Prevalence and determinants of visual impairment in Canada: cross-sectional data from the Canadian Longitudinal Study on Aging

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ABSTRACT • RÉSUMÉ

Objective: To determine the prevalence and determinants of visual impairment in Canada.
Design: Cross-sectional population-based study.
Participants: 30,097 people in the Comprehensive Cohort of the Canadian Longitudinal Study on Aging
Methods: Inclusion criteria included being between the ages of 45 and 85 years old, community-dwelling, and living near one of the 11 data collection sites across 7 Canadian provinces. People were excluded if they were in an institution, living on a First Nations reserve, were a full-time member of the Canadian Armed Forces, did not speak French or English, or had cognitive impairment. Visual acuity was measured using the Early Treatment Diabetic Retinopathy Study (ETDRS) chart while participants wore their usual prescription for distance, if any. Visual impairment was defined as presenting binocular acuity worse than 20/40.
Results: Of Canadian adults, 5.7% (95% CI 5.4–6.0) had visual impairment. A wide variation in the provincial prevalence of visual impairment was observed ranging from a low of 2.4% (95% CI 2.0–3.0) in Manitoba to a high of 10.9% (95% CI 9.6–12.2) in Newfoundland and Labrador. Factors associated with a higher odds of visual impairment included older age (odds ratio [OR] = 1.07, 95% CI 1.06–1.08), lower income (OR = 2.07 for those earning less than $20 000 per year, 95% CI 1.65–2.59), current smoking (OR = 1.52, 95% CI 1.25–1.85), type 2 diabetes (OR = 1.20, 95% CI 1.03–1.41), and memory problems (OR = 1.44, 95% CI 1.04–2.01).
Conclusions: Refractive error was the leading cause of visual impairment. Older age, lower income, province, smoking, diabetes, and memory problems were associated with visual impairment.

Objet : Déterminer la prévalence et les causes des déficiences visuelles au Canada.
Méthodes : Les données de 30 097 adultes qui formaient la cohorte globale de l'Étude longitudinale canadienne sur le vieillissement (ÉLCV) ont été colligées. Pour être inclus, les sujets devaient être âgés de 45 à 85 ans et vivre dans la collectivité près de l'un des 11 centres de cueillette de données situés dans 7 provinces canadiennes. Les sujets étaient exclus s'ils vivaient dans un établissement public ou privé ou sur une réserve des Premières Nations, s'ils étaient membres à temps plein des Forces armées canadiennes, ne parlaient ni français ni anglais ou présentaient des troubles cognitifs. L'acuité visuelle a été mesurée à l'aide de l'échelle ETDRS (*Early Treatment of Diabetic Retinopathy Study*), tandis que les participants portaient leurs lunettes ou lentilles correctrices habituelles pour la vision de loin, le cas échéant. Une déficience visuelle se définissait comme une acuité visuelle binoculaire inférieure à 20/40.
Résultats : Quelque 5,7 % (intervalle de confiance [IC] à 95 %: 5,4-6,0) des Canadiens adultes avaient une déficience visuelle. On a observé une importante variation à cet égard d'une province à l'autre: du pourcentage le plus faible au Manitoba (2,4 %; IC à 95 %: 2,0-3,0) au pourcentage le plus élevé dans la province de Terre-Neuve-et-Labrador (10,9 %; IC à 95 %: 9,6-12,2). Au nombre des facteurs associés à une cote plus élevée de déficience visuelle, on note l'âge avancé (rapport de cotes [RC]: 1,07; IC à 95 %: 1,06-1,08), le revenu relativement faible (RC: 2,07 chez les sujets dont le revenu est inférieur à 20 000 $ par année; IC à 95 %: 1,65-2,59), le tabagisme actuel (RC: 1,52; IC à 95 %: 1,25-1,85), le diabète de type 2 (RC: 1,20; IC à 95 %: 1,03-1,41) et les troubles de la mémoire (RC: 1,44; IC à 95 %: 1,04-2,01).
Conclusions : Les erreurs de réfraction représentaient la principale cause de déficience visuelle. L'âge avancé, le revenu relativement faible, la province de résidence, le tabagisme, le diabète et les troubles de la mémoire étaient tous associés à une déficience visuelle.

Despite the high prevalence of visual impairment in older age as demonstrated in previous research throughout the world,[1,2] Canada lacks high-quality data on the prevalence of visual impairment. Previous Canadian studies have had limitations, including extrapolating U.S. rates to the Canadian population,[3,4] relying on self-report of visual impairment,[5,6] or sampling people or patients from a single city.[7,8] First, relying on U.S. rates may not give an accurate picture of the burden of visual impairment in Canada given the differences between the 2 countries in health care systems, educational systems, ethnic backgrounds, and other factors that may affect vision.[9,10] Second, the self-report of visual impairment can result in substantial misclassification that can vary by demographic factors, such as age, sex, and education. Third, results from people from a single city may not be generalizable to the

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Canadian population, and sampling eye care patients ignores people with visual impairment who have not yet sought treatment. Given these limitations, there is a pressing need for data on visual impairment from a population-based sample from sites across Canada.

Cross-sectional data collected as part of the Canadian Longitudinal Study on Aging (CLSA) offer an unparalleled opportunity to examine the frequency of vision loss throughout Canada.[11] Our objective is to report the prevalence of visual impairment and its determinants. These data will provide essential information to allow eye care professionals, health policy planners, and low vision rehabilitation providers to more adequately prepare for the needs of the aging population and identify groups in need of intervention.

METHODS

Study Population

The 30 097 adults in the CLSA Comprehensive study were randomly selected and had to meet the following inclusion criteria: aged between 45 and 85 years and living within 25–50 km of the 11 data collection sites (Victoria, Vancouver, Surrey, Calgary, Winnipeg, Hamilton, Ottawa, Montreal, Sherbrooke, Halifax, and St. John's) in 7 Canadian provinces. To try to ensure maximum retention and follow-up in this longitudinal study, people were excluded from the CLSA if they were in an institution, were living on a First Nations reserve or settlement, were a full-time member of the Canadian Armed Forces, did not speak French or English, or had overt cognitive impairment as determined by trained interviewers. A face-to-face interviewer-administered questionnaire was administered to patients and a physical assessment was conducted at the data collection site. Baseline recruitment was between the years 2012 and 2015. The project was approved by research ethics boards in 7 different provinces. Research followed the tenets of the Declaration of Helsinki. Written informed consent was obtained from all participants.

Study Design

The participants in the CLSA Comprehensive cohort were sampled using a combination of provincial health registries (14%) and random digit dialling (86%). For those recruited using provincial health registries, a letter was sent to the randomly chosen, age-eligible person, introducing the study and providing a consent form to be returned to the CLSA. For those recruited through random digit dialling, a random sample of landline telephone numbers was selected for a given geographic area. Once a call was answered, eligibility was established and consent was obtained. Stratified sampling was used to ensure adequate representation of various demographic groups. Strata within a province were defined by age group, sex, and distance from the data collection sites.[12]

Data Collection

All CLSA personnel underwent detailed training in all aspects of data collection. The training was standardized across all data collection sites. Data were collected at the data collection site.

Visual Acuity. During each participant's data collection site visit, visual acuity was evaluated by a trained assessor. Acuity was measured with the participant wearing prescribed glasses or contact lenses for distance vision, if any, both monocularly (right eye followed by left eye) and then binocularly using the Early Treatment of Diabetic Retinopathy Study (ETDRS) letter chart and its standard protocol.[13] The test distance was 2 meters. Acuity was scored as the total number of letters read correctly and then converted to logMAR units. Acuity measurements were also made with pinhole correction. Our primary outcome was visual impairment, which was defined as binocular acuity worse than 20/40 (0.301 logMAR) with the participant wearing prescribed glasses or contact lenses for distance vision, if any, as is standard in North America.[14]

Self-Reported Eye Disease and Corrective Lens Utilization. Self-reported eye diseases and corrective lens utilization were assessed using an interviewer-administered questionnaire at the data collection site. Participants were asked if they had ever been told by a doctor that they had glaucoma, cataract, or macular degeneration. People who reported having been told that they had a cataract were then asked if they currently had a cataract. Those who said no were assumed to have had it removed. Participants were classified as using corrective lenses (wearing contact lenses or glasses) if they answered "yes" to either or both: "Do you wear glasses?" and "Do you wear contact lenses?" No additional information was collected to differentiate whether the glasses were prescriptive lenses or whether they were ready-made reading glasses.

Demographic, Health, and Lifestyle Data. Data on demographic variables (age, sex, race/cultural group, education, household income, urban vs rural residence), health conditions (diabetes and memory problems), and lifestyle (smoking status) were obtained as part of the interviewer-administered questionnaire. Household income was assessed by asking, "What is your best estimate of the total household income received by all household members, from all sources, before taxes and deductions, in the past 12 months?" Participants were classified as having diabetes if they answered "yes" to "Has a doctor ever told you that you have diabetes, borderline diabetes or that your blood sugar is high?" They were then further classified as having type 1 or type 2 diabetes based on self-report. Memory problems were determined using the following question: "Has a doctor ever told you that you have a memory problem?" Participants were classified as

Table 1—Crude and age-adjusted prevalence rates of visual impairment by province.

Province	Crude VI, % (95% CI)	Age-Standardized VI, %
Alberta (n = 2923)	7.8 (6.8–8.9)	8.7
British Columbia (n = 6212)	8.6 (7.9–9.3)	8.4
Manitoba (n = 3095)	2.4 (2.0–3.0)	2.3
Newfoundland & Labrador (n = 2203)	10.9 (9.6–12.3)	10.9
Nova Scotia (n = 3046)	6.9 (6.0–7.9)	6.9
Ontario (n = 6304)	3.5 (3.1–4.0)	3.4
Quebec (n = 5883)	3.2 (2.8–3.7)	2.9
Canada (n = 29 666)	5.7 (5.4–6.0)	6.0

VI, visual impairment.

having memory problems if they responded "yes." A former smoker was defined as someone who has smoked at least 100 cigarettes in life but who has not smoked in the last 30 days. A current smoker has smoked a cigarette in the last 30 days.

Statistical Analysis

The primary outcome for this paper is the prevalence of binocular visual impairment. Associations between demographic, lifestyle, and health variables with visual impairment were tested in preliminary analyses using χ^2 tests. Logistic regression was used to determine the adjusted relationships between these variables and visual impairment. We included the following variables as possible covariates due to prior research[14–17]: age, sex, ethnicity, education, income, rural residence, smoking, diabetes, and memory problems. The complex survey design was accounted for in all analyses by using the primary sampling unit, sample weight, and strata variables within the SVY commands in STATA Version 11 (College Station, Tex.). Age standardization of the primary outcome was done by direct age adjustment in which age-stratified rates were applied to a standard population (arbitrarily picked as Alberta). Crude rates were presented for all other outcomes. Estimates of the numbers of Canadians aged 45–85 years affected by visual impairment were calculated using data from the 2011 Canadian Census.[18]

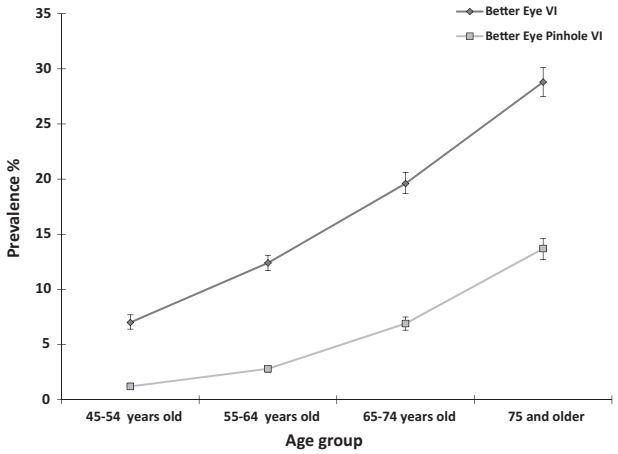


Fig. 1—Prevalence of visual impairment (VI) with and without pinhole correction by age group. The prevalence of visual impairment, both with and without pinhole correction, increases with age. The proportion of visual impairment explained by refractive error is higher in the younger age group than in the older age group.

Results

Our analysis sample consisted of 29 666 people after excluding 431 people who were missing data for binocular visual acuity (1.4%). Those missing data on visual acuity were 2 years older, on average. The overall crude prevalence of visual impairment was 5.7% (95% CI 5.4–6.0), whereas the age-standardized rate was 6.0%. There was heterogeneity in the rates of visual impairment by province as Manitoba, Quebec, and Ontario all had rates under 4%, whereas Nova Scotia, Alberta, British Columbia, and Newfoundland and Labrador all had rates over 6.5% (Table 1).

As shown in Figure 1, between 64% and 80% of visual impairment was due to refractive error as can be seen by comparing the better eye rate of visual impairment while wearing usual correction to the better eye pinhole corrected rate of visual impairment, wherein the latter removes refractive error. Middle-aged participants with visual impairment were more likely to be affected by refractive error than older participants. As shown in Table 2, 86.1% of respondents reported wearing glasses or contact lenses, 5.6% reported a diagnosis of cataract currently in the eye, 3.9% reported a diagnosis of glaucoma, and 3.2% reported a diagnosis of macular degeneration.

In Table 3, demographic risk factors for visual impairment are presented. The prevalence of visual impairment increased substantially with age ranging from 2.7% in those 45–54 years old to 15.6% in those 75–84 years old. Women, those with less education, those living in urban or semi-urban areas, and those with lower income had higher rates of visual impairment in unadjusted analyses ($p < 0.05$). There was no significant difference by race/cultural group although rates ranged from a low of 3.7% in black participants to a high of 6.5% in Aboriginal participants and 8.0% in participants of other races than those listed. In Table 4, lifestyle and health factors and their relationship to visual impairment are shown. Former or current smokers, those with high blood pressure, those with type 1 or type 2 diabetes, and those with memory problems were more likely to have visual impairment ($p < 0.05$).

In Table 5, demographic, lifestyle, and health variables are included in a logistic regression model. Education was dropped from the model for 2 reasons: (*i*), it was correlated with income, and (*ii*), it was not significant with income in the model. Race/cultural group was also dropped from the model due to its lack of statistical significance. The lower the household income, the higher

Table 2—Prevalence rate of corrective lens usage and self-reported eye disease by province.

Site	Alberta (n = 2923), %	BC (n = 6212), %	Manitoba (n = 3095), %	NF & L (n = 2203), %	Nova Scotia (n = 3046), %	Ontario, (n = 6304), %	Quebec (n = 5883), %	Canada (n = 29 666), %
Wear glasses/ contact lenses	89.8	87.3	72.5	86.9	83.1	90.9	86.3	86.1
Cataract								
None	90.0	88.7	88.2	90.3	92.6	88.3	90.0	90.0
Removed	6.0	5.1	4.8	4.9	3.3	5.6	4.4	4.9
Present	4.0	6.2	7.1	4.8	4.2	6.1	5.4	5.6
Glaucoma								
Yes	3.2	3.5	4.4	3.4	3.7	3.5	5.0	3.9
Macular degeneration								
Yes	3.2	3.5	3.3	2.6	2.4	3.3	2.9	3.2

VI, visual impairment; BC, British Columbia; NF & L, Newfoundland and Labrador.

the odds of having visual impairment. In particular, those making less than $20 000 per year had 2.07 times the odds of visual impairment compared to those making $100 000 or more per year (95% CI 1.65–2.59). Other factors associated with a higher odds of visual impairment included older age (odds ratio [OR] =1.07, 95% CI 1.06–1.08), current smoking (OR = 1.52, 95% CI 1.25–1.85), type 2 diabetes (OR = 1.20, 95% CI 1.03–1.41), memory problems (OR = 1.44, 95% CI 1.04–2.01), and province.

Table 3—Rates of visual impairment by demographic factors.

	Visually Impaired (n = 2183), %	Not Visually Impaired (n = 27 483), (%)	*p*
Age group, years			<0.01
45–54 (n = 7595)	2.7	97.4	
55–64 (n = 9716)	5.0	95.0	
65–74 (n = 7234)	8.3	91.7	
75–84 (n = 5191)	15.6	84.4	
Sex			0.03
Male (n = 14 587)	5.4	94.6	
Female (n = 15 079)	6.0	94.0	
Race/cultural group			0.73
White (n = 27 960)	5.7	94.3	
Black (n = 252)	3.7	96.3	
Asian (East, South, SE) (n = 673)	5.6	94.4	
Arab and West Asian (n = 141)	4.4	95.6	
Latin American (n = 123)	6.3	93.7	
Aboriginal (n = 357)	6.5	93.5	
Other (n = 160)	8.0	92.0	
Education*			<0.01
No postsecondary training (n = 2201)	6.9	93.1	
Some postsecondary training (n = 9594)	5.6	94.1	
Bachelor's degree (n = 6988)	4.9	95.1	
More than bachelor's (n = 6413)	5.1	94.9	
Residence*			<0.01
Urban, semi-urban (n = 26 920)	5.9	94.2	
Rural (n = 2374)	3.7	96.4	
Household income per year			<0.01
≥ $100 000 (n = 10 225)	3.7	96.3	
$50 000–$100 000 (n = 9777)	5.8	94.2	
$20 000–$50 000 (n = 6232)	8.5	91.5	
<$20 000 (n = 1519)	11.2	88.8	
Refused/don't know (n = 1913)	8.0	92.0	

*n missing: education (n = 4470), residence (n = 372).

The numbers of middle-aged and older adults estimated to be affected by visual impairment by province are shown in Table 6. The numbers range from 11 570 people in Manitoba to 191 094 people in Ontario.

Discussion

In a large population-based sample of 29 666 Canadians aged 45–85 years, we found that the overall crude prevalence of visual impairment was 5.7%, ranging from 2.7% in those aged 45–54 years to 15.6% in those aged 75–85 years. Of the 7 provinces from which we had data, the rate of visual impairment was lower in Manitoba, Quebec, and Ontario (2.4%–3.5%), whereas it was higher in Nova Scotia, Alberta, British Columbia, and Newfoundland and Labrador (6.9%–10.9%). The risk factors for visual impairment included older age, lower income, current smoking, diabetes, and memory problems.

The primary cause of visual impairment was not determined by an eye care professional in the CLSA. However, it is clear from comparing the rate of visual impairment with and without pinhole correction (which removes most refractive error) that, as in other studies,

Table 4—Rates of visual impairment by lifestyle and health factors.

	Visually Impaired, %	Not Visually Impaired, %	*p*
Smoking*			<0.01
Never (n = 14 060)	5.2	94.8	
Former (n = 12 987)	6.2	93.8	
Current (n = 2517)	6.3	93.7	
High blood pressure*			<0.01
No (n = 18 577)	4.9	95.1	
Yes (n = 10 929)	7.4	92.6	
Diabetes*			<0.01
None (n = 24 354)	5.3	94.7	
Type 1 (n = 169)	8.4	91.6	
Type 2 (n = 2727)	8.7	91.3	
Suspect/neither type (n = 2090)	6.0	94.0	
Memory problems*			<0.01
No (n = 29 079)	5.6	94.4	
Yes (n = 503)	9.7	90.3	

*n missing: smoking (n = 102), high blood pressure (n = 160), diabetes (n = 326), memory problems (n = 84).

Table 5—Multiple logistic regression analysis of variables and their independent association with visual impairment using.

	Visual Impairment (N = 28 725), Adjusted Odds Ratio*	95% Confidence Interval
Age, per 1 year	1.07	1.06–1.08
Female sex	1.04	0.93–1.17
Household income per year		
≥ $100 000	1.00	
$50 000–$100 000	1.14	0.98–1.32
$20 000–$50 000	1.33	1.13–1.57
<$20 000	2.09	1.67–2.63
Refused/don't know	1.21	0.98–1.50
Rural vs nonrural	0.85	0.68–1.06
Smoking		
Never	1.00	
Former	1.04	0.93–1.17
Current	1.52	1.25–1.85
Diabetes		
None	1.00	
Type 1	1.57	0.84–2.97
Type 2	1.21	1.04–1.42
Suspect/neither type	0.95	0.77–1.17
Memory problems	1.44	1.04–2.01
High blood pressure	1.02	0.91–1.15
Province		
Alberta	1.00	
British Columbia	0.98	0.82–1.18
Manitoba	0.23	0.17–0.30
Newfoundland & Labrador	1.32	1.07–1.64
Nova Scotia	0.76	0.61–0.94
Ontario	0.37	0.30–0.45
Quebec	0.29	0.23–0.36

*Adjusted for all variables in table and also for the complex study design.

refractive error is the leading cause of visual impairment in the CLSA data.[19] Refractive error is an easily correctable cause of visual impairment. Changes in refraction can occur in middle age due to cataract surgery, cataract itself, or presbyopia, which primarily affects near vision, which was not assessed. Cataract, glaucoma, and macular degeneration were also reported by 2%–7% of the population.

Prior population-based research in Canada done in the city of Brantford, Ontario, found that 2.7% of adults aged 40 years and older had visual impairment.[7] This is consistent with our rate for the 2 cities in the province of Ontario (Hamilton and Ottawa), which was 3.5%. Our overall rate of 5.7% compares well with other U.S. and Australian data.[2,19] For example, Vitale et al. found that 6.4% of Americans had visual impairment,[19] whereas Taylor et al. found that 4% of Australians had visual impairment.[2] However, we did see great heterogeneity in the rates of visual impairment by province ranging from a low of 2.4% in Manitoba to a high of 10.9% in Newfoundland and Labrador. These differences remained after adjustment for demographic, lifestyle, and health factors. The reason for these provincial differences is unclear. Differing provincial eye care coverage policies may explain some of this variation. For example, Newfoundland and Labrador, which had the highest rate of visual impairment, is one of the few Canadian provinces to not pay for a routine eye examination for seniors,[20] an examination that is recommended at least every 2 years by the Canadian Ophthalmological Society.[21] Indeed, prior research found that Newfoundland and Labrador had the lowest rate of eye care utilization in Canada.[22] Manitoba, which had the lowest rate of visual impairment, covers not only an eye examination every 2 years for seniors, but also at least part of the cost of eyeglasses for seniors and for visual field, tonometry, and dilated fundus examinations performed by an optometrist.[23] Interprovincial differences in the number of eye care professionals could also affect the rates of visual impairment. However, prior research did not indicate an obvious shortage of eye care professionals in any province.[24]

Several risk factors were related to visual impairment. Lower personal income was linearly related to the prevalence of visual impairment, which is consistent with prior research.[25–27] People may delay getting appropriate eye care in the absence of adequate income or insurance. Smoking was also related to visual impairment and is a

Table 6—Estimated numbers of people aged 45–85 years with visual impairment by province.

Site	Alberta	BC	Manitoba	NF & L	Nova Scotia	Ontario	Quebec
% with binocular VI by age							
45–54	4.1	3.1	1.7	5.7	3.0	1.8	1.3
55–64	6.4	7.7	1.8	10.2	5.6	3.1	2.5
65–74	14.1	13.6	3.1	15.2	9.8	5.3	3.7
75–85	26.7	24.7	5.4	28.1	22.3	8.0	9.7
Population size by age, years							
45–54	560 340	705 215	180 060	85 405	153 735	2 062 015	1 272 270
55–64	415 945	614 380	148 670	81 780	137 385	1 630 275	1 092 110
65–74	220 470	371 615	88 665	48 855	85 315	1 004 270	694 965
75–85	133 765	224 425	57 120	24 695	47 670	627 660	408 775
45–85	1 330 520	1 915 635	474 515	240 735	424 105	5 324 220	3 468 120
Estimated # with binocular VI							
45–54	22 974	21 862	3061	4868	4612	37 116	16 540
55–64	26 620	47 307	2676	8341	7694	50 539	27 303
65–74	31 086	50 540	2749	7426	83 601	53 226	25 714
75–85	35 715	55 433	3084	6939	10 630	50 213	39 651
45–85	116 396	175 142	11 570	27 575	31 297	191 094	109 207

VI, visual impairment; BC, British Columbia; NF & L, Newfoundland and Labrador.

known risk factor for cataract and age-related macular degeneration.[16,17] People with diabetes were more likely to have visual impairment, likely due to the damage that high glycemic levels cause to the retina, resulting in diabetic retinopathy. It is recommended that people with diabetes see an eye care provider at least every 1–3 years, depending on their age.[21] Finally, memory problems were associated with visual impairment. People with obvious cognitive impairment were excluded at recruitment. However, some participants reported a diagnosis of a memory problem. A small proportion (10%) of this group with memory problems reported a diagnosis of dementia or Alzheimer's disease. The causes of the other 90% are assumed to be a variety of factors, including mild cognitive impairment, medication side effects, and blood flow problems. Prior research has demonstrated a relationship between visual impairment and cognitive impairment although the reason for this relationship is unclear.[15,28,29] Female sex was not related to visual impairment after adjustment in our study. This is consistent with other studies that were done using presenting visual acuity.[7,19] By contrast, women are sometimes more likely to have visual impairment than men if best-corrected visual acuity is used.[1]

The main strength of this work is that this is the first national population-based assessment of visual impairment in Canada using a visual acuity chart. There are a few limitations of this work. The cross-sectional nature of the data precludes our ability to determine the temporality of the risk factors and the onset of visual impairment. Some of the data used in the analysis were based on self-report such as the data on eye disease, demographic, lifestyle, and health factors. This could have led to misclassification although we suspect that it would have been nondifferential with regard to visual impairment status and thus would have diluted our results. We did not have data from outside of the areas around the 11 data collection sites, particularly the far north where access to eye care may be more of a challenge. In addition, our exclusion criteria excluded those in institutions, those not speaking French or English, those living on a First Nations reserve, those in the military, and those with overt cognitive impairment. Also, those recruited by random digit dialling required a landline phone, although it was estimated by Statistics Canada that only 5% of people in this age range did not have a landline telephone in 2010. Therefore, generalizability of our results to other parts of Canada (more remote areas and excluded provinces) and to groups other than those studied is unknown. Also, a small percentage (1.4%) of the sample was missing data on visual acuity. These individuals were 2 years older, on average, indicating that our prevalence estimates may be somewhat underestimated because visual impairment is so strongly related to age. Furthermore, the test distance of the ETDRS chart was 2 meters rather than the standard 4 meters, which due to accommodative difficulties for some people may have led to a slight overestimation of visual impairment. To conclude, visual impairment is a significant problem in Canada, especially among older adults. These data can be used by health policy planners, low vision rehabilitation providers, and eye care professionals to plan for the future eye care needs of Canada's aging population. Provinces with higher prevalence rates of visual impairment should consider ways to lower these rates. Concerted national efforts are needed to reduce refractive errors, increase access to regular eye care and smoking cessation programs, and to ensure that diabetics are educated about their eye care needs and have access to routine eye fundus examinations.

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