Original Article

Cataract prevalence following a nationwide policy to shorten wait time for cataract surgery

Ge Yang [1,2,3], Sherif El-Defrawy [4], Graham E Trope [4], Yvonne M Buys [4], Sophia Y Liu [5] and Ya-Ping Jin [1,4,6]

[1] *Institute of Medical Science, University of Toronto, Toronto, Ontario, Canada*
[2] *School of First Clinical Medicine, Southern Medical University, Guangzhou, Guangdong, China*
[3] *Institute of Ophthalmology, University College London, London, United Kingdom*
[4] *Department of Ophthalmology and Vision Sciences, University of Toronto, Toronto, Ontario, Canada*
[5] *Department of Family Medicine, Schulich School of Medicine and Dentistry, Western University, London, Ontario, Canada*
[6] *Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada*

ABSTRACT

Background: Cataract is an age-related eye disease. Visual impairment from cataract can be restored by cataract surgery. In 2004 the Canadian federal government invested in a multibillion dollar wait time strategy to shorten the wait time for cataract surgery, a government-insured health service in all Canadian jurisdictions. We assessed if this nationwide policy reduced the number of Canadians waiting for cataract surgery as more individuals with cataract were free of cataract following the rapidly conducted surgery.

Methods: In this cross-sectional study we analyzed data from randomly selected individuals aged ≥ 45 years responding to the Canadian Community Health Survey (CCHS) in 2000/2001, 2003, 2005, and the CCHS Healthy Aging in 2008/2009. Information on cataract was obtained from self-reported questionnaire. The age- and sex-standardized prevalence of cataract was calculated for comparisons.

Results: Cataract was reported by 0.93 million Canadians in 2000/2001, 0.99 million in 2003, 1.10 million in 2005, and 1.34 million in 2008/2009. This corresponds to an age- and sex-standardized prevalence of 8.9% in 2000/2001, 9.0% in 2003, 9.5% in 2005, and 10.2% (P <0.05) in 2008/2009. The increase in age- and sex-standardized prevalence was greater in individuals without secondary school graduation than those with secondary school graduation or higher (4.3% versus 1.3%, P < 0.05) and was seen in all Canadian provinces. The largest increase was documented in a province (Saskatchewan, from 9.8% in 2000/2001 to 12.6% in 2008/2009, P < 0.05) with the longest median wait times for cataract surgery (118 days in 2008) and the lowest number of ophthalmologists per 100,000 population (1.96 versus 3.35 national average).

Conclusions: The age- and sex-standardized prevalence of cataract increased 4-5 years after the multibillion-dollar wait time strategy was launched in 2004. A lower threshold to diagnose cataract may be one potential reason for this finding. Further research is needed to understand the true reasons for the increase.

KEY WORDS

cataract, cataract surgery, prevalence, policy, government investment

INTRODUCTION

Cataract is a leading cause of visual impairment [1]. It increases the risk of falls and injuries [2, 3]. Visual impairment from cataract can be restored by cataract surgery. In Canada, the cost of cataract surgery is covered by

Correspondence: Ya-Ping Jin, MD, PhD, Department of Ophthalmology and Vision Sciences, University of Toronto, 340 College Street, Suite 400, Toronto, Ontario, Canada, M5T 3A9. Email: Yaping.Jin@utoronto.ca. ORCHID iD: 0000-0002-6348-0895.

How to cite this article: Yang G, El-Defrawy S, Trope GE, Buys YM, Liu SY, Jin YP. Cataract prevalence following a nationwide policy to shorten wait time for cataract surgery. Med Hypothesis Discov Innov Ophthalmol. 2021 Summer; 10(2): 86-94. https://doi.org/10.51329/mehdiophthal1426

Copyright © Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (http://creativecommons.org/licenses/by-nc/4.0/) which permits copy and redistribute the material just in noncommercial usages, provided the original work is properly cited.

federal and provincial governments. Prior to 2004, Canadians complained about the lengthy wait for cataract surgery. For instance, nearly half (48%) of Ontarians waited longer than the recommended maximum wait time benchmark of 16 weeks in 2003/2004 for this surgery [4].

To address the long wait times, from 2004, the Canadian federal government invested multibillion dollars to launch a wait time strategy to shorten wait times for medical care in five priority areas including cataract surgery in all Canadian jurisdictions [5]. This study examines the policy in relation to cataract surgery. Following this strategy, the number of cataract surgeries increased and the wait time for cataract surgery was reduced. As an example, in Ontario the number of cataract surgeries increased from 100,000 in 2003 to 140,000 in 2009 [6] and the percentage of patients who received cataract surgery within the benchmark of 16 weeks increased from 52% in 2003/2004 to 81% in 2014 [4, 7].

It is unknown however if this nationwide wait time strategy was successful in reducing the number of Canadians with cataract. We hypothesized that post-2004, the number of Canadians with cataract was reduced due to the shortened wait times and the increased volumes of cataract surgery [6, 7]. This study aimed to test this hypothesis. To better understand the impact of the policy intervention, our study also analyzed trends of cataract prevalence by province, educational level, and visual impairment in individuals with and without cataract.

METHODS

In this cross-sectional surveys we analyzed data collected from participants randomly selected by Statistics Canada in four nationwide surveys: the Canadian Community Health Survey (CCHS) in 2000/2001 (n = 60,569), 2003 (n = 68,036), 2005 (n = 66,475), and the CCHS Healthy Aging in 2008/2009 (n = 30,849) [8-11]. 2008/2009 was the last study year because vision-related questions, including cataract, were removed from the CCHS by Statistics Canada thereafter. Survey subjects were randomly chosen by Statistics Canada from a complex survey design with 2 sampling processes: household sampling and individual sampling [12-15]. Survey response rates ranged from 91.9% in CCHS 2000/2001 to 92.9% in CCHS 2005 at the individual level [12-15]. Only respondents aged ≥ 45 years were included in the study for two reasons: 1) this was the youngest age surveyed in the CCHS Healthy Aging; and 2) cataract is a condition that largely affects people aged ≥ 45 years. Informed consent was obtained by Statistics Canada from all participants. The analysis of Statistics Canada data for this study was approved by the University of Toronto Research Ethics Board (protocol number 36562).

The number of individuals with cataract and the prevalence of cataract were the primary outcomes. Information on cataract was collected through survey questions: "Now I'd like to ask about certain chronic health conditions which you may have. We are interested in long-term conditions that have lasted or are expected to *last 6 months or more* and that have been *diagnosed by a health professional*." Following this opening question, respondents were asked "Do you have cataracts?" [16-19]. A positive answer was considered having cataract.

Respondent's age, sex, ethnic background, and province of residence were self-reported. Information on the highest level of education attained by the respondent was obtained through a series of questions that were grouped into four categories by Statistics Canada: less than secondary school graduation, secondary school graduation but no postsecondary education, some postsecondary education, and postsecondary degree/diploma. To allow for adequate sample sizes for meaningful analyses, we further consolidated this information into those who graduated from secondary school and those who did not.

Information on vision status was obtained from the survey question [16-19]: "The next set of questions asks about your day-to-day health. The questions are not about illnesses like colds that affect people for short periods. They are concerned with a person's usual abilities. You may feel that some of these questions do not apply to you, but it is important that we ask the same questions of everyone" [16-19]. After this introduction, respondents were asked:

"Are you usually able to see well enough to read ordinary newsprint *without* glasses or contact lenses?"
"Are you usually able to see well enough to read ordinary newsprint *with* glasses or contact lenses?"
"Are you able to see at all?"
"Are you able to see well enough to recognize a friend on the other side of the street *without* glasses or contact lenses?"
"Are you usually able to see well enough to recognize a friend on the other side of the street *with* glasses or contact lenses?"

Replies to the above questions were categorized by Statistics Canada into five mutually exclusive groups [8-11]:
(i) no visual problems;
(ii) problems corrected by lenses (distance, close, or both);
(iii) problems seeing distance (not corrected);

(iv) problems seeing close (not corrected); and
(v) problems seeing close and distance (not corrected) or no sight at all (blindness).

In the analyses, respondents with answers of (iii), (iv), or (v) represented someone with visual impairment seeing distance (iii), close (iv) or both (v), while those with answers of (i) and (ii) represented individuals with intact vision or vision problems corrected by lenses.

Data on median wait time for cataract surgery were gathered from reports by the Canadian Institute for Health Information [7] and the Institute for Clinical Evaluative Sciences [4]. We compared wait times for cataract surgery both before and after the wait time strategy was introduced for the provinces of Ontario and British Columbia using published reports [4, 6, 7]. Provincial distributions of ophthalmologists per 100,000 population were obtained from a published report [20].

Data were analyzed with SAS software (version 9.4). The prevalence of cataract was calculated as the proportion of people who self-reported having cataract among all respondents. Analyses were broken down by age, sex, highest level of education attained, and province of residence. To remove the effects of age and sex on comparisons over different study years, we calculated the age- and sex-standardized prevalence of cataract using the Canadian 2006 census population as the standard [21, 22]. Standardized rate ratios (SRR), obtained by dividing one age-standardized rate by another, and their corresponding 95% confidence intervals (CIs) were calculated to assess the statistical significance of the difference in standardized rates [23]. To account for the complex survey design and sample selections and to adjust for nonresponse, seasonal effect, and post-stratification, we used the survey weights provided by Statistics Canada in all analyses as required by Statistics Canada when producing population estimates [12-15].

RESULTS

Figure 1 shows the number of Canadians who answered positively to the cataract question in each of the survey years. The number of individuals with cataract increased from 0.93 million in 2000/2001 to 1.34 million in 2008/2009. Figure 2 displays the age- and sex-standardized prevalence of cataract in Canada. As shown, this increased from 8.9% in 2000/2001 to 10.2% in 2008/2009 ($P < 0.05$) among Canadians aged ≥ 45 years, and from 22.2% in 2000/2001 to 24.2% ($P < 0.05$) among those aged ≥ 65 years.

The increase in age- and sex-standardized prevalence was significantly greater ($P < 0.05$, Figure 3) in individuals who did not graduate secondary school (4.3%) compared to those who completed secondary school education or higher (1.3%).

Figure 4 shows the age- and sex-standardized prevalence in each province in all survey years. The greatest increase was documented in the province Saskatchewan, from 9.8% in 2000/2001 to 12.6% ($P < 0.05$) in 2008/2009.

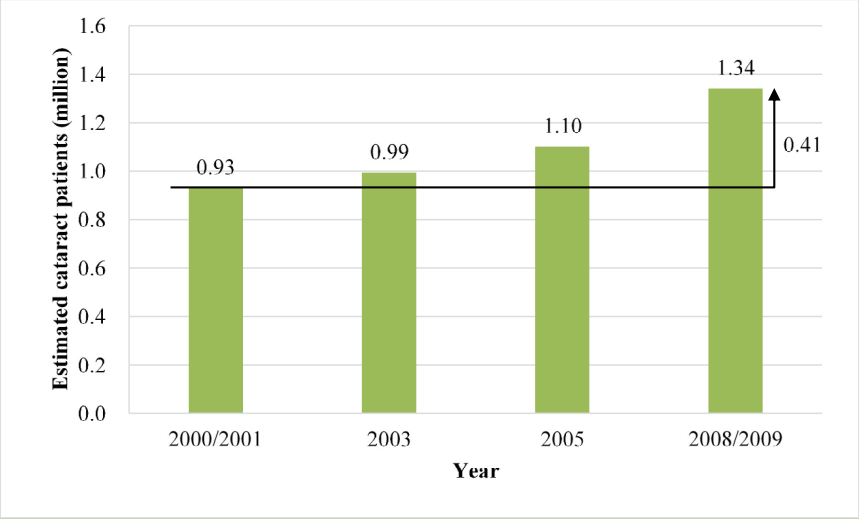

Figure 1. Estimated number of individuals with cataract in Canada from 2000/2001 to 2008/2009.

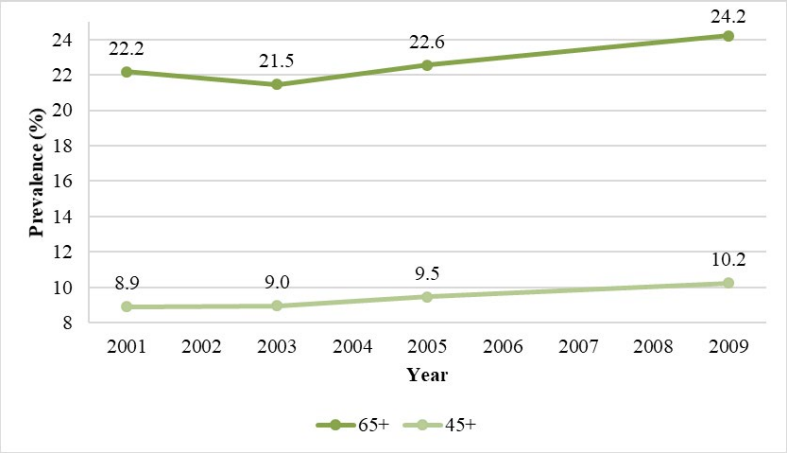

Figure 2. Age- and sex-standardized prevalence (%) of cataract in Canada from 2000/2001 to 2008/2009.

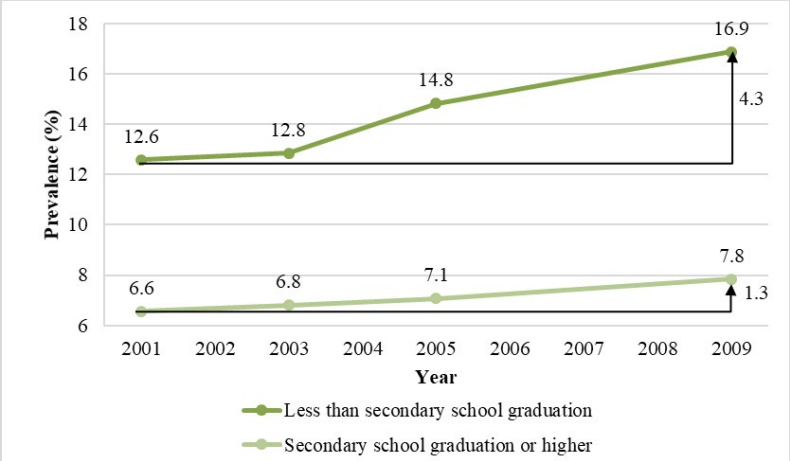

Figure 3. Age- and sex-standardized prevalence (%) of cataract by the highest level of education attained.

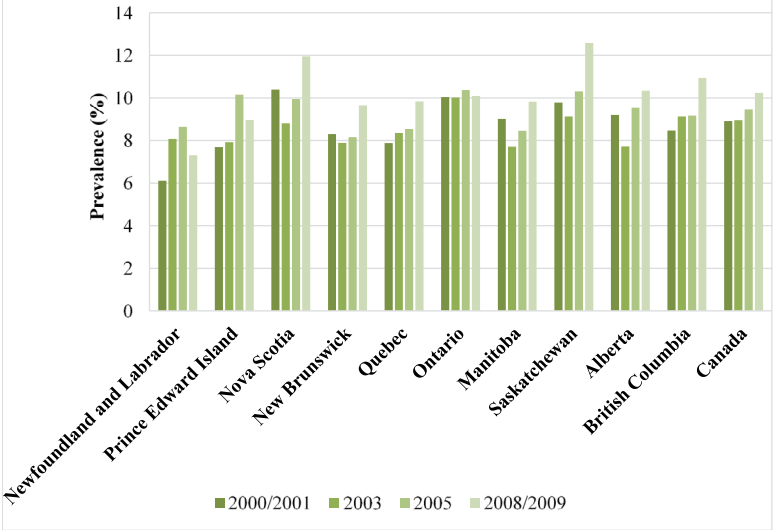

Figure 4. Age- and sex-standardized prevalence (%) of cataract in 10 Canadian provinces from 2000/2001 to 2008/2009.

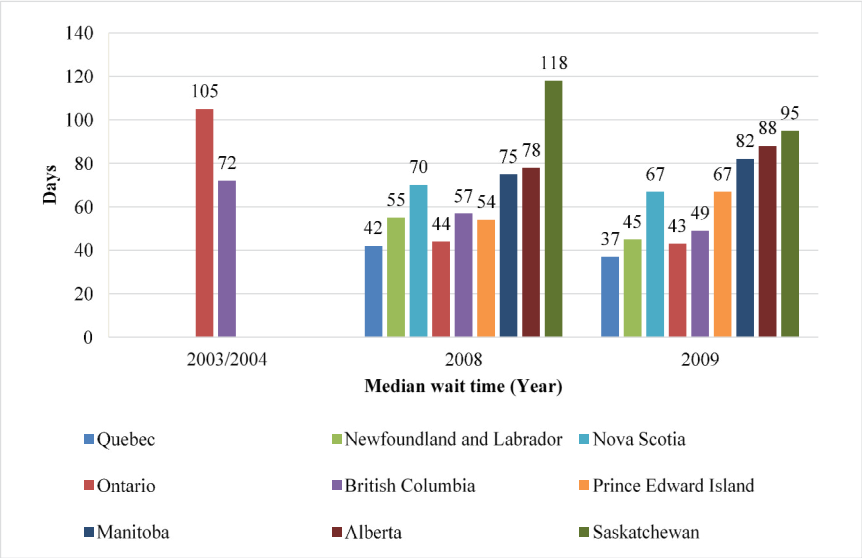

Figure 5. The median wait time for cataract surgery in 9 Canadian provinces. Detailed information for Newfoundland and Labrador is not available. Data for other study years was not available. Data source: Canadian Institute for Health Information [7] and Institute for Clinical Evaluative Sciences [4].

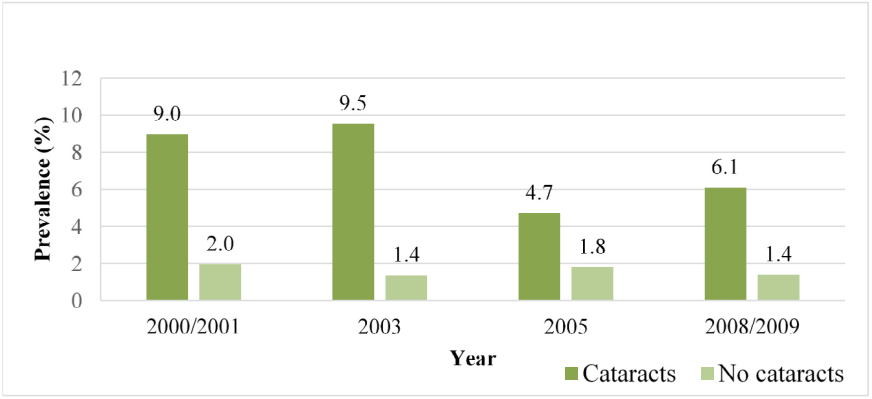

Figure 6. The prevalence (%) of visual impairment in individuals with and without self-reported cataract from 2000/2001 to 2008/2009. For 2005 data, only respondents from British Columbia were available.

Figure 5 shows the cataract surgery median wait time from 9 Canadian provinces. Wait time was 105 days (15 weeks) in 2003/2004 in Ontario compared with 43 days (6 weeks) in 2009 and was 72 days (10.3 weeks) in 2004 in British Columbia versus 49 days (7 weeks) in 2009. In 2008, wait times in the 9 provinces ranged from 42-118 days (6-17 weeks) and was 37-95 days (5-14 weeks) in 2009. In both 2008 and 2009, Saskatchewan had the longest median wait times for cataract surgery (118 days versus 42-78 days in other provinces in 2008 and 95 days versus 37-88 days in other provinces in 2009, Figure 5) [7]. Saskatchewan also had the lowest number of ophthalmologists per 100,000 population (1.96 versus 3.35 national averages) [20]. These results indicate that the greatest increase in cataract prevalence occurred in Saskatchewan (Figure 4).

Figure 6 shows that individuals with cataract were more likely to report visual impairment than those without cataract (4.7%-9.5% versus 1.4%-2.0%, $P < 0.05$). This finding holds in all survey years. However, the prevalence of visual impairment in individuals with cataract decreased from 9.0%-9.5% pre-2004 to 4.7%-6.1% post-2004 ($P < 0.05$), possibly suggesting both a lowered threshold for cataract surgery and shortened wait time for cataract surgery. This is in contrast with a stable prevalence of visual impairment among individuals without cataract over the study years (1.4%-2.0% pre-2004 versus 1.4%-1.8% post-2004, $P > 0.05$).

DISCUSSION

The prevalence of cataract and wait times for cataract surgery are two different concepts. However, they are highly correlated. If cataracts were not surgically removed, the number of people with cataracts would increase. This would lead to an increased prevalence of cataracts in the population.

In 2004, all Canadian provincial governments implemented a nationwide policy to shorten wait times for cataract surgery. This policy successfully reduced patient wait times for cataract surgery as shown in some individual provinces from 2004-2008 [4, 6, 7, 24], for example from 15 weeks in 2003/2004 to 7-8 weeks in 2009 in Ontario [4, 6]. Following the policy, the rate of cataract extraction increased significantly [6], mainly through increasing access to operating room time and improved efficiencies [25]. Despite these achievements, we report that the age- and sex-standardized prevalence of cataract increased post- versus pre-2004 ($P < 0.05$), particularly among people with lower levels of education and those residing in Saskatchewan. The reported increased prevalence of cataract post-2004 is in line with the projected need for cataract surgery doubling from 2006 to 2036 in Ontario, Canada, using the 2006 surgery rate (during the wait times strategy) as the base rate in the calculations [26].

Population aging increases the prevalence of cataract. In 2004, Condon et al. projected a dramatic increase in the number of aging Americans affected by cataract by 2020 [27]. Their conclusion was based on estimates of population aging with no policy interventions. In the wake of a Canada-wide policy intervention aimed at reducing wait time for cataract surgery, our data indicates that more Canadians had cataract post- versus pre-intervention, even when the effect of aging was adjusted for. Thus, additional factors other than aging likely contributed to the increased prevalence of cataract.

We postulate four potential reasons to account for the increase. First, the increased prevalence may have resulted from a lowered threshold to diagnose cataract in 2008/2009 compared with the threshold used to diagnose cataract and cataract surgery about 10 years earlier in 2000/2001 [28-32]. This postulation could be justified utilizing the outcome data from a prospective study that compared two patient cohorts (6 years apart, 1999-2000 versus 2006-2007) waiting for cataract surgery in Montreal, Canada. These authors reported better preoperative visual acuity in the latter/recent cohort (2006-2007 versus 1999-2000) [28]. The increased number of cataract patients from the lowered threshold for cataract diagnosis and cataract surgery may have outweighed the impact of changes introduced through the wait time strategy, thus leading to more cataract patients overall.

A second possibility involves the rising prevalence of diabetes in recent years in Canada [33, 34]. The risk of cataract in patients with diabetes was nearly twice that in non-diabetic subjects (odds ratio 1.97, 95% confidence interval 1.45-2.67) in a meta-analysis [33]. From 1998/1999 to 2008/2009, the prevalence of diabetes among Canadians increased by 70% [35]. However, our study was cross-sectional surveys, that is information on cataract and diabetes was collected at the same time, thus we could not provide reliable data whether cataract occurred before or after diabetes.

Thirdly, better detection of cataract from an increased number of optometrists in recent years may have led to the increase. The number of actively registered optometrists in Canada increased from 3,584 in 2000 to 4,581 in 2009 [36]. The increased optometric services may have resulted in improved access to eye examinations and better detection of cataract, thus more cataract patients.

Finally, incorrect answers cannot be ruled out in any population-based surveys. However, we do not think it is likely that incorrect answers drove the time trend we reported, as we do not have any reasons to believe that incorrect answers occurred more frequently in years after 2004 than years prior to 2004. The high prevalence of visual impairment in individuals with self-reported cataract versus those without self-reported cataract in all survey years (Figure 6) suggests that the cataract question was answered correctly by the majority of respondents in all survey years.

Our cataract prevalence increase was found to be greater among individuals with lower levels of education. This may suggest a greater incidence of cataract and/or disparity in accessing cataract surgery in this sub-population. Lower levels of education and poor diet are risk factors for cataract [37-39]. Together they may contribute synergistically to the increased prevalence of cataract among the low educated [37-39]. Furthermore, although cost barriers for cataract surgery have generally been removed by universal health coverage in Canada, health inequality is a well-documented issue in this country. Bell et al. showed that Ontarians living in low-income neighborhoods are less likely to receive cataract surgery than those living in higher-income neighborhoods [40]. The mechanisms underlying socioeconomic-related vision health inequality are not well-known and need to be investigated further.

There are limitations to this study. First, self-reported health data may be associated with detection and recall biases. The validity of self-reported cataract has been rarely examined. In a study from Mexican-Americans, self-

reported cataract was associated with a sensitivity of 36.8% and a specificity of 92.5% within 1 year from their last eye examination [41]. We do not know if this Mexican-American-based finding can be applied to a majority-white Canadian population. To provide accurate estimates on the prevalence of cataract, population-based eye exams are needed. Such studies however have not been conducted in Canada.

Health administrative data may contain information on cataract diagnosis and offers the potential to study changes in the prevalence of cataract over time. However, such data contains no information beyond age and sex and still suffers from the issue of inaccurate diagnosis as all patients referred for cataract consultation will be coded with cataract diagnosis during the physician billing process, even if the final diagnosis is not cataract. Moreover, it is quite challenging for researchers to negotiate data sharing agreements from 10 provinces to use their administrative data. Thus, self-reported surveys are a good alternative for obtaining data on cataract from a large population-based scale. This type of data has been widely used in many prior studies in the USA, Canada, Korea, and Taiwan [42-45].

A second limitation relates to the CCHS content change from year to year. Unfortunately, the CCHS Healthy Aging survey from 2008/2009 was the last one to assess cataract. We are thus unable to report more recent changes. However, the focus of our study was to examine if the wait time strategy reduced the number of Canadians with cataract, not to provide the latest number of Canadians affected by cataract. We therefore do not think this limitation invalidates our results. Previously we reported that the wait time for cataract surgery decreased from around 100 days in 2006 to 50 days in 2009 in Ontario, and then increased slightly from 50 days in 2009 to around 70 days in 2013 (a 28.5% increase) [6]. Nationwide, the percentage of patients undergoing cataract surgery within the benchmark (16 weeks) decreased from 80% in 2014 to 70% in 2018 [7]. All these suggest that the prevalence of cataract may be even higher post- versus pre-2004 if data from more recent years were available, thus supporting our findings with data up to 2009.

Thirdly, data on nationwide wait time before 2004 is not available. However, such information is available for Ontario and British Columbia. The data supports the reduction in wait times for cataract surgery following the introduction of the wait time strategy (Figure 5). Furthermore, information on interquartile range (IQR) for wait times was not available from the published report. The Canadian Institute for Health Information (CIHI) only reported the 50th percentile (median) wait time for individual provinces. There is no information available for the whole country or the 9 Canadian provinces combined. We are, therefore, unable to combine the cumulative data of all nine provinces.

Study strengths include randomly selected participants, good response rate, comprehensive information, and data from ten provinces. We call for Statistics Canada to continuously include vision related questions (e.g. questions related to cataract and glaucoma) in their annual surveys so that data from more recent years will be available. We also call for Statistics Canada to include an additional question on cataract surgery following the cataract question. Furthermore, to have accurate estimates on eye diseases, studies of population-based eye exams in Canada are needed.

CONCLUSIONS

A shortened wait time for cataract surgery likely leads to reduced numbers of people with cataract owning to more individuals with cataract receiving cataract surgery. However, this study reports that 4-5 years after a nationwide wait time strategy was launched, the prevalence of cataract and the number of Canadians with cataract were not reduced, but increased. This finding may reflect a change in the cataract diagnosis threshold, the rising prevalence of diabetes, and increased access to eye examinations. More studies are needed to investigate the reasons behind this increase.

ETHICAL DECLARATIONS

Ethical approval: Informed consent was obtained by Statistics Canada from all participants. The analysis of Statistics Canada data for this study was approved by the University of Toronto Research Ethics Board (protocol number 36562).

Conflict of interests: None.

FUNDING

Access to the data is through the Statistics Canada Research Data Centres (RDC) Program. RDCs are part of an initiative by Statistics Canada, the Social Sciences and Humanities Research Council (SSHRC) and university

consortia to help strengthen Canada's social research capacity and to support the policy research community. The program would like to acknowledge the generous support of the Canada Foundation for Innovation (CFI) and the Canadian Institutes of Health Research (CIHR). Although the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada or the Canadian Research Data Centre Network (CRDCN).

ACKNOWLEDGMENTS

The study abstract was presented at the 2017 Annual Meeting of the Association for Research in Vision and Ophthalmology (ARVO) on May 11, 2017 in Baltimore, Maryland and at the 2017 Annual Meeting of the Canadian Ophthalmological Society (COS) on June 18, 2017 in Montreal, Quebec. The dataset utilized in the present study is not publicly available due to privacy and confidentiality rules but may be available to those who meet the requirements set forth by Statistics Canada Research Data Centres (RDC). RDCs are operated under the provisions of the Statistics Act in accordance with all the confidentiality rules. Researchers with approved projects by Statistics Canada can access the data. Detailed contact information and application process and guidelines to access RDC data can be found at https://www.statcan.gc.ca/eng/rdc/process.

REFERENCES

1. Khairallah M, Kahloun R, Bourne R, Limburg H, Flaxman SR, Jonas JB, et al. Number of People Blind or Visually Impaired by Cataract Worldwide and in World Regions, 1990 to 2010. Invest Ophthalmol Vis Sci. 2015;56(11):6762-9. doi: 10.1167/iovs.15-17201 pmid: 26567788
2. Palagyi A, McCluskey P, White A, Rogers K, Meuleners L, Ng JQ, et al. While We Waited: Incidence and Predictors of Falls in Older Adults With Cataract. Invest Ophthalmol Vis Sci. 2016;57(14):6003-6010. doi: 10.1167/iovs.16-20582 pmid: 27820872
3. Hong T, Mitchell P, Burlutsky G, Samarawickrama C, Wang JJ. Visual impairment and the incidence of falls and fractures among older people: longitudinal findings from the Blue Mountains Eye Study. Invest Ophthalmol Vis Sci. 2014;55(11):7589-93. doi: 10.1167/iovs.14-14262 pmid: 25370514
4. Bell CM, Hatch WV, Cernat G, Slaughter PM, Singer S, Tu JV. (2005). Cataract Surgery. In: Tu JV, Pinfold SP, McColgan P, Laupacis A, editors. 'Access to Health Services in Ontario: ICES Atlas. Toronto: Institute for Clinical Evaluative Sciences; 2005'. Available at: https://www.ices.on.ca/Publications/Atlases-and-Reports/2005/Access-to-health-services (Accessed: June 6, 2021).
5. Canadian Institute for Health Information (2006). 'Waiting for Health Care in Canada: What We Know and What We Don't Know'. Available at: https://cwhn.ca/en/node/27523 (Accessed: June 6, 2021).
6. Szigiato AA, Trope GE, Jin Y, Buys YM. Wait times and volume of cataract surgery in Ontario: 2000-2012. Can J Ophthalmol. 2016;51(1):7-13. doi: 10.1016/j.jcjo.2015.09.006 pmid: 26874152
7. Canadian Institute for Health Information (2021). Wait times for cataracts, from 'Wait Times for Priority Procedures in Canada - Data Tables. Ottawa, ON: CIHI; 2021'. Available at: https://www.cihi.ca/sites/default/files/document/wait-times-priority-procedures-in-canada-data-tables-en.xlsx (Accessed: June, 2021).
8. Statistics Canada, Canadian Community Health Survey (CCHS) (2002). 'Detailed information for 2000-2001 (Cycle 1.1)'; public use microdata files. Ottawa, Ont.: Statistics Canada; 2003. Available at: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=3359 (Accessed: July 22, 2021).
9. Statistics Canada, Canadian Community Health Survey (CCHS) (2003). ' Detailed information for 2003 (Cycle 2.1)' ; public use microdata files Ottawa, Ont.: Statistics Canada; 2005. Available at: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=4995 (Accessed: July 22, 2021).
10. Statistics Canada, Canadian Community Health Survey (CCHS) (2005). ' Detailed information for 2005 (Cycle 3.1)'; public use microdata files. Ottawa, Ont.: Statistics Canada; 2006. Available at: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=22642 (Accessed: July 22, 2021).
11. Statistics Canada, Canadian Community Health Survey - Healthy Aging (CCHS) (2010). 'Detailed information for 2008-2009' ; public use microdata files. Ottawa, Ont.: Statistics Canada; 2010. Available at: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=47963 (Accessed: July 22, 2021).
12. Statistics Canada, Canadian Community Health Survey (CCHS) (2003). 'CCHS Cycle 1.1 (2000-2001), Public Use Microdata File Documentation'. User Guide. Available at: https://www.statcan.gc.ca/eng/statistical-programs/document/3226_D7_T9_V1-eng.pdf (Accessed: June 6, 2021).
13. Statistics Canada, Canadian Community Health Survey 2003 (2005). 'User Guide for the Public Use Microdata File'. Available at: https://www.statcan.gc.ca/eng/statistical-programs/document/3226_D7_T9_V2-eng.pdf (Accessed: July 22, 2021).
14. Statistics Canada, Canadian Community Health Survey (CCHS)(2006). 'Cycle 3.1 (2005) PUBLIC USE MICRODATA FILE (PUMF) USER GUIDE'. Available at: https://www.statcan.gc.ca/eng/statistical-programs/document/3226_D7_T9_V3-eng.pdf (Accessed: July 22, 2021).
15. Statistics Canada, Canadian Community Health Survey (CCHS) - Healthy Aging (2010). 'User Guide May 2010'. Available at: https://www.statcan.gc.ca/eng/statistical-programs/document/5146_D1_T1_V1-eng.pdf (Accessed: July 22, 2021).
16. Statistic Canada, Canadian Community Health Survey (CCHS) (2000). 'Questionnaire for Cycle 1.1 September, 2000 - November, 2001'. Available at: https://www.statcan.gc.ca/eng/statistical-programs/instrument/3226_Q1_V1-eng.pdf (Accessed: July 22, 2021).
17. Statistic Canada, Canadian Community Health Survey (CCHS) (2005). 'Questionnaire for CYCLE 2.1 January 2003 to November 2003, Revised version - July 2005'. Available at: https://www.statcan.gc.ca/eng/statistical-programs/instrument/3226_Q1_V2-eng.pdf (Accessed: July 22, 2021).
18. Statistic Canada, Canadian Community Health Survey (CCHS) (2005). ' CYCLE 3.1 FINAL Questionnaire June 2005 '. Available at: https://www.statcan.gc.ca/eng/statistical-programs/instrument/3226_Q1_V3-eng.pdf (Accessed: July 22, 2021).
19. Statistic Canada, Canadian Community Health Survey (CCHS) -Healthy Aging (2010). 'Questionnaire May 2010'. Available at: https://www.statcan.gc.ca/eng/statistical-programs/instrument/5146_Q1_V2-eng.pdf (Accessed: July 22, 2021).
20. Al Ali A, Hallingham S, Buys YM. Workforce supply of eye care providers in Canada: optometrists, ophthalmologists, and subspecialty

ophthalmologists. Can J Ophthalmol. 2015;50(6):422-8. doi: 10.1016/j.jcjo.2015.09.001 pmid: 26651300
21. Statistics Canada (2007). '2006 Census release topics'. [updated 2013-03-12]. Available at: http://www12.statcan.gc.ca/census-recensement/2006/rt-td/as-eng.cfm (Accessed: July 22, 2021).
22. Bains N. (2009). 'Stantardization of rates'. Available at: http://core.apheo.ca/resources/indicators/Standardization%20report_Nam-Bains_FINALMarch16.pdf (Accessed: July 22, 2021).
23. Ohsawa M, Tanno K, Okamura T, Yonekura Y, Kato K, Fujishima Y, et al. Standardized Prevalence Ratios for Atrial Fibrillation in Adult Dialysis Patients in Japan. J Epidemiol. 2016;26(5):272-6. doi: 10.2188/jea.JE20150077 pmid: 26804038
24. Canadian Institute for Health Information (2008). 'Wait Time Alliance Member Assessments Of 10-Year Plan To Strengthen Health Care 2008'. Available at: https://www.waittimealliance.ca/wp-content/uploads/2014/05/WTA_10-Year_Assessment.pdf (Accessed: July 22, 2021).
25. Campbell RJ, Hatch WV, Bell CM. Canadian health care: a question of access. Arch Ophthalmol. 2009;127(10):1384-6. doi: 10.1001/archophthalmol.2009.275 pmid: 19822859
26. Hatch WV, Campbell Ede L, Bell CM, El-Defrawy SR, Campbell RJ. Projecting the growth of cataract surgery during the next 25 years. Arch Ophthalmol. 2012;130(11):1479-81. doi: 10.1001/archophthalmol.2012.838 pmid: 23143457
27. Congdon N, Vingerling JR, Klein BE, West S, Friedman DS, Kempen J, et al. Prevalence of cataract and pseudophakia/aphakia among adults in the United States. Arch Ophthalmol. 2004;122(4):487-94. doi: 10.1001/archopht.122.4.487 pmid: 15078665
28. Boisjoly H, Freeman EE, Djafari F, Aubin MJ, Couture S, Bruen RP, et al. Reducing wait time for cataract surgery: comparison of 2 historical cohorts of patients in Montreal. Can J Ophthalmol. 2010;45(2):135-9. doi: 10.3129/i09-256 pmid: 20379297
29. Bassett K, Noertjojo K, Nirmalan P, Courtright P, Anderson D. RESIO revisited: visual function assessment and cataract surgery in British Columbia. Can J Ophthalmol. 2005;40(1):27-33. doi: 10.1016/S0008-4182(05)80113-9 pmid: 15825526
30. Leinonen J, Laatikainen L. Changes in visual acuity of patients undergoing cataract surgery during the last two decades. Acta Ophthalmol Scand. 2002;80(5):506-11. doi: 10.1034/j.1600-0420.2002.800509.x pmid: 12390162
31. Taylor HR. Cataract: how much surgery do we have to do? Br J Ophthalmol. 2000;84(1):1-2. doi: 10.1136/bjo.84.1.1 pmid: 10611088
32. Wong WL, Li X, Li J, Cheng CY, Lamoureux EL, Wang JJ, et al. Cataract conversion assessment using lens opacity classification system III and Wisconsin cataract grading system. Invest Ophthalmol Vis Sci. 2013;54(1):280-7. doi: 10.1167/iovs.12-10657 pmid: 23233255
33. Li L, Wan XH, Zhao GH. Meta-analysis of the risk of cataract in type 2 diabetes. BMC Ophthalmol. 2014;14:94. doi: 10.1186/1471-2415-14-94 pmid: 25060855
34. Saxena S, Mitchell P, Rochtchina E. Five-year incidence of cataract in older persons with diabetes and pre-diabetes. Ophthalmic Epidemiol. 2004;11(4):271-7. doi: 10.1080/09286580490510733 pmid: 15512989
35. Government of Canada (2011). 'Highlights: Diabetes in Canada: Facts and figures from a public health perspective'. Available at: https://www.canada.ca/en/public-health/services/chronic-diseases/reports-publications/diabetes/diabetes-canada-facts-figures-a-public-health-perspective/report-highlights.html#chp1 (Accessed: July 22, 2021).
36. Canadian Institute for Health Information (2010). 'Canada's Health Care Providers, 2000 to 2009- A Reference Guide'. Available at: https://publications.gc.ca/collections/collection_2016/icis-cihi/H118-1-4-2009-eng.pdf (Accessed: July 22, 2021).
37. Weikel KA, Garber C, Baburins A, Taylor A. Nutritional modulation of cataract. Nutr Rev. 2014;72(1):30-47. doi: 10.1111/nure.12077 pmid: 24279748
38. Springvloet L, Lechner L, Oenema A. Can individual cognitions, self-regulation and environmental variables explain educational differences in vegetable consumption?: a cross-sectional study among Dutch adults. Int J Behav Nutr Phys Act. 2014;11:149. doi: 10.1186/s12966-014-0149-1 pmid: 25480542
39. Klein BE, Klein R, Lee KE, Meuer SM. Socioeconomic and lifestyle factors and the 10-year incidence of age-related cataracts. Am J Ophthalmol. 2003;136(3):506-12. doi: 10.1016/s0002-9394(03)00290-3 pmid: 12967805
40. Bell CMHW, Slaughter PM, Cernat G, Singer S. Cataract surgery (2004). 'Access to Health Services in Ontario. ICES Atlas, 2nd Edition'. Available at: https://www.ices.on.ca/flip-publication/access-to-health-service-2d-edition-2006/files/assets/basic-html/index.html#1 (Accessed: July 22, 2021).
41. Patty L, Wu C, Torres M, Azen S, Varma R, Los Angeles Latino Eye Study G. Validity of self-reported eye disease and treatment in a population-based study: the Los Angeles Latino Eye Study. Ophthalmology. 2012;119(9):1725-30. doi: 10.1016/j.ophtha.2012.02.029 pmid: 22537615
42. Chan CH, Trope GE, Badley EM, Buys YM, Jin YP. The impact of lack of government-insured routine eye examinations on the incidence of self-reported glaucoma, cataracts, and vision loss. Invest Ophthalmol Vis Sci. 2014;55(12):8544-9. doi: 10.1167/iovs.14-15361 pmid: 25491296
43. Rim TH, Kim DW, Kim SE, Kim SS. Factors Associated with Cataract in Korea: A Community Health Survey 2008-2012. Yonsei Med J. 2015;56(6):1663-70. doi: 10.3349/ymj.2015.56.6.1663 pmid: pmid: 26446652
44. Ryskulova A, Turczyn K, Makuc DM, Cotch MF, Klein RJ, Janiszewski R. Self-reported age-related eye diseases and visual impairment in the United States: results of the 2002 national health interview survey. Am J Public Health. 2008;98(3):454-61. doi: 10.2105/AJPH.2006.098202 pmid: 18235074
45. Shih YH, Chang HY, Lu MI, Hurng BS. Time trend of prevalence of self-reported cataract and its association with prolonged sitting in Taiwan from 2001 and 2013. BMC Ophthalmol. 2014;14:128. doi: 10.1186/1471-2415-14-128 pmid: 25370503