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