

Canadian Optometric Low Vision: Predictive Factors and Regional Comparisons

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Abstract

Purpose: To investigate the regional differences in low vision (LV) provision across Canada and to identify predictive factors for the provision of more extensive low vision services (LVS).

Methods: Practising optometrists across Canada were invited to participate in a questionnaire that investigated personal and practice demographics, levels of LVS offered, patterns of referrals and barriers to provision of LVS.

Results: 459 optometrists responded. Predictive factors for providing more extensive LVS included: optometrists with >15 years of practice, having a local LV optometrist/ophthalmologist within one day's travel, not having a multi-disciplinary LV clinic within one-day's travel, working in a practice in a population of <50,000, and having 2+ optometrists in the same practice. Regional differences were found in the following variables: the presence of an optometrist offering LVS within the respondent's primary practice, referral criteria, the type of LV provider receiving the referral, and the perceived quality of LVS.

Conclusions: LVS are provided differently across Canada and the availability of government-funded LVS appeared to enhance optometric referrals to multidisciplinary low vision clinics. Optometrists who were in a group practice setting, who had practiced for >15 years and who worked in a less populated area were more likely to provide more extensive LVS.

Key Words: low vision, low vision services, visual impairment, rehabilitation, service provision, barriers

Résumé

Objet : Étudier les différences régionales dans la prestation de services sur la basse vision (BV) au Canada et déterminer des facteurs prédictifs de la prestation de services plus poussés sur la basse vision.

Méthodes : On a invité des optométristes en exercice de partout au Canada à répondre à un questionnaire portant sur les caractéristiques démographiques de la personne et du cabinet, les niveaux de services plus poussés sur la basse vision offerts, les tendances des aiguillages et les obstacles à la prestation de services plus poussés sur la basse vision.

Résultats : 459 optométristes ont répondu. Les facteurs prédictifs de la prestation de services plus poussés sur la basse vision comprenaient les suivants : optométristes exerçant depuis plus de 15 ans, présence à moins d'une journée de route d'un optométriste/ophtalmologiste local spécialisé en BV, absence de clinique multidisciplinaire de BV à moins d'une journée de route, travail dans un cabinet situé dans une agglomération de moins de 50 000 habitants et présence de 2 optométristes et plus dans le même cabinet. On a découvert des différences régionales au niveau des variables suivantes : présence d'un optométriste

offrant des services plus poussés sur la basse vision dans la pratique principale du répondant, critères d'aiguillage, type de fournisseur de services plus poussés sur la basse vision recevant l'aiguillage et qualité perçue des services plus poussés sur la basse vision.

Conclusions : Les services plus poussés sur la basse vision sont fournis différemment au Canada et la disponibilité de tels services financés par l'État a semblé améliorer les aiguillages optométriques vers des cliniques multidisciplinaires de services sur la basse vision. Les optométristes qui exerçaient en groupe, qui exerçaient depuis plus de 15 ans et qui travaillaient dans une région moins peuplée étaient plus susceptibles de fournir des services plus poussés sur la basse vision.

Mots clés : services sur la basse vision, déficit visuel, réadaptation, prestation de services, obstacles

Introduction

The demand for low vision services (LVS) in Canada will rise in the next few decades, due mainly to the aging of the Canadian population^{1,2} and the association between age and vision loss.^{2,3} Despite this fact, there is no consistent model for the provision of LVS among the Canadian provinces, with LVS being provided by a variety of professions (optometrists, ophthalmologists, CNIB LVS personnel, opticians), singularly or together, and in a variety of settings (private practices, CNIB offices, multi-disciplinary clinics, hospitals). Funding for low vision is also inconsistent, with LVS and LV devices being fully or partially covered under health care plans in some provinces, but not in others, and for some professionals who provide the service and not others.^{2,4} In order to build a more effective and consistent model across Canada,^{5,6} the first step is to document what is currently being provided.

This paper is the second report on a Canadian nationwide survey on LVS provision by optometrists. The previous paper illustrated that while many optometrists were willing to provide LVS, access to optometric LVS appeared to be hindered by the lack of remuneration, device subsidy, education, and collaboration between different low vision providers.⁴ The purpose of the current paper is to examine the factors which predict the provision of LVS beyond basic levels (the basic level being defined as what can be offered with routine optometric equipment and similar to level 1 and 2 in the SmartSight model⁷). The differences in optometric low vision provision among four different geographic regions in Canada are compared.

Methods

This study was approved and received ethics clearance through the Office of Research Ethics at University of Waterloo and adhered to the tenets of the Declaration of

Helsinki. The questionnaire design and data collection have been described previously.⁴ The questionnaire is summarized in the Appendix. Optometrists were sampled at the rate of 30% in more populated provinces (Ontario, Quebec, Alberta and British Columbia) and at 100% in the other provinces, in order to obtain similar numbers of responses from each area.

The provision of LVS was divided into basic or more extensive. Basic LVS was defined as managing patients with equipment available in a typical primary optometric setting, including recognition of a LV case, assessment of the impairment and disability, and managing patients with minimum disability with high-powered additions and lighting (similar to Levels 1 and 2 in the SmartSight model).⁷ More extensive LVS included managing patients using optical devices such as hand and stand magnifiers, filters, and more specialized LV equipment and devices such as telescopes, electronic LV aids, and custom-designed microscopes, up to and including managing patients with more complex goals.

Statistical analysis

Statistical analyses were conducted using SPSS v.21. An alpha level of 0.05 was considered statistically significant. Univariate logistic regression was used to determine the predictor variables associated with the provision of LVS at a more extensive level. The predictor variables that were studied are listed in Table 1. Those found to be potentially statistically associated in the univariate analyses ($p < 0.30$) were included as possible predictors in an automated forward stepwise, multiple logistic regression. The entry criteria was a p -value of < 0.20 and the exit criteria was $p > 0.10$. Odds ratios, confidence intervals and p -values are reported.

Chi-square analysis was used to compare the four geographic regions: Eastern Provinces (New Brunswick, Newfoundland and Labrador, Nova Scotia and Prince Edward

Island), Quebec, Ontario and the Western Provinces (British Columbia, Alberta, Saskatchewan and Manitoba). For some of the multiple choice questions (e.g. the type of provider to which the optometrist would refer and the hypothetical patient-case questions), the respondent was asked to check off as many answers as they deemed fit. As a result, the answers were not mutually exclusive. To overcome this, a chi-square test was run for each of the multiple choice answers. The alpha value for significance was adjusted using a modified Bonferroni test (Keppel⁸). If an adjusted residual was greater than ± 1.96 , the particular observed count in a cell was deemed significantly different than expected.

Results

Of the 1851 optometrists sampled, 459 (25%) responded, although not answered all the questions. The proportion of female respondents was 48.8%. The years of practice of the respondents followed a bimodal distribution with one peak (25%) at 0-5 years and another at 26 or more years (25%). Private group practice or cost-sharing practice (defined as 2 or more optometrists in association or sharing the expenses of a practice) was the most frequent type of practice at 56%. The modal city/town population of our respondents' primary practice was 500,000. Other details of the population are described by Lam et al.⁴

Table 1: Univariate analysis of potential predictive factors of performing Low Vision Services (LVS) at a more extensive versus basic level. Those marked with * were put into the multivariate analysis which followed.

Predictive Factors (comparison group vs. reference group)	Coefficient	Odds Ratio (Lower CI, Upper CI)	P value
Gender (male, female)	-0.46	0.63 (0.43, 0.92)	0.016*
Years of practice (16 years more vs. less than 16 years)	1.06	2.89 (1.97, 4.25)	<0.0005*
Number of patients seen by respondent (61-120+ vs. 0-60)	0.38	1.46 (1.01, 2.13)	0.046*
Number of patients seen by all optometrists within primary practice (61-120+ vs. 0-60)	0.40	1.50 (0.93, 2.40)	0.094*
Type of LVS available within one-day's travel – local optometrist or ophthalmologist (Yes vs. No)	0.53	1.69 (1.12, 2.55)	0.012*
Type of LVS available within one-day's travel – CNIB (Yes vs. No)	-0.14	0.87 (0.49, 1.56)	0.645
Type of LVS available within one-day's travel – multi-disciplinary LV Clinic (Yes vs. No)	-0.58	0.56 (0.38, 0.83)	0.004*
Population (50,000 or more vs. less than 50,000)	-0.74	0.48 (0.33, 0.70)	<0.0005*
Type of Practice (optical vs. private)	-0.39	0.68 (0.35, 1.3)	0.240*
Type of Practice (institutional vs. private)	-1.11	0.33 (0.16, 0.67)	0.002*
Number of optometrists in primary practice (2+ vs. 1)	0.65	1.91 (1.30, 2.81)	0.001*

Table 2: Multivariate analysis of predictive factors of providing more extensive versus basic low vision services.

Factor	Coefficient	Odds Ratio (lower and upper CI)	P value
Years of practice (16 years or more vs. less than 16 years)	1.09	2.98 (1.97, 4.51)	<0.0005
Other optometrist/ophthalmologist providing LVS within 1 days travel	0.65	1.92 (1.22, 3.02)	0.005
Multidisciplinary LV clinic within 1 day's travel	-0.78	0.46 (0.30, 0.71)	<0.0005
Population of practice location (50,000 or more vs. less than 50,000)	-0.86	0.42 (0.28, 0.65)	<0.0005
Number of optometrists in office (2 or more vs. 1)	0.81	2.24 (1.46, 3.45)	<0.0005
Final Cox and Snell R2CS = 0.152 and Nagelkerke's R2N = 0.203,			

Table 3: Summary of regional differences in low vision practice patterns and services

Characteristics	Geographic Regions Count (% Region)				Chi ² , df, 2-sided p
	Western Provinces	Ontario	Quebec	Eastern Provinces	
Provision of LVS					
Basic (see text for definition)	68 (46.3)	55 (35.3)	25 (35.2)	47 (66.2)	21.58, 3, <0.0005
More extensive	79 (53.7)	101 (64.7)	46 (64.8)	24 (33.8)	
Column Total	147	156	71	71	
The presence of an optometric colleague(s) offering LVS within respondent's primary practice					
Yes	46 (62.2)	50 (37.9)	26 (41.3)	34 (59.6)	8.89, 3, 0.031
No	74 (37.8)	82 (62.1)	37 (58.7)	23 (40.4)	
Column total	120	132	63	57	
Level of BCVA at which respondent would refer to specialized services for persons with visual impairment					
Better than 6/21	38 (27.3)	39 (27.3)	11 (15.7)	18 (26.1)	19.29, 6, 0.004
6/21 to < 6/60	61 (43.9)	76 (53.1)	51 (72.9)	31 (44.9)	
6/60 and worse	40 (28.8)	28 (19.6)	8 (11.4)	20 (29.0)	
Column total	139	143	70	69	
Level of total visual field diameter at which respondents would refer to specialized services for persons with visual impairment?					
>50°	25 (20.0)	21 (16.4)	12 (18.5)	14 (21.2)	18.44, 9, 0.030
35° to 49°	41 (32.8)	49 (38.3)	37 (56.9)	22 (33.3)	
20° to 34°	35 (28.0)	41 (32.0)	14 (21.5)	22 (33.3)	
<20°	24 (19.2)	17 (13.3)	2 (3.1)	8 (12.1)	
Column total	125	128	65	66	
Type of LV provider to which respondents refer for LVS					
Do not refer					1.14, 3, 0.763*
Yes	4 (2.7)	2 (1.3)	1 (1.4)	2 (2.8)	
No	144 (97.3)	155 (98.7)	70 (98.6)	70 (97.2)	
Column total	148	157	71	72	
CNIB					
Yes	139 (93.9)	128 (81.5)	38 (53.5)	66 (91.7)	59.77, 3, <0.0005
No	9 (6.1)	29 (18.5)	33 (46.5)	6 (8.3)	
Column total	148	157	71	72	11.61, 3, 0.009
Local OD/OMD					
Yes	39 (26.3)	57 (36.3)	12 (16.9)	27 (37.5)	69.62, 3, <0.0005
No	109 (73.7)	100 (63.7)	59 (83.1)	45 (62.5)	
Column total	148	157	71	72	
MDLVC					
Yes	29 (19.6)	60 (38.2)	44 (62.0)	3 (4.2)	69.62, 3, <0.0005
No	119 (80.4)	97 (61.8)	27 (38.0)	69 (95.8)	
Column total	148	157	71	72	

Table 3 continued:

Characteristics	Geographic Regions Count (% Region)				Chi ² , df, 2-sided p
	Western Provinces	Ontario	Quebec	Eastern Provinces	
Rating of the availability of local LV service					
Don't know	9 (6.1)	9 (6.0)	5 (7.1)	0	16.15, 12, 0.185
Poor or None	43 (29.4)	36 (24.2)	18 (25.7)	24 (34.8)	
Fair	57 (39.0)	62 (41.6)	34 (48.6)	29 (42.0)	
Good	15 (10.3)	23 (15.4)	7 (10.0)	3 (4.3)	
Outstanding	22 (15.1)	19 (12.8)	6 (8.6)	13 (18.8)	
Column total	146	149	70	69	
Rating of the quality of local LV services					
Don't know	15 (10.4)	16 (10.9)	7 (10.0)	1 (1.4)	40.93, 12, <0.0005
Poor or None	37 (25.7)	33 (22.4)	8 (11.4)	24 (34.8)	
Fair	56 (38.9)	60 (40.8)	37 (52.1)	31 (44.9)	
Good	18 (12.5)	29 (19.7)	18 (25.7)	3 (4.3)	
Outstanding	18 (12.5)	9 (6.1)	0	10 (14.5)	
Column total	144	147	70	69	
Frequency of receiving a report after referral (% of the time)					
Almost never (0-5%)	59 (43.7)	59 (41.3)	21 (31.3)	33 (50.0)	20.30, 12, 0.062
Rarely (6-25%)	28 (20.7)	26 (18.2)	10 (14.9)	17 (25.8)	
Sometimes (26-74%)	15 (11.1)	16 (11.2)	14 (20.9)	10 (15.2)	
Often (75-94%)	20 (14.7)	20 (14.0)	13 (19.4)	3 (4.5)	
Almost always (95-100%)	13 (9.6)	22 (15.4)	9 (13.4)	3 (4.5)	
Column total	135	143	67	66	
Action(s) taken for a hypothetical patient with early ARMD, BCVA = 6/12 and a main goal of reading					
Refer to another OD					
Yes	6 (4.1)	16 (11.8)	2 (2.8)	2 (2.9)	9.10, 3, 0.028
No	140 (95.9)	135 (88.2)	69 (97.2)	67 (97.1)	
Column total	146	151	71	69	
Refer to CNIB					
Yes	17 (11.6)	18 (11.9)	8 (11.3)	12 (17.4)	1.74, 3, 0.628
No	129 (88.4)	133 (88.1)	63 (88.7)	57 (82.6)	
Column total	146	151	71	69	
Refer to MDLVC					
Yes	1 (0.7)	9 (6.0)	8 (11.3)	1 (1.4)	15.22, 3, 0.002
No	145 (99.3)	142 (94.0)	63 (88.7)	68 (98.6)	
Column total	146	151	71	69	
Assess for basic magnification and lighting requirement					
Yes	135 (92.5)	125 (82.8)	59 (83.1)	62 (90.0)	7.77, 3, 0.051
No	11 (7.5)	26 (17.2)	12 (16.9)	7 (10.0)	
Column total	146	151	71	69	

Table 3 continued:

Characteristics	Geographic Regions Count (% Region)				Chi ² , df, 2-sided p
	Western Provinces	Ontario	Quebec	Eastern Provinces	
Action(s) taken for a hypothetical patient with advanced ARMD, BCVA = 6/60 and goals of reading, TV and writing Refer to another OD					15.49, 3, 0.001
Yes	17 (12.7)	34 (22.7)	4 (5.6)	6 (8.8)	
No	127 (87.3)	116 (77.3)	67 (94.4)	62 (91.2)	
Column total	144	150	71	68	
Refer to CNIB					6.04, 3, 0.110
Yes	88 (61.1)	80 (53.3)	36 (50.7)	46 (67.6)	
No	56 (38.9)	70 (46.7)	35 (49.3)	22 (32.4)	
Column total	144	150	71	68	
Refer to MDLVC					51.43, 3, <0.0005
Yes	23 (16.0)	34 (22.7)	35 (44.3)	1 (1.5)	
No	121 (84.0)	116 (77.3)	36 (55.7)	67 (98.5)	
Column total	144	150	71	68	
Assess for basic magnification and lighting requirements and then refer					12.53, 3, 0.006
Yes	43 (29.9)	37 (24.7)	11 (15.5)	28 (41.2)	
No	101 (70.1)	113 (75.3)	60 (84.5)	40 (58.8)	
Column total	144	150	71	68	
Undertake rehabilitation, including magnification, lighting and advice re: writing devices					9.16, 3, 0.027
Yes	31 (27.4)	18 (12.0)	6 (8.4)	14 (20.6)	
No	113 (72.6)	132 (88.0)	65 (91.6)	54 (79.4)	
Column total	144	150	71	68	
Action(s) taken for a hypothetical patient with bilateral homonymous hemianopia who is having difficulty with reading and mobility Provide information about reading techniques					6.80, 3, 0.079
Yes	45 (32.4)	37 (25.3)	11 (15.7)	19 (27.5)	
No	94 (67.6)	109 (74.7)	59 (84.3)	50 (82.5)	
Column total	139	146	70	69	
Provide information about reading techniques and prescribe sector Fresnel or Peli prism					13.24, 3, 0.004
Yes	33 (23.7)	34 (23.3)	5 (7.1)	22 (31.9)	
No	106 (76.3)	112 (76.7)	65 (92.9)	47 (68.1)	
Column total	139	146	70	69	
Refer to CNIB					10.97, 3, 0.012
Yes	80 (57.6)	74 (50.7)	34 (48.6)	50 (72.5)	
No	59 (42.4)	72 (49.3)	36 (51.4)	19 (27.5)	
Column total	139	146	70	69	
Refer to MDLVC					32.69, 3, <0.0005
Yes	35 (25.2)	55 (37.7)	36 (51.4)	7 (10.1)	
No	104 (74.8)	91 (72.3)	34 (48.6)	62 (89.9)	
Column total	139	146	70	69	

LVS = Low vision service, LV = Low vision, OD = Optometrist, OMD = Ophthalmologist, MLVC = Multi-disciplinary low vision clinic, BCVA= Best corrected visual acuity
 Note: Those in bold are significant *4 cells or 50% cell have an expected count of less than 5

Provision of more extensive Low Vision Service

The factors that were associated with the provision of more extensive LVS (Table 1) were male gender ($p=0.016$), having practised for 16 years or more ($p<0.0005$), seeing >60 patients a week ($p=0.046$), having another local optometrist/ophthalmologist who provides LVS within one day's travel ($p=0.012$), not having a multi-disciplinary LV clinic (MDLVC) within one-day's travel ($p=0.004$), working in a practice located in a community of <50,000 people ($p<0.0005$), working in a private practice versus institution ($p=0.002$) and having two or more optometrists in the same practice ($p=0.001$).

Table 2 shows the final factors that were included in the multivariate model for providing more extensive LVS. These were the optometrist having practiced for 16 years or more ($p<0.0005$), having a local LV optometrist/ophthalmologist within one day's travel ($p=0.005$), not having a MDLVC within one-day's travel ($p<0.0005$), working in a practice located in a population of <50,000 ($p<0.0005$), and having two or more optometrists in the same practice ($p<0.0005$).

Comparisons between Regions

Of all the respondents, 9 did not indicate the province of their practice and therefore were not included in the comparison across provinces. Table 3 shows a summary of the regional comparisons. Regarding the availability of local LVS, no statistically significant regional differences were found in the frequency of: receiving a written report from the LV provider to which a referral was made, referring an early or more advanced ARMD patient to the CNIB, assessing an early ARMD patient for basic magnification and lighting, and providing information about reading techniques to a patient with hemianopia.

The provision of more extensive LVS differed between regions, such that optometrists in the Eastern provinces were more likely to offer more extensive LVS. The presence of an optometrist offering LVS in the respondent's primary practice also significantly differed across regions ($p=0.031$), being more likely in the Eastern Provinces. Note that this question did not specify the level of LVS (basic versus extensive).

Referral Criteria

Respondents from Quebec were less likely to refer patients to LVS when the patient's BCVA was better than 6/21, more likely when the patient's BCVA was 6/21 to better than 6/60 and less likely when the patient's BCVA was 6/60 and worse. This may be because they have already referred these patients before their BCVA dropped to 6/60. Respondents from the Western Provinces seemed less likely to refer when the patient's BCVA

was 6/21 to better than 6/60 and more likely to refer when the patient's BCVA was 6/60 and worse.

Respondents from Quebec were more likely to refer patients to LVS when the patient's total visual field diameter was between 35° to 49° and less likely to refer when the patient's total visual field diameter was <20°. Conversely, respondents from the Western Provinces were more likely to wait until the patient's total visual field diameter was <20°.

Patterns of Referrals to Other Low Vision Providers

Respondents from the Western and Eastern provinces were more likely to refer patients to CNIB, whereas respondents from Quebec were less likely to do so. Respondents from Ontario tended to be more likely to refer patients to local optometrists/ophthalmologists, whereas respondents from Quebec were less likely to make such a referral. Respondents from Quebec and Ontario were more likely to refer patients to MDLVC, while respondents from Eastern and Western Provinces were less likely to do so.

Quality of Low Vision Services

Respondents from the Eastern Provinces were less likely to report not knowing the quality of LVS, less likely to report the quality of LVS as outstanding and more likely to report the quality of LVS as fair. Respondents from Quebec were more likely to report the quality of LVS as outstanding and less likely to report the quality as fair, poor or none.

Hypothetical Case Questions

For the patient with early ARMD, respondents from Ontario were more likely to refer the patient to a local optometrist. Respondents from Quebec were more likely to refer to a MDLVC, whereas respondents from the Western Provinces were less likely to refer to a MDLVC. These remained significant when applying the adjusted Bonferroni p value.

For the patient with advanced ARMD, respondents from Quebec were less likely to refer to another optometrist whereas those from Ontario were more likely to refer to fellow optometrists. Respondents from the Eastern and Western Provinces were less likely to refer to a MDLVC. In contrast, respondents from Quebec were more likely to refer to a MDLVC. Respondents from Quebec were less likely to assess for basic magnification and lighting and then refer whereas respondents from the Eastern Provinces were more likely to assess and then refer. Lastly, respondents from the Western and Eastern provinces were more likely to undertake full vision rehabilitation by themselves, including distance and near magnification, lighting and advice about writing devices.

For the hypothetical patient with hemianopia, respondents from Quebec were less likely to provide information and prescribe prism whereas respondents from the Eastern Provinces were more likely to do so. Respondents from the Eastern Provinces were more likely to refer the patient to CNIB than those in other provinces. Respondents from the Eastern provinces were less likely to refer the patient to a MDLVC whereas respondents from Ontario and Quebec were both more likely to refer to a MDLVC.

Discussion

Characteristics of Optometrists Who Provide More Extensive Low Vision Care

The multivariate logistic regression analysis found that optometrists with 16+ years of practice were more likely to provide more advanced LVS. There has been an increasing concern about the scarcity of optometry students who were expressing interest in LV as a “clinical subspecialty.”⁹ The cost of providing LVS may be a barrier and it is possible that optometrists in more advanced years of practice have more financial means to set-up and equip their office with specialized LV equipment. Also, perhaps older optometrists empathize more with older adults who suffer from vision loss.

MDLVCs or more specialized LVS tend to be situated in urban centres. Optometrists in less populated communities may therefore be more inclined to provide more extensive LVS. What is more surprising is that having another optometrist or ophthalmologist or a MDLVC within a day's travel was also predictive for providing more extensive LVS and these were independent factors. It is possible that having one professional provide services actually encourages others to do so or perhaps optometrists feel that they do not want to “lose” their patients to other local offices.

Respondents who worked in a group practice were found to be more likely to provide more extensive LVS. Group practice may allow the individual optometrist to have more time and freedom to accommodate patients with vision impairment. Also, it may be easier to establish a patient-base for low vision as fellow colleagues in the same practice may become the referral sources.

Geographic comparisons

As would be anticipated, the regional comparisons suggest that the character of referrals is influenced by the services available and their eligibility criteria.

In each of the hypothetical cases, respondents from Quebec were more likely to refer to a MDLVC than respondents from other regions. Also, more respondents from Quebec than other

provinces reported the quality of the LVS to be outstanding. In Quebec, there are full multi-disciplinary, government-sponsored rehabilitation centres, and assessments are provided by optometrists, occupational therapists, orientation and mobility counsellors, psychologists and social workers in one location.¹⁰ In contrast, some clinics in other provinces are sometimes considered multi-disciplinary but may only consist of an optometrist or ophthalmologist who performs the LV assessment and a LV therapist who performs rehabilitation training. The eligibility criterion for assessment and device coverage in the Quebec LV centres is a BCVA of <6/21 in each eye or a visual field of <60°. ¹⁰ Our results found that respondents from this province referred to other LVS at these levels of vision loss.

Optometrists from the Western provinces were more likely to refer to CNIB than multi-disciplinary clinics. However, some ambiguity exists in these two choices as there is a partnership between MDLVCs and CNIB in service delivery. To be eligible for device subsidy, patients in Alberta have to be registerable with CNIB (i.e. legally blind)¹¹ and patients in Saskatchewan need a BCVA of 6/45 or worse, or fields <20 degrees^{12,13} Respondents from the Western provinces were more likely to assess for basic magnification and lighting requirements and then refer, which may reflect the more stringent criteria for device eligibility compared to Quebec. This preferred course of action may also reflect that private practice optometrists in British Columbia and Alberta can claim a fee for LVS under the provincial health plan.

In Ontario, MDLVCs are found in Waterloo, Toronto and Ottawa, but are generally not as fully multi-disciplinary as those in Quebec. Patients outside these catchment areas may be referred to local optometrists or ophthalmologists for LVS. Since 2008 LVS provided by or under the supervision of an ophthalmologist became covered under the Ontario Health Insurance Plan.¹⁴ Thus optometrists in Ontario may be more likely to refer patients to “local optometrists or ophthalmologists”. The optometrists in Ontario had a wider spread of referral criteria which may reflect the variety of options available and the lack of one clear criterion.

The population of most communities in the Eastern and Western provinces is smaller and more spread out than Ontario and Quebec. Low vision assessments are covered by the provincial health plan in Nova Scotia by optometrists¹⁵ and ophthalmologists,¹⁶ and in Newfoundland and Labrador by an ophthalmologist. However, in these eastern provinces, there is no device coverage. To the authors' knowledge there are no MDLVCs in the Eastern provinces which may explain why respondents from these provinces tended to have optometric

colleagues in their primary practice who offer LVS and were more likely to offer more extensive LVS themselves. Referral to CNIB may be the only choice in some localities. Additionally, respondents from the Eastern provinces tended to intervene more in each of the hypothetical cases, likely due to the availability of provincial coverage for optometric low vision services in Nova Scotia and the lack of MDLVCs.

Limitations of the study

As with all surveys, the results of this survey may be biased towards the characteristics of those who have an interest or feel strongly about the topic. Therefore, the numbers of optometrists who offer more extensive LV services may be overestimated. Additionally, not all optometrists responded to all questions. In particular, fewer respondents answered the questions regarding the presence of an optometrist within the respondent's primary practice offering LVS. Perhaps these respondents were more likely not to have a colleague in the office. Also, fewer respondents answered the question regarding their visual field referral criteria. This may be because visual fields are not always measured, being typically used for detection or monitoring of specific eye disease, rather than for functional purposes. The term "multidisciplinary LV clinic" was not defined and can mean anything from an optometrist working with a low vision therapist to a full multidisciplinary team, including optometrists, ophthalmologists, opticians, social workers, low vision trainers, counsellors, orientation and mobility specialists and occupational therapists.¹⁷ Indeed, there is a wide array of arrangements in these clinics across Canada. Since only an English version of the survey was available, the results may be biased towards respondents who are able or willing to communicate in English, especially in Quebec. However, a sub-analysis of the distribution of responses from Quebec indicated that primarily Anglophone areas were not over-represented. For example, over half ($n=31$) of the respondents from Quebec practice in towns/cities with populations of $<500,000$. Of these smaller towns/cities, only four have an Anglophone population of $>5\%$.¹⁸

Conclusion

This study shows that optometrists who worked in less populated areas were more likely to provide more extensive optometric LVS, and thus optometrists do adapt to offer needed services. They are also prepared to refer when more specialized LVS are available. Optometrists have the optical and health knowledge required to become competent providers of basic and more extensive LVS.⁶ They are well distributed geographically to offer these services in less populated areas

or in areas where MDLVCs do not currently exist. How LVS are provided clearly differs between regions, with Quebec's model being the most comprehensive. Further studies should investigate the benefits of a more consistent model of low vision provision across Canada, the strategic placements of more regional MDLVCs and the possible adoption of a model such as the Quebec model in other provinces/territories in Canada.

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Appendix. Summary of the questionnaire

	Question	Description	Multiple Choices Available
Demographics - Respondent's profile	A1	How many years have you been practicing optometry?	0-5 years 6-10 years 11-15 years 16-20 years 21-25 years 26 or more years
	A2	Gender	Male Female
Demographics - Primary practice profile	B1	In which province is your primary practice situated?	BC, SK, MN, AL, ON, QC, NS, NB, PEI, NL
	B2	Please estimate the population of the city/town where your primary practice is located?	Under 2500 2,500 to 9,999 10,000 to 49,999 50,000 to 99,999 100,000 to 499,999 500,000+
	B3	In what type of practice do you work (regarding your primary practice)?	Private single practice (one optometrist in solo practice) Private group practice/Cost-sharing (two or more optometrists working in association or sharing the expenses of the practice) Practice beside an optical (dispensing optician practice) Practice within an optical Educational institution
	B4	How many optometrists are practicing at this office at one time (i.e. are physically working at the office simultaneously)?	1, 2, 3, 4, More than 4
	B5	In a typical week, please estimate the percentage of patients seen in each of the following categories at your primary practice (i.e. by all practitioners):	Open answer – respondent gives the percentage
	B6	How does this practice see patients? (check all that apply)	By appointment only By a mixed drop-in/appointment system Accepts emergencies Does not accept emergencies Other

	Question	Description	Multiple Choices Available
Demographics – Primary practice profile	B7	In a typical week, please estimate how many patients are seen in your primary practice (including all optometrists)?	0-20 21-40 41-60 61-80 81-100 101-120 >120 (please specify)
	B8	Which of the following low vision services are within one day's travelling distance for your patients? (check all that apply)	Local OD or ophthalmologist CNIB Multi-disciplinary low vision clinic Other
	B9	Does any optometrist in your primary practice specifically offer the following services (check all that apply)	Binocular vision therapy Paediatric care Low vision care Special contact lenses Geriatric care Assessments for children with reading/learning difficulties Other
Demographics – Respondent's patient profile	C1	In a typical week, please estimate the percentage of patients seen in each of the following categories by you:	Open answer – respondent enters the percentage
	C3	In a typical week, please estimate how many patients are seen by you?	0-20 21-40 41-60 61-80 81-100 101-120 >120 (please specify)
	C4	On average, please estimate what percentage of your patients have best corrected visual acuity in the better eye of:	Open answer – respondent enters the percentage for the following: % Better than 6/12 % 6/12 to better than 6/21 % 6/21 to better than 6/60 % 6/60 and worse
Low Vision Practice Pattern	C5	For a patient with early ARMD with VA = 6/12 in the better eye and with a main goal of reading, would you:	Referral to OD Referral to CNIB Referral to multi-disciplinary low vision clinic Assess for basic magnification and lighting requirements Other
	C6	For a patient with more advanced ARMD, with best VA = 6/60, and goals of reading, TV and writing, would you:	Referral to OD Referral to CNIB Referral to multi-disciplinary low vision clinic Assess for basic magnification and lighting requirements and then refer Undertake rehabilitation, including distance and near magnification, lighting and advice re: writing devices Other
	C7	For a patient with bilateral homonymous hemianopia who is having difficulty with reading and mobility, would you:	Provide information about reading techniques Provide information about reading techniques and prescribe sector Fresnel or Peli prism Refer to CNIB Refer to multi-disciplinary low vision clinic Other

	Question	Description	Multiple Choices Available
Demographics – Primary practice profile	C9	Which of the following equipment do you have in your practice (check as many as apply)?	logMAR VA chart Feinbloom chart Paper contrast sensitivity chart Computer contrast sensitivity chart Lighthouse continuous text card for adults or equivalent Range of selective transmission tints/fit-overs Range of full field microscopes Range of prism half eyes Range of hand magnifiers Range of internally illuminated stand magnifiers Range of hand held telescope Other
	C10	What level(s) of LV service do you provide? (check all that apply)	A. Recognition of a LV case B. Assessment of visual impairment C. Assessment of disability D. Manage a patient with minimum visual disability and simple goals using high powered additions and lighting E. Manage a patient with minimal visual disability and simple goals using optical devices such as hand and stand magnifiers and filter lenses F. Manage a patient with more than minimum visual disability who requires more than basic devices (ex. Telescopes, electronic low vision aids, custom-designed microscopes, etc) G. Manage a patient with complex goals (ex. Vocational, requiring multiple interventions)
Referral Pattern	C8	At what level of vision loss would you refer to specialized services for persons with visual impairment? Check one answer for VA and one for fields	VA Better than 6/12 6/12 to better than 6/21 6/21 to better than 6/60 6/60 and worse VF >50 deg 35-49 deg 20-34 deg <20 deg
	D1	Who or which organization(s) do you refer to, if any, for low vision service? (check all that apply)	Do not refer CNIB Local OD or ophthalmologist Multi-disciplinary low vision service Other
	D2	Rate the low vision services in your local area, other than any low vision services provided by you, in terms of availability or quality. Please check the box that apply	Availability Outstanding, Good, Fair, Poor, None, Don't know Quality Outstanding, Good, Fair, Poor, None, Don't know
	D4	Of the referrals you make for low vision services, how often do you receive a written report of the results? Please check the box that applies.	Almost never Rarely Sometimes Often Almost always

	Question	Description	Multiple Choices Available
Exploratory Questions	C11	If you do not manage many low vision patients at levels D and E in question 10 above, please indicate your reasons for not seeing these patients (select only those that apply and rank in order of importance; where 1 = most important reason. If you do manage patients at levels D and E, skip to question 14.	Lack experience Lack knowledge Inadequate equipment to do reliable examination No devices to do a trial of low vision aids No fee claimable for LV assessment Time consuming Lack of interest Too frustrating Partner(s) or associate(s) sees the LV patient Other
	C12	If your answer to #11 was that you do not have adequate equipment or devices, then please let us know what factors might influence the decision not to acquire LV equipment. (select only those that apply and rank in order of importance; where 1 = most important reason)	Lack of interest Not financially viable Not enough foreseeable demand No funding for devices Funding is available but paperwork too time consuming No time to train staff and/or limited staff resource Other
	C14	If you do not manage many low vision patients at levels D or E in question 10, please indicate what would need to change for you to be willing to manage more of these patients (check all that apply and number in order of importance; where 1 = most important reason).	More education More equipment A fee for low vision service Funding for low vision devices Nothing would entice me Other
	C13	Do you feel that you would want to benefit from more education on the subject of low vision? If so, please give information about what aspects of training/education of low vision would be useful and how this might best be achieved?	Open answer
	C15	Please let us know any other comments that you have about provision of LV services in your practice or area.	Open answer