using suprachoroidal shunts to increase uveoscleral outflow, thereby relieving intraocular pressure | Yes, comparisons included:<br>CyPass Micro-Stent + cataract surgery vs. cataract surgery alone |
| XEN 45 Gel Stent<br>XEN 63 Gel Stent<br>XEN 140 Gel Stent | Creating a subconjunctival pathway for filtration to relieve intraocular pressure | Yes, comparisons included:<br>• XEN vs. surgery (trabeculectomy) |

[a]Table adapted from collaborative health technology assessment.[1]
[b]The only clinical study identified compared the Kahook dual blade + cataract vs. iStent + cataract, and this comparison was not included in the economic model.
[c]No clinical studies identified; thus, this comparison was not included in the economic model.
[d]CyPass Micro-Stent was voluntarily withdrawn from the global market by the manufacturer.

**Table A2: Number of Cataract Surgeries and Filtration Surgeries Expected Per Year in Ontario**

| | | Projected Volumes[a] | | | | |
|---|---|---|---|---|---|---|
| | 2010-2016 | Year 1 (2019) | Year 2 (2020) | Year 3 (2021) | Year 4 (2022) | Year 5 (2023) |
| Cataract surgery, total # patients (E140A)[b] | 99,591–100,111 | 100,558 | 100,781 | 101,005 | 101,228 | 101,451 |
| Proportion with glaucoma[55] | 0.226 | 0.226 | 0.226 | 0.226 | 0.226 | 0.226 |
| Total cataract surgery with glaucoma | 22,507–22,625 | 22,726 | 22,777 | 22,827 | 22,878 | 22,928 |
| Filtration surgery, total # patients (E132A, E214A)[b] | 2,318–3,332 | 3,721 | 3,877 | 4,033 | 4,189 | 4,345 |

[a]Linear projection.
[b]Intellihealth, total number of patients, accessed October 24, 2018.

**Table A3: Annual Per-Person Cost Breakdowns—Reference Case**

| | | Annual Per-Person Cost, $[a] | | | | |
|---|---|---|---|---|---|---|
| | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| **Subgroup 1** | | | | | | |
| Average MIGS[b] | Initial procedure | 4,891 | 0 | 0 | 0 | 0 |
| | Pharmacotherapy | 0 | 0 | 0 | 0 | 0 |
| | Follow-up procedure | 10 | 30 | 48 | 63 | 76 |
| | Severity-specific costs | 201 | 207 | 212 | 215 | 216 |
| | **Total** | 5,101 | 237 | 260 | 278 | 292 |
| Average comparator[c] | Initial procedure | 1,941 | 0 | 0 | 0 | 0 |
| | Pharmacotherapy | 39 | 35 | 30 | 26 | 22 |
| | Follow-up procedure | 11 | 34 | 53 | 70 | 82 |
| | Severity-specific costs | 202 | 208 | 213 | 217 | 218 |
| | **Total** | 2,194 | 277 | 297 | 312 | 322 |
| **Subgroup 2** | | | | | | |
| Average MIGS[d] | Initial procedure | 3,736 | 0 | 0 | 0 | 0 |
| | Pharmacotherapy | 38 | 32 | 27 | 23 | 20 |
| | Follow-up procedure | 80 | 103 | 111 | 113 | 113 |
| | Severity-specific costs | 253 | 261 | 262 | 261 | 258 |
| | **Total** | 4,107 | 397 | 401 | 397 | 391 |
| Average comparator[e] | Initial procedure | 1,684 | 0 | 0 | 0 | 0 |
| | Pharmacotherapy | 96 | 88 | 81 | 74 | 67 |
| | Follow-up procedure | 81 | 97 | 106 | 109 | 110 |
| | Severity-specific costs | 253 | 261 | 262 | 260 | 258 |
| | **Total** | 2,113 | 446 | 448 | 443 | 434 |
| **Subgroup 3** | | | | | | |
| Average MIGS[f] | Initial procedure | 3,565 | 0 | 0 | 0 | 0 |
| | Pharmacotherapy | 33 | 30 | 26 | 23 | 20 |
| | Follow-up procedure | 0 | 0 | 0 | 0 | 0 |
| | Severity-specific costs | 324 | 307 | 314 | 319 | 324 |
| | **Total** | 3,922 | 337 | 340 | 342 | 344 |
| Average comparator[g] | Initial procedure | 5,065 | 0 | 0 | 0 | 0 |
| | Pharmacotherapy | 0 | 0 | 0 | 0 | 0 |
| | Follow-up procedure | 0 | 0 | 0 | 0 | 0 |
| | Severity-specific costs | 323 | 304 | 310 | 314 | 318 |
| | **Total** | 5,388 | 304 | 310 | 314 | 318 |

Abbreviations: MIGS, minimally invasive glaucoma surgery

*Table A3 notes continued on the next page.*

*Table A3 notes continued from the previous page.*
[a]In 2018 Canadian dollars.
[b]MIGS in this subgroup included Hydrus Microstent (and cataract surgery).
[c]Comparator in this subgroup included cataract surgery.
[d]MIGS in this subgroup included iStent inject, Hydrus Microstent, and trabectome.
[e]Comparators in this subgroup included medication, laser therapy, and trabeculectomy.
[f]MIGS in this subgroup included endoscopic cyclophotocoagulation and trabectome (and cataract surgery).
[g]Comparators in this subgroup included drainage implant, and trabeculectomy (and cataract surgery).

### Table A4: Scenario Analyses—Population and Uptake

| | Year of Analysis | | | | |
|---|---|---|---|---|---|
| | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| **Scenario 1: Type of glaucoma** | | | | | |
| Reference case, # people with open-angle glaucoma | 214,528 | 220,724 | 226,926 | 233,133 | 239,345 |
| Scenario 1, # people with any type of glaucoma | 289,903 | 298,276 | 306,657 | 315,044 | 323,439 |
| **Scenarios 2–4: Prevalence** | | | | | |
| Reference case[a], # people with glaucoma | 289,903 | 298, 276 | 306,657 | 315,044 | 323,439 |
| Scenario 2[b], # people with glaucoma | 279,696 | 287,972 | 296,248 | 304,525 | 312,801 |
| Scenario 3[c], # people with glaucoma | 300,127 | 308,266 | 316,405 | 324,545 | 332,684 |
| Scenario 4[d], # people with glaucoma | 198,297 | 200,786 | 203,275 | 205,764 | 208,253 |
| **Scenario 5: Current scenario uptake** | | | | | |
| Reference case, constant update, # people expected to get MIGS | 1,500 | 1,529 | 1,566 | 1,598 | 1,630 |
| Scenario 5, increased uptake (+ 0.2% each year), # people expected to get MIGS | 1,500 | 1,985 | 2,494 | 3,029 | 3,588 |

Abbreviations: MIGS, Minimally Invasive Glaucoma Surgery.
[a]Prevalence based on mean from Percurrio et al[10] and projected over time.
[b]Prevalence based on lower confidence interval from Percurrio et al[10] and projected over time.
[c]Prevalence based on upper confidence interval from Percurrio et al[10] and projected over time.
[d]Prevalence based on mean from Percurrio et al[10] (2002/03) and assumed to stay constant over time.

**Table A5: Scenario Analyses—Costs**

| | Annual Per-Person Cost, $[a] | | | | |
|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| **Reference case: 50% get bilateral intervention** | | | | | |
| Subgroup 1, average MIGS[b] | 5,101 | 237 | 260 | 278 | 292 |
| Subgroup 1, average comparator[c] | 2,194 | 277 | 297 | 312 | 322 |
| Subgroup 2, average MIGS[d] | 4,107 | 397 | 401 | 397 | 391 |
| Subgroup 2, average comparator[e] | 2,113 | 446 | 448 | 443 | 434 |
| Subgroup 3, average MIGS[f] | 3,922 | 337 | 340 | 342 | 344 |
| Subgroup 3, average comparator[g] | 5,388 | 304 | 310 | 314 | 318 |
| **Scenario 10: 0% get bilateral intervention** | | | | | |
| Subgroup 1, average MIGS[b] | 3,471 | 237 | 260 | 278 | 292 |
| Subgroup 1, average comparator[c] | 1,546 | 277 | 297 | 312 | 322 |
| Subgroup 2, average MIGS[d] | 2,861 | 397 | 401 | 397 | 391 |
| Subgroup 2, average comparator[e] | 1,552 | 446 | 448 | 443 | 434 |
| Subgroup 3, average MIGS[f] | 2,734 | 337 | 340 | 342 | 344 |
| Subgroup 3, average comparator[g] | 3,700 | 304 | 310 | 314 | 318 |
| **Scenario 11: 100% get bilateral intervention** | | | | | |
| Subgroup 1, average MIGS[b] | 6,732 | 237 | 260 | 278 | 292 |
| Subgroup 1, average comparator[c] | 2,841 | 277 | 297 | 312 | 322 |
| Subgroup 2, average MIGS[d] | 5,352 | 397 | 401 | 397 | 391 |
| Subgroup 2, average comparator[e] | 2,675 | 446 | 448 | 443 | 434 |
| Subgroup 3, average MIGS[f] | 5,111 | 337 | 340 | 342 | 344 |
| Subgroup 3, average comparator[g] | 7,076 | 304 | 310 | 314 | 318 |
| **Scenario 12, new MIGS billing code** | | | | | |
| Subgroup 1, average MIGS[b] | 4,658 | 237 | 260 | 278 | 292 |
| Subgroup 2, average MIGS[d] | 3,664 | 397 | 401 | 397 | 391 |
| Subgroup 3, average MIGS[f] | 3,479 | 337 | 340 | 342 | 344 |

Abbreviations: MIGS, minimally invasive glaucoma surgery
[a]In 2018 Canadian dollars.
[b]MIGS in this subgroup included Hydrus Microstent (and cataract surgery).
[c]Comparator in this subgroup included cataract surgery.
[d]MIGS in this subgroup included iStent inject, Hydrus Microstent, and trabectome.
[e]Comparators in this subgroup included medication, laser therapy, and trabeculectomy.
[f]MIGS in this subgroup included endoscopic cyclophotocoagulation and trabectome (and cataract surgery).
[g]Comparators in this subgroup included drainage implant, and trabeculectomy (and cataract surgery).

**Table A6: Budget Impact Analysis Results—Reference Case Cost Breakdowns; Slow Uptake**

| Scenario | Budget Impact, $ Million[a] | | | | | |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| **Current Scenario (Not Publicly Funded)** | | | | | | |
| **MIGS Costs** | | | | | | |
| Initial procedure | 6.79 | 6.99 | 7.18 | 7.38 | 7.58 | 35.92 |
| Pharmacotherapy | 0.02 | 0.03 | 0.04 | 0.06 | 0.07 | 0.21 |
| Follow-up procedure | 0.03 | 0.10 | 0.18 | 0.29 | 0.41 | 1.01 |
| Severity-specific costs | 0.34 | 0.69 | 1.06 | 1.44 | 1.83 | 5.34 |
| **Total** | 7.18 | 7.80 | 8.47 | 9.16 | 9.88 | 42.49 |
| **Non-MIGS Costs[b]** | | | | | | |
| Initial procedure | 1.10 | 1.01 | 5.16 | 11.81 | 17.40 | 36.48 |
| Pharmacotherapy | 0.02 | 0.04 | 0.10 | 0.41 | 0.73 | 1.30 |
| Follow-up procedure | 0.01 | 0.03 | 0.06 | 0.32 | 0.66 | 1.08 |
| Severity-specific costs | 0.11 | 0.22 | 0.68 | 2.10 | 3.91 | 7.01 |
| **Total** | 1.25 | 1.30 | 6.00 | 14.64 | 22.70 | 45.88 |
| **MIGS + Non-MIGS Costs** | | | | | | |
| Initial procedure | 7.89 | 7.99 | 12.35 | 19.19 | 24.98 | 72.40 |
| Pharmacotherapy | 0.04 | 0.07 | 0.14 | 0.46 | 0.80 | 1.52 |
| Follow-up procedure | 0.05 | 0.13 | 0.24 | 0.61 | 1.08 | 2.10 |
| Severity-specific costs | 0.45 | 0.90 | 1.74 | 3.54 | 5.74 | 12.36 |
| **Total** | 8.43 | 9.10 | 14.47 | 23.80 | 32.58 | 88.37 |
| **New Scenario (Publicly Funded)** | | | | | | |
| **MIGS Costs** | | | | | | |
| Initial procedure | 9.05 | 9.05 | 20.55 | 31.66 | 43.34 | 113.66 |
| Pharmacotherapy | 0.02 | 0.04 | 0.08 | 0.15 | 0.23 | 0.53 |
| Follow-up procedure | 0.05 | 0.13 | 0.30 | 0.59 | 1.04 | 2.11 |
| Severity-specific costs | 0.45 | 0.90 | 1.94 | 3.53 | 5.73 | 12.55 |
| **Total** | 9.57 | 10.13 | 22.86 | 35.94 | 50.35 | 128.85 |
| **Non-MIGS Costs[b]** | NA | NA | NA | NA | NA | NA |
| **MIGS + Non-MIGS Costs** | | | | | | |
| Initial procedure | 9.05 | 9.05 | 20.55 | 31.66 | 43.34 | 113.66 |
| Pharmacotherapy | 0.02 | 0.04 | 0.08 | 0.15 | 0.23 | 0.53 |
| Follow-up procedure | 0.05 | 0.13 | 0.30 | 0.59 | 1.04 | 2.11 |
| Severity-specific costs | 0.45 | 0.90 | 1.94 | 3.53 | 5.73 | 12.55 |
| **Total** | 9.57 | 10.13 | 22.86 | 35.94 | 50.35 | 128.85 |
| **Budget Impact (New Scenario – Current Scenario)** | | | | | | |
| Initial procedure | 1.16 | 1.06 | 8.20 | 12.47 | 18.37 | 41.26 |
| Pharmacotherapy | -0.02 | -0.03 | -0.06 | -0.31 | -0.56 | -0.99 |
| Follow-up procedure | 0.00 | 0.00 | 0.06 | -0.01 | -0.03 | 0.01 |
| Severity-specific costs | 0.00 | 0.00 | 0.20 | 0.00 | 0.00 | 0.19 |
| **Total** | 1.14 | 1.03 | 8.40 | 12.14 | 17.77 | 40.48 |

Abbreviations: MIGS, minimally invasive glaucoma surgery; NA, not applicable

[a]In 2018 Canadian dollars.

[b]Non-MIGS alternatives include the comparators as described previously (i.e., cataract surgery alone, pharmacotherapy, laser therapy, filtration surgery, filtration surgery + cataract surgery).

**Table A7: Budget Impact Analysis Results—Reference Case Cost Breakdowns; Fast Uptake**

| Scenario | Budget Impact, $ Million[a] | | | | | |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
| **Current Scenario (Not Publicly Funded)** | | | | | | |
| **MIGS Costs** | | | | | | |
| Initial procedure | 6.79 | 6.99 | 7.18 | 7.38 | 7.58 | 35.92 |
| Pharmacotherapy | 0.02 | 0.03 | 0.04 | 0.06 | 0.07 | 0.21 |
| Follow-up procedure | 0.03 | 0.10 | 0.18 | 0.29 | 0.41 | 1.01 |
| Severity-specific costs | 0.34 | 0.69 | 1.06 | 1.44 | 1.83 | 5.34 |
| **Total** | 7.18 | 7.80 | 8.47 | 9.16 | 9.88 | 42.49 |
| **Non-MIGS Costs[b]** | | | | | | |
| Initial procedure | 6.15 | 22.12 | 37.65 | 56.74 | 71.11 | 193.77 |
| Pharmacotherapy | 0.13 | 0.59 | 1.27 | 2.41 | 3.65 | 8.05 |
| Follow-up procedure | 0.07 | 0.36 | 0.96 | 2.16 | 3.87 | 7.42 |
| Severity-specific costs | 0.62 | 2.89 | 6.71 | 12.80 | 20.24 | 43.26 |
| **Total** | 6.97 | 25.95 | 46.59 | 74.11 | 98.87 | 252.49 |
| **MIGS + Non-MIGS Costs** | | | | | | |
| Initial procedure | 12.94 | 29.11 | 44.83 | 64.12 | 78.68 | 229.68 |
| Pharmacotherapy | 0.15 | 0.62 | 1.32 | 2.46 | 3.72 | 8.26 |
| Follow-up procedure | 0.10 | 0.46 | 1.14 | 2.45 | 4.28 | 8.43 |
| Severity-specific costs | 0.96 | 3.57 | 7.76 | 14.24 | 22.07 | 48.61 |
| **Total** | 14.14 | 33.76 | 55.05 | 83.27 | 108.75 | 294.98 |
| **New Scenario (Publicly Funded)** | | | | | | |
| **MIGS Costs** | | | | | | |
| Initial procedure | 19.42 | 52.46 | 87.33 | 124.02 | 151.76 | 434.99 |
| Pharmacotherapy | 0.05 | 0.17 | 0.35 | 0.60 | 0.91 | 2.08 |
| Follow-up procedure | 0.10 | 0.44 | 1.16 | 2.35 | 4.10 | 8.15 |
| Severity-specific costs | 0.96 | 3.57 | 7.96 | 14.22 | 22.04 | 48.76 |
| **Total** | 20.53 | 56.64 | 96.79 | 141.20 | 178.82 | 493.97 |
| **Non-MIGS Costs[b]** | NA | NA | NA | NA | NA | NA |
| **MIGS + Non-MIGS Costs** | | | | | | |
| Initial procedure | 19.42 | 52.46 | 87.33 | 124.02 | 151.76 | 434.99 |
| Pharmacotherapy | 0.05 | 0.17 | 0.35 | 0.60 | 0.91 | 2.08 |
| Follow-up procedure | 0.10 | 0.44 | 1.16 | 2.35 | 4.10 | 8.15 |
| Severity-specific costs | 0.96 | 3.57 | 7.96 | 14.22 | 22.04 | 48.76 |
| **Total** | 20.53 | 56.64 | 96.79 | 141.20 | 178.82 | 493.97 |
| **Budget Impact (New Scenario – Current Scenario)** | | | | | | |
| Initial procedure | 6.49 | 23.35 | 42.49 | 59.90 | 73.08 | 205.31 |
| Pharmacotherapy | -0.10 | -0.45 | -0.96 | -1.86 | -2.81 | -6.18 |
| Follow-up procedure | 0.00 | -0.02 | 0.02 | -0.10 | -0.18 | -0.29 |
| Severity-specific costs | 0.00 | 0.00 | 0.19 | -0.02 | -0.03 | 0.15 |
| **Total** | 6.38 | 22.88 | 41.74 | 57.92 | 70.06 | 198.99 |

Abbreviations: MIGS, minimally invasive glaucoma surgery; NA, not applicable

[a]In 2018 Canadian dollars.

[b]Non-MIGS alternatives include the comparators as described previously (i.e., cataract surgery alone, pharmacotherapy, laser therapy, filtration surgery, filtration surgery + cataract surgery).

## Appendix 2: Letter of Information

Ontario
Health Quality Ontario

**LETTER OF INFORMATION**

Health Quality Ontario is conducting a review of **Minimally Invasive Glaucoma Surgery (MIGS)** for the treatment of mild to moderate **glaucoma.** The purpose is to understand whether this procedure should be more broadly funded in Ontario.

An important part of this review involves speaking to patients and families of those who have experience with glaucoma, who may or may not have experience a MIGS procedure. Our goal is to make sure the experiences of patients and caregivers are considered in the funding recommendations for the Flash device.

### WHAT DO YOU NEED FROM ME?

- ✓ 20-40 minutes of your time for a phone or in-person interview to share your story
- ✓ Permission to audio- (not video-) record the interview

### WHAT YOUR PARTICIPATION INVOLVES

If you agree to share your experiences, you will be asked to have an interview with Health Quality Ontario staff. The interview will likely last 20-40 minutes. It will be held in a private location or over the telephone. With your consent, the interview will be audio-recorded. The interviewer will ask you questions about you or your loved one's condition and your perspectives about glaucoma and treatment options in Ontario. If you or your loved one have experienced a MIGS procedure, the interviewer will ask some additional questions surrounding the procedure.

Participation is voluntary. You may refuse to participate, refuse to answer any questions or withdraw before your interview. Withdrawal will in no way affect the care you receive.

### CONFIDENTIALITY

All information collected for the review will be kept confidential and privacy will be protected except as required by law. The results of this review will be published, however no identifying information will be released or published. Any records containing information from your interview will be stored securely.

### RISKS TO PARTICIPATION:

There are no known physical risks to participating. Some participants may experience discomfort or anxiety after speaking about their lived experience. If this is the case, please speak to our staff.

If you are interested in participating, please contact Health Quality Ontario staff:

## Appendix 3: Interview Guide

Ontario
Health Quality Ontario

*Interview for Minimally Invasive Glaucoma Surgery (MIGS)*

**Intro**
Explain HQO purpose, HTA process, and purpose of interview
History of Glaucoma - diagnosis and background (general only) – family history?

**Lived- Experience**
Day-to-day routine
What is the impact of glaucoma and its progression on quality of life?
(Loss of independence?)
Impact on loved ones/caregivers, work, etc.?

**Therapies**
What current therapies/treatments are used and their impact?
Cost of therapies (example, eye drops?)
Is accessibility to therapies/treatments an issue (are you able to take advantage of all potential therapies?)
Expectations of current therapies?

**MIGS (if applicable)**
Information surrounding surgery for glaucoma?
Decision-making
Procedure (if applicable)
Recovery period?
Result, impact, change in quality of life (if applicable)

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# About Health Quality Ontario

Health Quality Ontario is the provincial lead on the quality of health care. We help nurses, doctors and other health care professionals working hard on the frontlines be more effective in what they do—by providing objective advice and data, and by supporting them and government in improving health care for the people of Ontario.

We focus on making health care more effective, efficient and affordable through a legislative mandate of:

- Reporting to the public, organizations, government and health care providers on how the health system is performing,
- Finding the best evidence of what works, and
- Translating this evidence into clinical standards, recommendations to health care professionals and funders, and tools that health care providers can easily put into practice to make improvements.

For more information about Health Quality Ontario, visit hqontario.ca.

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