A Retrospective Population-Based Analysis of Wait Times for Cataract Surgery in Ontario, Canada

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A Retrospective Population-Based Analysis of Wait Times for Cataract Surgery in Ontario, Canada

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Abstract

Background: This population-level study aims to estimate the wait times for cataract surgery in Ontario using a novel, objective, and data-driven method.

Methods: Using linked administrative health services records, adults that underwent cataract surgery between 2005-2019 in Ontario were included. Wait time 1 (WT1) represented the number of days from referral to initial visit with the cataract surgeon and wait time 2 (WT2) was the number of days from when the decision for surgery was made until the first eye cataract surgery date. In the primary analysis, a ranking method prioritized referrals from optometrists and then ophthalmologists over family physician referrals.

Results: The study cohort consisted of 1,138,532 individuals. Most patients were female (57.4%) and aged 65 and older (79.0%). In the primary analysis, the median WT1 was 67 days (interquartile range [IQR] = 118). There was a median WT2 of 77 days (IQR = 118). A total of 54.1%, 78.5% and 91.7% of patients waited less than 3, 6 and 12 months for WT1, respectively. For WT2, 49.5%, 77.1% and 93.3% of patients waited less than 3, 6 and 12 months. 19.3% of patients did not meet the provincial target time for WT1, and 20.5% did not meet the target for WT2.

Interpretation: Administrative health services data can be used to estimate wait times for cataract surgery in a data-driven manner. With this method, 35.0% of Ontario cataract surgery patients in 2005-2019 did not receive initial consultation or cataract surgery within the provincial wait time target of 182 days.

Keywords: cataract surgery, wait time, referral and consultation, ophthalmology, optometry

For Peer Review Only

Introduction

Cataract surgery is one the most commonly performed surgeries in Canada and is expected to more than double in volume over 25 years.[1-2] In Ontario, Canada, the Ministry of Health and Long-Term Care (MOHLTC) has identified access to cataract surgery as an essential priority.[3] There has been a projected 128% necessary increase in cataract surgical volumes over 25 years to meet population demand.[2] An examination of surgical wait time (WT) metrics is necessary to inform public policy.

Current cataract surgery WTs are publicly available via the Wait Time Information System™ (WTIS).[4] This database records and compares monthly WT data to provincial benchmarks. Two separate WTs are disclosed: the time from initial referral to the first appointment with an ophthalmologist (i.e., wait time 1 [WT1]), and the time from the diagnosis of a visually significant cataract to cataract surgery (i.e., wait time 2 [WT2]).[4] Surgeons assign one of four priority levels, which all have corresponding surgical WT targets (Table 1).[4] Most patients are designated as priority 4, meaning there is minimal risk of disease progression impacting morbidity. For these patients, the provincial target time is 182 days for WT1 and another 182 days for WT2. According to the WTIS, 82% and 59% of patients receive care within this benchmark for WT1 and WT2, respectively; however, there remains a significant range in WTs (12 days to 343 days) across different institutions and surgeons.[4] Long WTs have been associated with substantial visual loss and impact on quality of life.[5]

WTs on the WTIS are self-reported by surgeons. We hypothesize that WTs are overestimated or underestimated relative to true WTs depending on the surgeon or institution. This is because administrative policies for identifying cases on the system can differ, and it is difficult to independently verify the accuracy of this information.

An independent and data-driven process of reporting cataract surgery WTs in Ontario is needed. This may avoid potential data entry differences between surgeons and resultant inaccuracies. If data are timely and transparent, this approach may provide clearer insights into the regions that have high WTs and need further allocation of publicly funded cataract surgery cases. Using a repository of administrative health services records for the population eligible for universal health coverage in Ontario, this study aims to evaluate the feasibility and potential issues of WT estimation via provider billing codes. We aim to report the WTs with the application of this method, as well as the proportion of patients reaching WT targets set by the provincial government.

Methods

Data Sources

ICES is an independent, non-profit research institute that collects and analyzes health care and demographic data, without consent, for health system evaluation and improvement. This study uses datasets linked using encoded identifiers at ICES.

The Registered Persons' Database (RPDB) contains demographic information for anyone with provincial health insurance coverage in Ontario. The RPDB was used to gather baseline characteristics for individuals. The Ontario Health Insurance Plan (OHIP) dataset contains the claims for insured health services. OHIP records were used to determine WT1 and WT2 (Appendix 1).

Ethics approval was granted by the Trillium Health Partners Research Ethics Board (ID #1057). A Privacy Impact Assessment was approved, and the ethical considerations of participants followed protocols at the ICES. The secure health services databases at the ICES

were consulted by an experienced data analyst (M.H.) and all data were anonymized so no patient identifiers were collected or reported.

Cohort Selection

Individuals were included if they had a valid sex, age and provincial health insurance identification number and lived in Ontario on their surgery date. Using the OHIP database, all individuals who had cataract surgery between January 1st, 2005, and December 31st, 2019 that were aged 18 and older were considered for enrollment. The cataract surgery selection procedure can be found on Appendix 1.

Wait time Definition

WT2 was determined first. OHIP records were examined up to a maximum of 2 years prior to surgery date, and the second last visit to the cataract surgeon was defined as the date the decision for surgery was made. The second last visit to the surgeon was chosen as the start of WT2 given that this is most often the date that the decision to pursue surgery is made, and when the preoperative visit (i.e. last visit before surgery) is booked where preoperative testing is performed and reviewed with the patient. If there was only one visit with the cataract surgeon within the 2-year lookback window, then that visit was used. The number of days between the second last visit or only visit and the surgery date was defined as WT2.

Given that most cataract surgery referrals are made by optometrists,[6] a ranking method was used for the primary analysis. This ranking method ranked the source of referral to determine the referral date. The referral date from an optometrist was selected first. If no optometrist referral existed, then the referral from an external ophthalmologist was used. If both referrals did not exist, the referral date from the family physician was used (Appendix 1). Universal coverage of routine eye exams is covered for seniors and children, however is not

available for those aged 20-64. In the analysis, two sensitivity analyses were conducted to evaluate WTs: 1. choosing the earliest (i.e. furthest from surgery date), and 2. the latest (i.e. closest to surgery date) potential referral from any source. The number of days from referral to the first visit to the cataract surgeon after their referral, up to a maximum of 3 years, was defined as WT1.

If an individual did not have a referral, or if they did not see their cataract surgeon before their surgery date, they were excluded from the study. Individuals were excluded if they did not see their cataract surgeon within 2 years prior to their surgery, had more than four visits to their cataract surgeon within the 2 years preceding surgery, or did not see their cataract surgeon within 3 years from their referral.

Statistical Analysis

The primary aim of this study was to evaluate the feasibility, challenges, and limitations of this data-driven method to assess WT1 and WT2, and to characterize WT1 and WT2 for cataract surgery with this method via descriptive characteristics. We investigated the proportion of patients who had a WT1 or WT2 of less than 3, 6, and 12 months, as well as the proportion that did not meet the provincial target time of 182 days for WT1 and WT2. A secondary analysis computed surgical WTs stratified by referral source. A subgroup analysis evaluated WTs in patients with a single referral that met eligibility criteria as a separate cohort from patients with multiple eligible referrals. No information on surgical priority groups were available, so all patients were compared to the WT targets for priority 4 cases. All analyses were conducted at ICES using SAS Statistical Software (version 9.4).

Results

Baseline Demographics

Overall, 20,795,884 individuals with a valid sex, age and provincial health insurance identification number were identified. Following exclusions, the study cohort consisted of 1,138,532 individuals (Figure 1). Table 2 details the baseline demographic information for the cohort. Briefly, more females (n=651,890, 57.3%) and those aged 65 and older (n=898,926, 79.0%) underwent cataract surgery. Most patients (n=869,724, 76.4%) had two or three potential referrals before surgery within the prespecified lookback window.

The practitioner type for initial referral is provided on Table 3. In the primary analysis, optometrists saw patients preoperatively as the potential referral source in 78.8% of cases (n=897,524). In the sensitivity analysis of the earliest potential referral, approximately a third of patients saw an optometrist, and over half saw a family physician. In the sensitivity analysis of the latest potential referral, over half of patients saw an optometrist, while just over a third saw a family physician.

Primary Analysis

In the primary analysis, the median WT1 using the referral source ranking method was 67 days (interquartile range [IQR]=118) (Figure 2a). A total of 54.1%, 78.5% and 91.7% of patients waited less than 3, 6 and 12 months for WT1, respectively. A total of 19.3% of patients did not meet the provincial target time of 182 days for WT1 using the same method. In the sensitivity analysis, there was a median WT1 of 173 days (IQR=330) when using the earliest possible referral method up to the maximum of 3 years between referral and initial consultation with the cataract surgeon. This was in contrast to a WT1 of 49 days (IQR=83) when using the latest possible referral within the same lookback window.

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There was a median WT2 of 77 days (IQR=118) with the referral source ranking method in the primary analysis. For WT2, 49.5%, 77.1% and 93.3% of patients waited less than 3, 6 and 12 months. With this method, 20.5% of surgeries did not meet the provincial WT target. Our results were similar in the sensitivity analysis, for which the median WT2 was 83 days (IQR=134) when considering the earliest possible referral and 64 days (IQR=95) for the latest possible referral (Figure 2b).

Secondary Analysis – Referral Source

When analysis was stratified by referral source, there was a median WT1 of 65 days (IQR=108) for patients seen by an optometrist, 93 days (IQR=267) for patients seen by another ophthalmologist, and 144 days (IQR=294) for patients seen by a family physician (Figure 3a). The median WT2 was 77 days (IQR=116) for patients seen by an optometrist, 76 days (IQR=133) for patients seen by another ophthalmologist, and 69 days (IQR=106) for patients seen by a family physician (Figure 3b).

Subgroup Analysis – Single Eligible Referral

After restricting the analysis to patients with a single eligible referral, the median WT1 was 68 days (IQR=124). The median WT2 was 74 days (IQR=113).

Subgroup Analysis – Multiple Eligible Referrals

When restricting the analysis to consider only patients with multiple eligible referrals, the median WT1 was 67 days (IQR=116) for the ranking method, which contrasted with 227 days (IQR=377) when the earliest potential referral was considered, and 45 days (IQR=72) when considering the latest potential referral (Figure 3c). The median WT2 was 78 days (IQR=120) using the ranking method, which was in line with the results when the earliest potential referral

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(median=86 days, IQR=140) or latest potential referral (median=61 days, IQR=90) were considered (Figure 3d).

Discussion

In this analysis, the WTs from initial referral to first consultation and from first consultation to cataract surgery were investigated for over 1 million patients in a single-payer system in Ontario, Canada. In the primary analysis, there was a median WT1 of 67 days using the ranking method. There was also significant variability in the WT1 depending on what method was used to identify the initial referral date. For WT2, the median WTs were similar across the methods used, and the results showed a median WT2 of two to three months. A high proportion (35.0%) of cataract patients receiving surgery between 2005 and 2019 did not meet the priority 4 provincial WT target for either WT1 or WT2. There were similar WTs depending on whether there was a single or multiple eligible referrals.

The consequences of long WTs for cataract surgery have been well documented. A systematic review showed that patients who waited more than 6 months had a greater visual loss, adverse quality of life impact and higher risk of falls relative to those waiting less than 6 weeks.[5] Patients with worse visual acuity that waited for cataract surgery were significantly more likely to be depressed.[7] A cost-effectiveness analysis showed that increasing public treatment volumes is a cost-effective way of reducing WTs for cataract surgery.[8] The unequivocal patient, societal, and health system benefits of additional surgical volume must be considered.

The use of a large health administrative database for documentation of cataract surgical WTs has multiple advantages. By using an objective, data-driven, standardized methodology across centres, policymakers can appreciate regional differences in cataract surgical WTs, which would allow them to further allocate surgical cases to centres most in need. This method also

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allows for seamless real-time updates to surgical WTs. In contrast, the current approach of self-reported WTs on the WTIS may suffer from issues with purposeful or accidental data manipulation, potential for missing data as well as inaccuracies in reporting from individual centres. In addition, WTs from the administrative database can be scrutinized over time. Important uncertainty estimations can be provided in the analysis of administrative data, such as by incorporating a sensitivity analysis using the latest and earliest referral date. As well, a major conclusion of this analysis is that when using administrative data for tabulation of WT data, there is likely to be a higher degree of confidence with the WT2 results observed relative to WT1. Overall, the total WT is likely to be the most reliable, reprodicible, comparable and accurate measure.

With the administrative databases used, there is no identifier for the date of referral, so sensitivity analyses based on differing assumptions about the referring provider were used to recognize the uncertainty in these estimates. We acknowledge the possibility of misclassification of the referring physician. We did not consider referrals for cataract surgery that did not involve an optometrist, ophthalmologist or family physician. These other referrals likely represent a minority of cases, and only 1.8% of patients were excluded due to not having an initial visit by at least one of these health care professionals or for not having a visit to the cataract surgeon before surgery (Figure 1). For WT1, optometrists do not always report a billing code with a cataract diagnosis, and therefore other diagnostic optometrist codes were considered. Based on clinical experience, unique cases in which the WT1 exceeded 3 years or WT2 exceeded 2 years were excluded in the analysis, though these were a minority of cases (0.9%, Figure 1). This method of data reporting would not be able to account for changes to surgeon behaviour in referral management in the setting of an incentivized system. For WT2, patients followed at baseline by

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a cataract surgeon had an unclear date of visually significant cataract diagnosis, thus impacting the accuracy of the observed WT2. Similarly, factors that may influence WT2, such as preoperative anesthesia or subspecialist consultation, preoperative management of ocular comorbidities or patient hesitancy, could not be captured in the databases analyzed. These factors may lead to an overestimation of WT2.

In conclusion, the use of administrative health data to systematically calculate cataract surgery WTs represents a promising modality. In our analysis, 35.0% of cataract surgery patients in 2005-2019 did not receive initial ophthalmic consultation or surgery within the WT target of 182 days when considering the ranking method. The method provided allows for regions to be identified and prioritized for further government funding for cataract surgery based on high WTs, as well as an evaluation of predictors of WTs, such as institution type and year of surgery. These methods can be easily incorporated in the evaluation of WTs of other ambulatory surgeries. In our efforts to characterize WTs, we hope to aid researchers and policymakers in highlighting the access and disparities to cataract surgery care in Ontario.

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Table 1: Ontario Ministry of Health and Long-Term Care Priority Group Definitions

Priority	Clinical description	Target wait time 1	Target wait time 2
1	High probability of disease occurrence or progression impacting morbidity/mortality.	Within 7 days	Within 24 hours
2	Moderate probability of disease progression. Low probability of disease occurrence or progression impacting morbidity/mortality.	Within 30 days	Within 42 days
3	All patients who do not meet the criteria of Priority 2 or 4	Within 90 days	Within 84 days
4	Minimal risk of disease progression impacting morbidity/mortality.	Within 182 days	Within 182 days

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Table 2: Baseline Demographics and their Distribution in the Study Cohort

Baseline demographic	Frequency (N = 1,138,532)	Percent of study cohort
Sex		
Female	651,890	57.26%
Male	486,642	42.74%
Income quintile (1=lowest, 5=highest)		
Missing	3,181	0.28%
1	226,139	19.86%
2	238,787	20.97%
3	227,673	20.00%
4	220,451	19.36%
5	222,301	19.53%
Location indicator		
Missing	985	0.09%
Urban	988,768	86.85%
Rural	148,779	13.07%
Age at surgery date		
18-19	144	0.01%
20-24	515	0.05%
25-29	684	0.06%
30-34	1,178	0.10%
35-39	2,643	0.23%
40-44	6,408	0.56%

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45-49	15,210	1.34%
50-54	32,882	2.89%
55-59	64,652	5.68%
60-64	115,290	10.13%
65-69	187,711	16.49%
70-74	232,763	20.44%
75-79	232,732	20.44%
80-84	160,851	14.13%
85-89	68,349	6.00%
90-94	14,601	1.28%
95-99	1,818	0.16%
100+	101	0.01%
Calendar Year of Surgery		
2005	82,818	7.27%
2006	79,441	6.98%
2007	78,563	6.90%
2008	75,257	6.61%
2009	74,136	6.51%
2010	73,128	6.42%
2011	74,041	6.50%
2012	71,805	6.31%
2013	71,573	6.29%
2014	71,461	6.28%

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2015	71,313	6.26%
2016	75,662	6.65%
2017	76,992	6.76%
2018	80,123	7.04%
2019	82,219	7.22%
Local Health Integration Network		
Central	137,901	12.11%
Central East	145,332	12.76%
Central West	61,042	5.36%
Champlain	113,009	9.93%
Erie St. Clair	72,000	6.32%
Hamilton Niagara Haldimand Brant	133,502	11.73%
Mississauga Halton	77,992	6.85%
North East	59,382	5.22%
North Simcoe Muskoka	40,663	3.57%
North West	21,253	1.87%
South East	51,361	4.51%
South West	89,904	7.90%
Toronto Central	80,907	7.11%
Waterloo Wellington	54,284	4.77%
Institution type		
Missing	327,439	**28.76%**

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Hospital	517,511	**45.45%**
Ambulatory care centre	270,648	**23.77%**
Other	22,934	**2.01%**
Number of potential referrals		
1	268,808	23.61%
2	697,057	61.22%
3	172,667	15.17%
Potential optometrist referral		
Yes	897,524	78.83%
Potential ophthalmologist referral		
Yes	315,416	27.70%
Potential family physician referral		
Yes	967,983	85.02%

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Table 3: Source of Initial Referral Stratified by Analysis Type

Primary analysis: priority ranking		
Optometrist	897,524	78.83%
Ophthalmologist	117,659	10.33%
Family Physician	123,349	10.83%
Sensitivity analysis: earliest potential referral		
Optometrist	386,423	33.94%
Ophthalmologist	144,099	12.66%
Family Physician	608,010	53.40%
Sensitivity analysis: latest potential referral		
Optometrist	580,371	50.98%
Ophthalmologist	144,044	12.65%
Family Physician	414,117	36.37%

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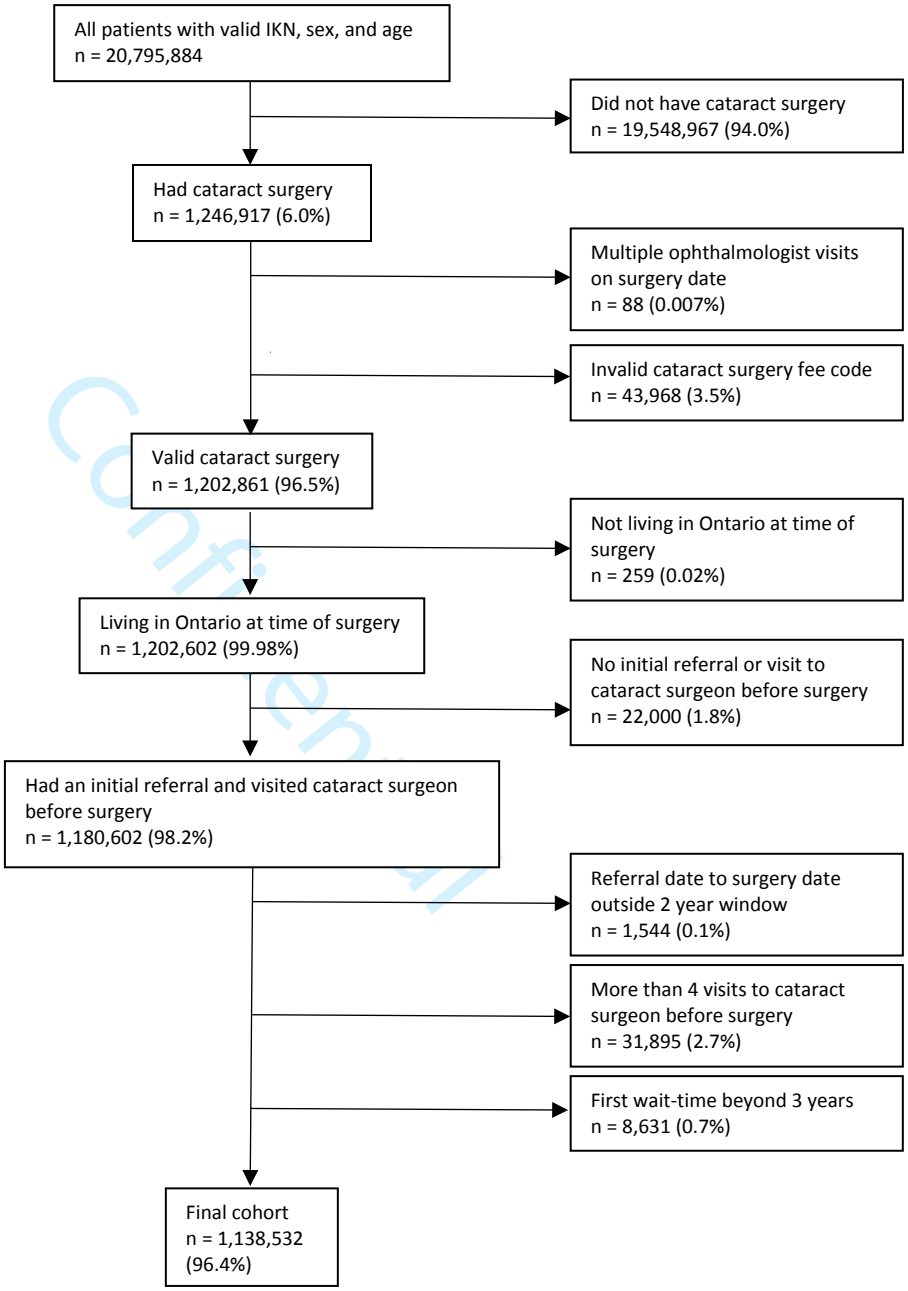
Figure 1: Consolidated Standards of Reporting Trials (CONSORT) Flow Chart for Study Selection



*IKN = Institute for Clinical Evaluative Sciences Number.

Figure 2a: Distribution of Time from Initial Referral to Initial Consultation with Cataract Surgeon (Wait Time 1) in the Primary Analysis

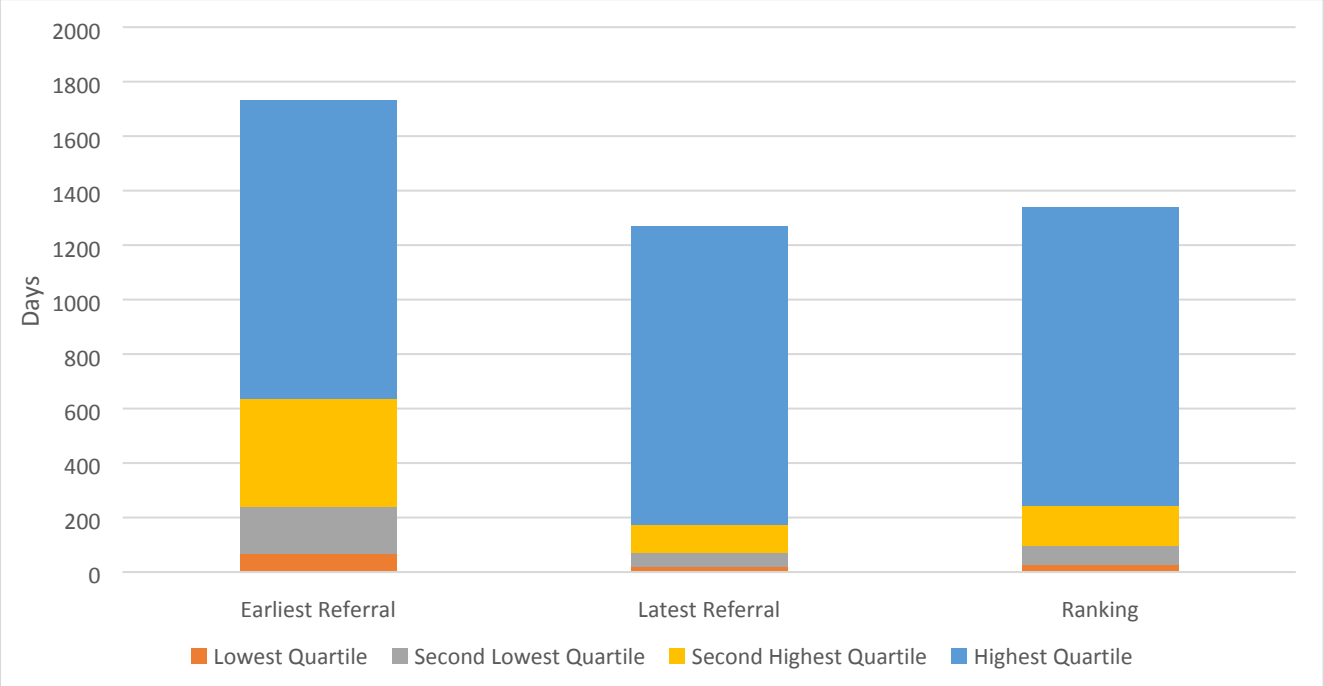


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Figure 2b: Distribution of Time from Initial Consultation with Cataract Surgeon to Cataract Surgery (Wait Time 2) in the Primary Analysis

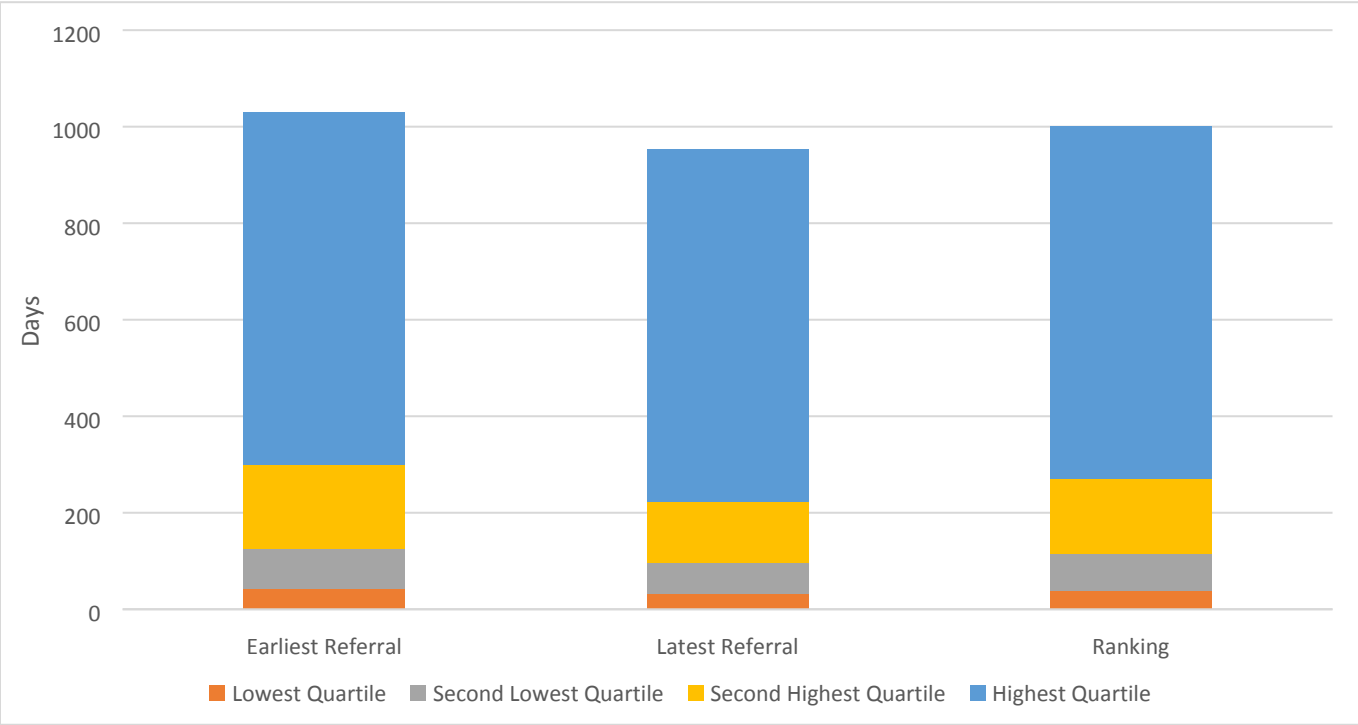

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Figure 3a: Distribution of Time from Initial Referral to Initial Consultation with Cataract Surgeon (Wait Time 1) Stratified by Referral Source

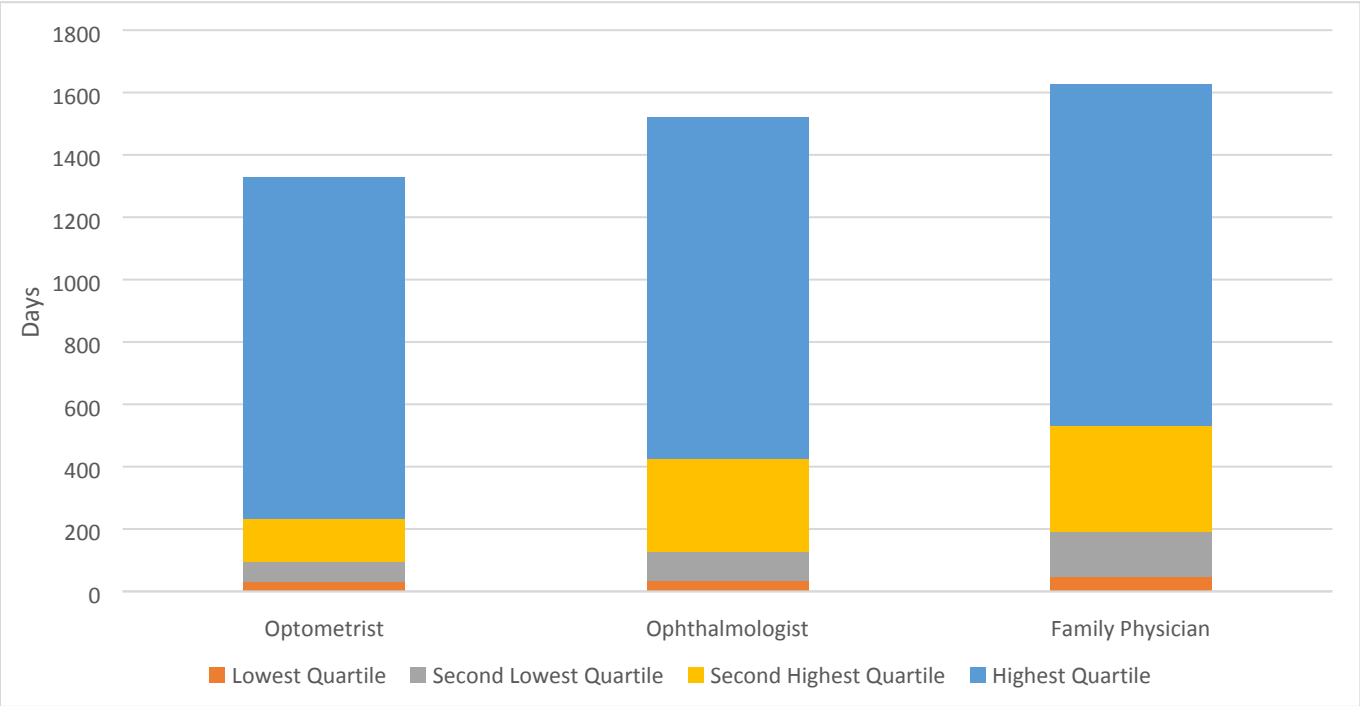

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Figure 3b: Distribution of Time from Initial Consultation with Cataract Surgeon to Cataract Surgery (Wait Time 2) Stratified by Referral Source

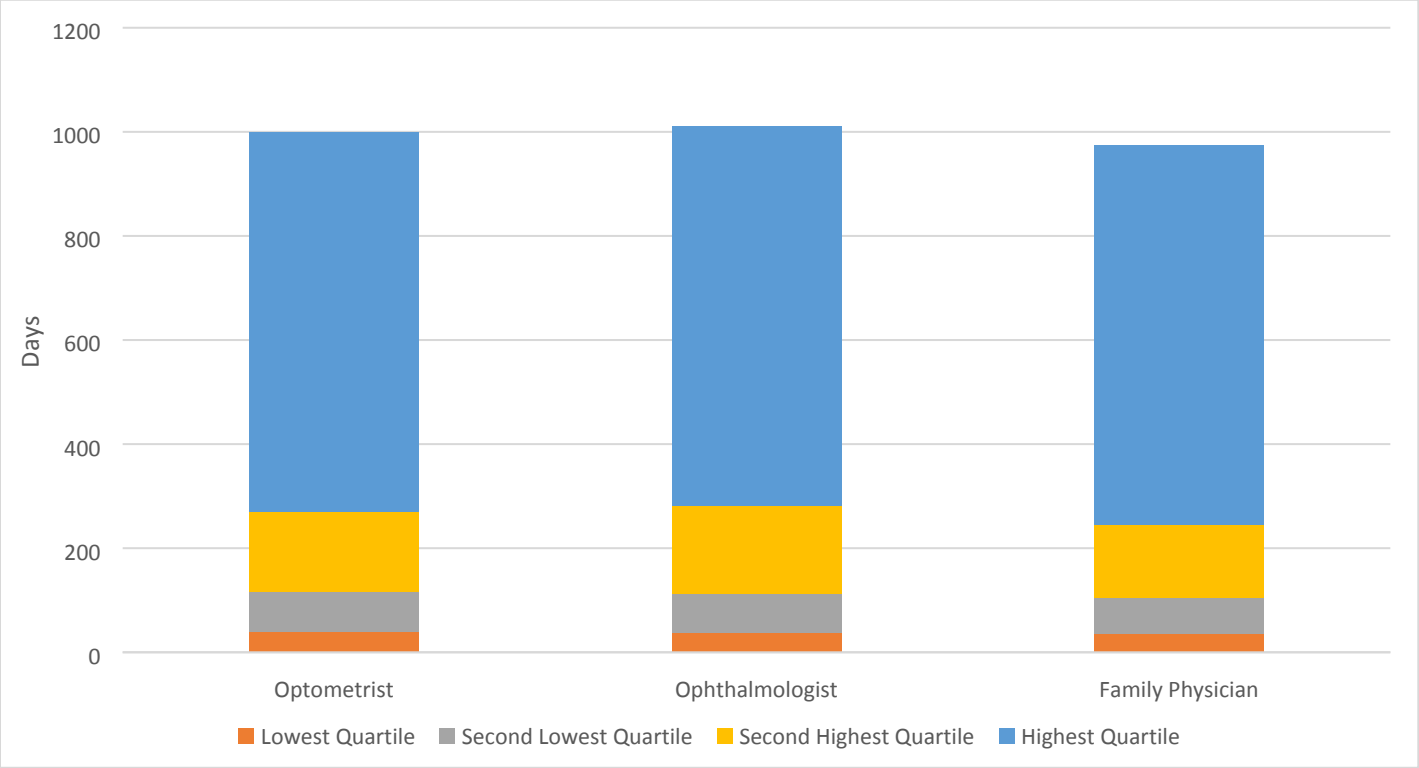


Figure 3c: Distribution of Time from Initial Referral to Initial Consultation with Cataract Surgeon (Wait Time 1) Restricted to Patients with Multiple Referral Sources

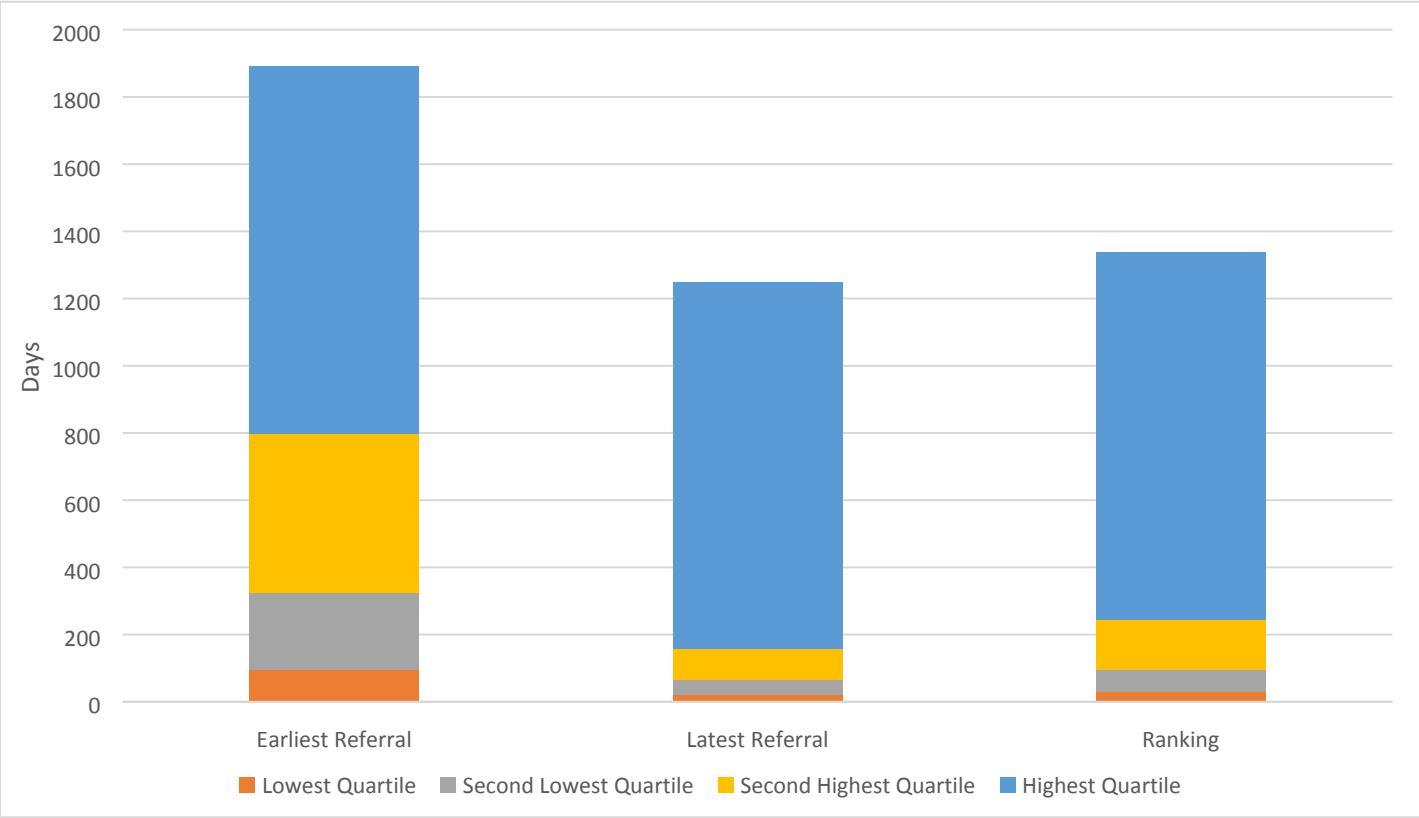
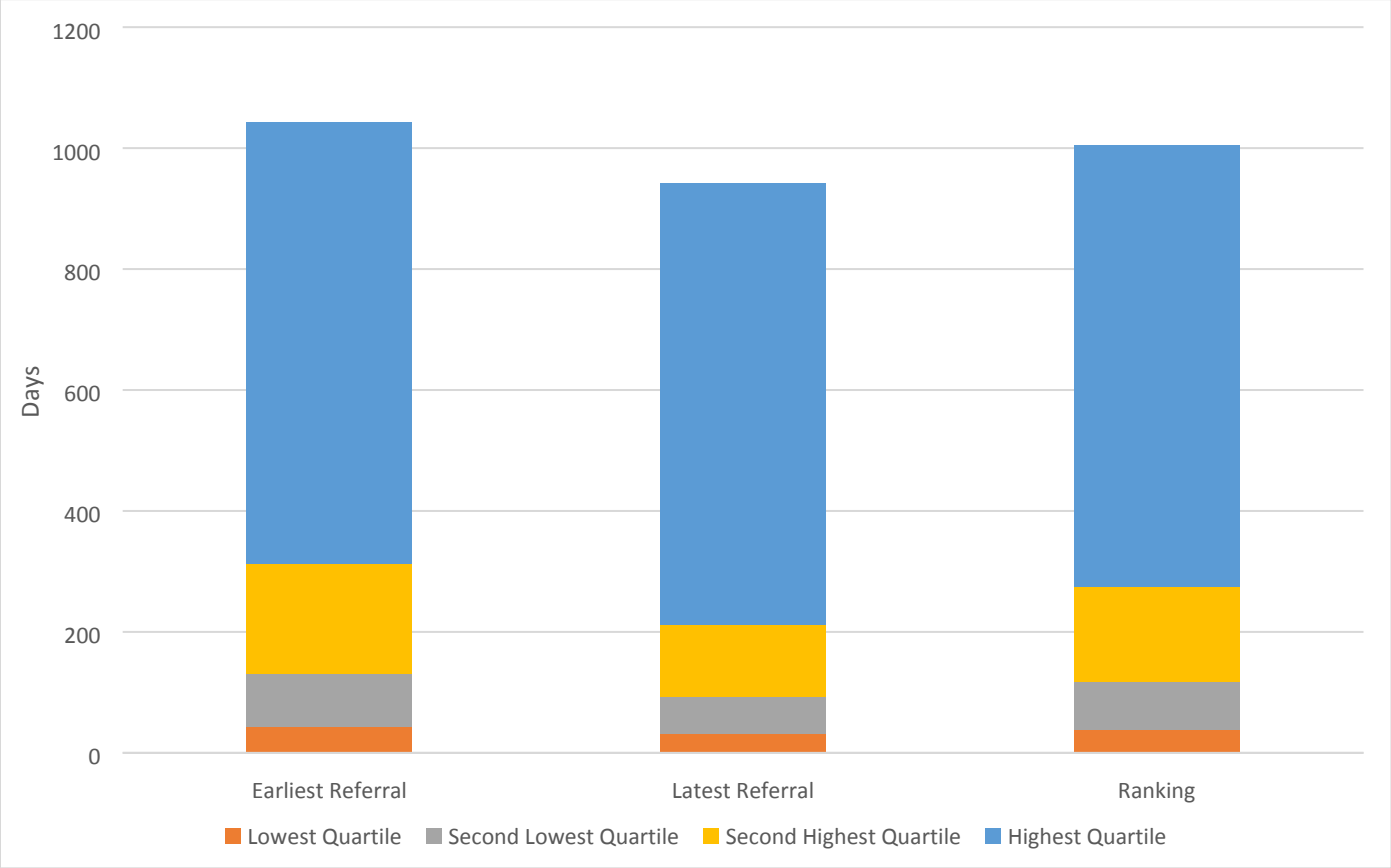


Figure 3d: Distribution of Time from Initial Consultation with Cataract Surgeon to Cataract Surgery (Wait Time 2) Restricted to Patients with Multiple Referral Sources



Appendix 1: Selection Procedure for Included Cataract Surgeries

Cataract surgery selection

OHIP fee codes were used to identify cataract surgeries for this study. All individuals who had a claim submitted by an ophthalmologist (spec=23) with the billing code 'E140' (i.e. cataract – all types, by any procedure, includes insertion of intraocular lens) were identified. Only the first claim within the study window was used to avoid potential overlap of claims for future cataract surgeries. The date this claim was made become the cataract surgery date.

To avoid complicated cataract surgeries, if another 'E-' billing code was present on the same day as the cataract surgery date, then these patients were removed from the cohort. Prior to September 1st, 2012, the 'E950' billing code was added with almost every 'E140' OHIP claim. As such, 'E950' was removed from the list of excluded 'E-' billing codes. In summary, all OHIP claims with only 'E140,' or 'E140' and 'E950' were considered for this study.

To identify the cataract surgeon, patients were removed from the study if they saw multiple ophthalmologists on the same day as their surgery.

Referral selection

The following OHIP claims were considered for a referral: a billing code 'V402', 'V406', 'V408'-'V409' submitted by an optometrist (spec=56), a billing code 'A233'-'A236' submitted by an ophthalmologist (spec=23) that was not their surgeon, or a billing code 'A001', 'A003'-'A006', 'A100', 'A112', 'A115', 'A888', 'A905', 'A911', 'A912', 'E077', 'K131', 'K132' submitted by a family physician (spec=00). For these claims to be considered a valid referral, the patient needed to see their cataract surgeon at least once between the referral date and the surgery date. A referral date from each source (i.e. optometrist, external ophthalmologist or family

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physician) was then selected, which satisfied the above requirements and was the closest to surgery date.

Given that most cataract surgery referrals are made by optometrists, a ranking method was used for the primary analysis. This ranking method ranked the source of referral to determine the referral date. The referral date from an optometrist was selected first. If no optometrist referral existed, then the referral from an external ophthalmologist was used. If both referrals did not exist, the referral date from the family physician was used.

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