A scoping review of vision rehabilitation services in Canada

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Abstract
Around 1.5 million Canadians live with some form of vision impairment. The demand for vision rehabilitation (VR) services is projected to increase as the number of older adults with age-related vision loss rises. To inform programmes and policies for VR, we aimed to answer two research questions: (1) How are VR services delivered in Canada? and (2) If gaps exist in current delivery of VR services, how can they be characterized? We used Arksey and O’Malley scoping review framework. A comprehensive search of five databases (PubMed, CINAHL/EBSCO, EMBASE, ProQuest, and Global Health) was performed during January 2019 and then updated in March 2021. Index terms and keywords relating to vision loss or impairment and rehabilitation were used. Non-peer-reviewed (grey) literature, in the form of reports and policies on VR in Canada, was sourced via Google/Google Scholar. To be included, sources had to (1) focus on VR services in Canada, (2) be available in English or French, and (3) be published after 2003. Data were extracted and analysed thematically to describe VR services across provinces and to identify gaps in service

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delivery in Canada. Out of 1311 studies identified, 62 were included. Findings indicate that the structure of VR services as well as provincial funding for assistive devices varies across provinces. The reported gaps at the level of service providers, users, and delivery systems were lack of awareness about the benefits of VR, limited collaboration and coordinated services between eye care and VR services, delayed referral to VR, shortage of specialists, and insufficient funding and training for vision devices. This article describes VR services in Canada and documents important gaps in VR services and research evidence across provincial jurisdictions. Future work to address gaps, and develop and evaluate interventions to facilitate optimal VR services is imperative.

**Keywords**
Blind, Canada, health services, low vision, review, vision impairment, vision loss, vision rehabilitation

Vision loss, defined as uncorrectable, partial, or complete impairment of vision, is an important public health concern (World Health Organization [WHO], 2019), with the demand for vision care and rehabilitation projected to rise alongside an increasingly older population with associated age-related eye conditions (Gresset, 2005; National Coalition for Vision Health, 2010). Vision loss now affects over 1.5 million Canadians (Morris et al., 2018), and almost 3.43 million more are at high risk of vision loss due to age-related eye conditions – age-related macular degeneration, cataract, diabetic retinopathy, and glaucoma (Access Economics Pty Limited, 2009). Two recent studies using the data from the 2016 Canadian Longitudinal Study on Aging reported that the prevalence of vision loss was 5.7% in Canadians aged 45–85 years (Aljied et al., 2018), and that 4 million Canadians had at least mild vision loss (logMAR $\geq 0.2$) (Mick et al., 2021).

Vision loss has profound effects on individuals’ daily functioning and community participation and poses serious implications for health and social care systems (Pérès et al., 2017; WHO, 2019). At an individual level, vision loss is associated with increased risk of depression, social isolation, unemployment, restricted mobility, falls, injuries, medication errors, early placement in long-term care homes, and even mortality (Meyniel et al., 2017; National Coalition for Vision Health, 2010). These are associated with a projected annual cost of $30.3 billion in health and social care by 2032 (Access Economics Pty Limited, 2009; Cruess et al., 2011). However, evidence also suggests that vision rehabilitation (VR) interventions are cost effective, reducing both the impact of vision loss and the costs of care (Taylor et al., 2006). Given the potential cost savings and demographics of low vision and blindness in Canada, there is a need for adequate planning for VR resources (Gresset, 2005). Despite this evidence, VR is often overlooked in health care policies, and vision research is critically underfunded in Canada (Maberley et al., 2006; National Coalition for Vision Health, 2010).

Comprehensive VR refers to ‘a multidisciplinary endeavour that encompasses the full spectrum of a patient’s rehabilitation journey after vision loss, from initial assessment through intensive rehabilitation therapy, laying the foundation for a healthy and independent life in the community’ (Gordon et al., 2015, p. 85). The WHO’s (2013) Global Eye Health Action Plan 2014–2019 explicitly refers to VR as an essential component of eye care and emphasizes its importance in mitigating the negative consequences of vision loss. The Government of Canada, as a signatory to WHO’s VISION 2020 and Global Eye Health Action Plan 2014–2019, has committed to the goal of ensuring universal access to comprehensive eye care and VR for all Canadians (Vision 2020 Canada, 2011; WHO, 2013).

While steps have been taken to improve VR services in Canada (Vision 2020 Canada, 2011), a comprehensive understanding of how services are structured and delivered across Canada is
lacking. Hence, this study aimed to describe provincial and territorial VR services (the type of services and their funding arrangements) and uncover gaps in service delivery in Canada to inform future research and service development.

**Methods**

We conducted a scoping review using the methodological framework published by Arksey and O’Malley (2005) and subsequent recommendations by Tricco and colleagues (2018). The framework includes the following stages: identifying the research question; identifying relevant studies; selecting studies; charting the data; collating, summarizing, and reporting the results; and confirming results with stakeholders (optional). The final, optional step was not considered necessary, given that the research team included both VR providers and stakeholders. In addition, this team composition (providers and stakeholders) promoted an integrated knowledge translation approach to this study (Bowen & Graham, 2013). We used the PRISMA Extension for Scoping Reviews (PRISMA-ScR) to report results (Tricco et al., 2018).

**Stage 1: identifying the research question**

The questions guiding this review were developed in collaboration with staff of Vision Loss Rehabilitation Canada (VLRC). The research questions were as follows: (1) How are VR services delivered in Canada? and (2) If gaps exist in current VR services, how can they be characterized? While terms such as vision loss and low vision are often used to refer to uncorrectable impairment of the eye(s) or visual system, the authors chose to use the term vision loss because it includes both low vision and blindness. VR – rather than low-vision rehabilitation – is therefore used throughout the manuscript.

**Stage 2: identifying relevant studies**

A comprehensive search was performed in January 2019 and updated in March 2021. The search strategy was developed by the research team in consultation with a health science librarian. Five scientific databases were searched using index terms and keywords (Table 1) tailored to each database. We included peer-reviewed journal articles, editorials, and letters to the editor. We did not apply a language limit in our search strategy. Non-peer-reviewed (grey) literature was retrieved from Google and Google Scholar using the terms ‘low vision’, ‘vision loss rehabilitation’, and ‘readaptation en déficience visuelle’ in combination with ‘Canada’. The first 100 hits were screened to identify relevant reports and policies using a priori inclusion criteria.

In addition, we searched through the online databases of the Canadian Journal of Ophthalmology and the Canadian Journal of Optometry published after 2003 to increase the likelihood of finding relevant articles in the Canadian context. These two journals were chosen because of their relevance to the field and the fact that not all of their content is indexed in scientific databases.

Finally, reference lists of the most relevant articles were reviewed to identify additional studies/documents. Sources were imported into the bibliographic manager Mendeley Desktop (2019) and duplicates removed.

**Stage 3: study selection**

The research team screened all titles/abstracts and then completed the full-text review of included sources. Two team members (S.S. and S.W.), who are proficient in French and in English,
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completed the screening and data extraction of articles/reports in French. To be included, the source had to: (1) focus on vision loss or low-vision rehabilitation services in Canada, (2) be available in English or French, and (3) be published after 2003, when Canada signed the WHO VISION 2020 declaration. Any doubts in selection were resolved in consultation with senior research team members (M.A.S. and D.K.). These team members monitored the overall screening process and provided input to ensure the search was thorough. The final list of identified sources was compiled in a Microsoft Excel (2017) spreadsheet for data charting.

**Stage 4: data charting**

Study details, including publication details, study location, design, population, focus, and key findings, pertinent to the research questions were extracted from included studies and entered into the spreadsheet. Data extracted from the grey literature included type of report, focus, and key recommendations.

**Stage 5: data synthesis and reporting**

Following data charting, the research team synthesized the findings, describing VR services across provincial jurisdictions in the form of tables and figures. Thematic analysis was used to identify and describe gaps in service delivery at the level of service providers, service users, and the service delivery system (Braun & Clarke, 2006).

**Results**

A total of 1311 sources were retrieved from the two searches, of which 62 met the inclusion criteria (Figure 1) (Moher et al., 2009). Findings are presented in three parts. First, characteristics of the included studies are described. Second, findings on VR services at national and provincial levels are presented. Finally, gaps in VR services in Canada are described.

**Characteristics of included sources**

Of 62 sources, the majority ($n = 51$) were peer-reviewed, while the remainder were non-peer-reviewed reports and policy papers ($n = 11$). The source type and methodology of peer-reviewed papers are displayed in Figure 2, while Tables 2 and 3 summarize the included sources.
Almost half of the sources were national in scope (n = 30), of which 21 were scientific publications while the other 9 were reports. The other 32 sources included were provincial studies and reports from Ontario (n = 9), Quebec (n = 19), Alberta (n = 2), and one each from Manitoba and Saskatchewan. Of the 62 sources, 18 were published in the last 5 years (2016–2021). Twenty of the 51 peer-reviewed sources involved patients with low vision or VR service users and focused primarily on the utilization, awareness, experiences, and barriers and enablers to VR service use. Eight sources examined the perspective of service providers and focused on the extent of or barriers to VR services. Nine sources discussed or proposed a model of VR services in Canada or discussed operational costs. Other sources (n = 18) focused on topics such as assistive technology, assessment tools, reading skills, service classification system, employment programmes, research in VR, and the role of occupational therapy in VR.

**VR service delivery in Canada**

The review shows that, in Canada, VR services are delivered in four settings. Each is described below.
A number of studies identified the Canadian National Institute for the Blind (CNIB), a nation-wide, registered charity-based organization, as the largest vision loss rehabilitation service provider in the country for people of all ages with vision loss (Canadian National Institute for the Blind [CNIB], 2014; Eye Health Council of Ontario, 2015; Lapointe, 2006; Leat, 2016; M. Markowitz, 2006). VLRC is a health service organization spun out of the CNIB. Today, VLRC is primarily funded by provincial governments, though at the time of publication of most included sources, VLRC was a component of CNIB charitable services. Vision loss rehabilitation involves training in the use of sight enhancement and/or sight substitution skills, strategies, and assistive devices (Gordon et al., 2015, p. 85). This organization provides multidisciplinary vision loss rehabilitation services including functional vision assessments, eye disease education, counselling, essential skills for daily living, travel and mobility instruction, assistive technology services, and, in some provinces, early intervention for children and their families (VLRC, n.d.). Services provided by VLRC are nationwide (with limited service in Quebec) and vary from province to province depending on provincial funding.

**University-based/affiliated VR centres.** Some studies described VR services provided through university-based VR centres or low-vision clinics, typically located in either Ophthalmology or Optometry departments of University-affiliated teaching hospitals (see Table 4 for example). These VR
Table 2. Summary of peer-reviewed sources on vision rehabilitation in Canada \( (n = 51) \).

| S. no. | Source | Study location | Study design | Study population | Study focus | Key finding |
|--------|--------|----------------|--------------|------------------|-------------|-------------|
| 1      | Chavda et al. (2014) | Canada | Systematic review | Not applicable | Identifying the benefits of LVR in children | LVR in children is understudied as most of the literature is descriptive case series with small sample sizes |
| 2      | Gold et al. (2006) | Canada | Survey | 30 older adults with VL; 26 ophthalmologists, 25 optometrists, and 10 opticians; 50 VR practitioners | Perspectives of service users and service providers on VR service in Canada | Availability and funding for VR services and aids differ between rural and urban areas across provinces |
| 3      | Gordon et al. (2015) | Canada | Letter to the editor | Not applicable | Review of existing guidelines and standards on comprehensive VR | Ophthalmologists and optometrists should be involved in the assessment and initial VR, while specialized rehabilitation professionals should provide post-VR to restore patients’ independence |
| 4      | Hamade et al. (2016) | Canada | Meta-analysis | Not applicable | Effect of various VR strategies on reading speed and depression in patients 55 and older with AMD | VR strategies such as micro-perimetric biofeedback, eccentric viewing training, and microscopes teaching programme significantly improved reading speed, of which eccentric viewing training showed the maximum improvement in reading speed. In addition, a non-significant improvement in depression scores was found |
| 5      | Jackson (2006) | Canada | Descriptive | Not applicable | Review and application of the American Academy of Ophthalmology SmartSight model in the Canadian setting | Lack of communication with caregivers about the consequences of VL act as a barrier to referral and utilization of appropriate VR |
| 6      | Jutai et al. (2009) | Canada | Systematic review | Not applicable | Effectiveness of assistive technologies for VR | The review indicated lack of evidence on performance measurements and the effectiveness of VR devices |
| 7      | Lam et al. (2015) | Canada | Survey | 459 optometrists | Extent of services provided, referral patterns, and barriers to service provision by optometrists | Optometrists need more education on LV services, provincial health coverage of optometric services, and improved communication with other service providers to provide better VR services |
| 8      | Lam & Leat (2013) | Canada | Literature review | Not applicable | Barriers to access LV care from the patient’s perspective | Barriers reported were lack of awareness and misconceptions about LV services among patients, cost, location and transportation, presence of comorbidities, income and education level, miscommunication and lack or delayed referral by eyecare professionals, and negative societal views and influence of family and friends |

(continued)
| S. no. | Source | Study location | Study design | Study population | Study focus | Key finding |
|-------|--------|----------------|--------------|------------------|-------------|-------------|
| 9     | Leat (2016) | Canada | Descriptive | Not applicable | Proposed model of integrated LVR services based on the evidence for the effectiveness of LV models elsewhere and comparing it with the current situation of services in Canada | Suggested a three-level VR model, wherein level 1 involves screening and triage, level 2 involves management at local optometry office, and level 3 involves comprehensive VR for patients with greater disabilities |
| 10    | M. Markowitz (2006) | Canada | Descriptive | Not applicable | Role of occupational therapy in LVR | Occupational therapy training for activities of daily living improves performance among those with residual vision |
| 11    | S. N. Markowitz (2006a) | Canada | Editorial | Not applicable | Ophthalmology research in LVR in Canada | Assessment of residual visual functions, and devices and training for rehabilitation of RVF are important aspects of modern LVR |
| 12    | S. N. Markowitz (2006b) | Canada | Descriptive | Not applicable | Principles and details of a modern VR service | Apart from optical devices, training programmes for restoration of lost vision-related skills are also needed and should be provided to the clients |
| 13    | S. N. Markowitz (2016) | Canada | Opinion piece | Not applicable | Description of modern VR services | Technological advancements such as retinal prosthetics are the way forward to advance VR services |
| 14    | M. Markowitz, Daibert-Nido & Markowitz (2018) | Canada | Literature review | Not applicable | Methods that can be used in rehabilitation of reading skills in patients with AMD | Reading skills for individuals with AMD are targeted using magnification and basic scotoma awareness training. However, most of training programmes are outdated |
| 15    | Martiniello et al. (2018) | Canada | Survey | 35 Teachers of Students with Visual Impairments and Rehabilitation Specialists who had taught braille within the past 5 years | Perspectives of professionals on the role of technology in current braille teaching practices | Technology is used less in braille instruction to older clients. The instructor beliefs in benefits of technology use and technological knowledge may influence the decision to incorporate technology within braille instruction |
| 16    | Mednick et al. (2017) | Canada | Qualitative study | Six patients with VL | Potential of iPad as a visual aid in patients with VL | Using an iPad improved independence and social connectedness among participants |
| 17    | Moore & Wanet-Defalque (2016) | Canada | Literature review | Not applicable | Overview of research advancements in the field of visual implants | The rehabilitation specialist has an important role in explaining the use of implants to clients, selecting candidates, and providing training with the use of the implant |
| S. no. | Source                           | Study location | Study design          | Study population                                      | Study focus                                                                 | Key finding                                                                                                                                                                                                 |
|-------|----------------------------------|----------------|-----------------------|-------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 18    | Simpson-Jones & Hunt (2019)      | Canada         | Literature review     | Not applicable                                       | Vision interventions following mild traumatic brain injury, professionals working in the field, and gaps in the literature | Interventions include optical devices and vision or oculomotor therapy. Professionals (e.g., optometrists, occupational therapists, physiotherapists) play an important role in screening, referral, assessment, and treatment of VL. Gaps in research included lack of studies on paediatric or older adult populations, small sample sizes, and most existing studies are associated with university-affiliated centres. |
| 19    | Teichman & Markowitz (2008)      | Canada         | Literature review     | Not applicable                                       | Involvement of researchers in LVR sciences                                  | There is limited evidence on effects of interventions for the restoration of functional vision.                                                                                                                   |
| 20    | Wanet-Defalque et al. (2009)     | Canada         | Literature review     | Not applicable                                       | Determinants of non-use of technical vision aids                           | Key determinants of abandonment were access to VR programmes, level and severity of impairment, design and appearance of equipment, training relating to use, and available social support.                                      |
| 21    | Wittich et al. (2012)            | Canada         | Systematic review     | Not applicable                                       | Professional leadership in advancing the frontiers of LVR research          | LVR research in Canada highlights collaborations among researchers, clinicians, funding sources, and rehabilitation agencies.                                                                                     |
| 22    | Harper et al. (2006)             | Alberta        | Narrative/ opinion piece | Not applicable                                      | LV service model in Alberta                                                  | Counselling and peer support are important parts of LVR, and all stakeholders are required to ensure this.                                                                                                     |
| 23    | Swift et al. (2021)              | Alberta        | Literature review     | Not applicable                                       | LV services in Alberta                                                      | Improving referral practices, increasing multidisciplinary efforts, simplifying access to LV devices programme, and advocacy for increased funding for LV services are recommended.                                      |
| 24    | Scanlan & Cuddeford (2004)       | Manitoba       | An experimental study with a control and experimental group | 64 individuals with AMD (age range: 65–89 years; 41 women) | Impact of extended education with clients with AMD to use LV devices         | An extended teaching time improved clients' ability to read and their overall quality of life.                                                                                                                  |
| 25    | Adam & Pickering (2007)          | Ontario        | Survey                | 29 ophthalmologists                                   | Barriers to referral for VR                                                  | Misconceptions about the referral criterion and lack of information about CNIB services were barriers to referral.                                                                                                |
| S. no. | Source | Study location | Study design            | Study population                                                                 | Study focus                                                                                   | Key finding                                                                                                                                                                                                 |
|-------|--------|----------------|-------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 26    | Basilious et al. (2019) | Ontario | Retrospective population-based study 2009–2015 | 92 ophthalmologists and 8949 patients with LV (age range: 71–90 years; 61% females) | Patterns of provision and utilization of VR services in Ontario | Less than 5% of patients accessed VR services provided by ophthalmologists. There was an overlap of services in geographic areas where largest patient populations exist, while many regions lacked services |
| 27    | Lapointe (2006) | Ontario | Narrative/opinion piece | Not applicable                                                                   | Provision of VR services                                                                        | A demographic upsurge of older adults in Ontario has made the planning of VR services in the province urgent. More funding and training for ophthalmologists are required to provide comprehensive VR services |
| 28    | Maberley et al. (2003) | Northern Ontario | Economic analysis | Isolated First Nations cohort with diabetes                                    | Cost-effectiveness of retinal photography with a portable digital camera                        | The portable retinal camera can be a cost-effective method for screening diabetic retinopathy in farther communities |
| 29    | M. Markowitz, Rankin et al. (2018) | Ontario | Retrospective review | 11 cases implanted with Argus II retinal prosthesis | Experience and concerns with VR training in patients with Argus II retinal prosthesis       | Surgical interventions, such as Argus II technology, are beneficial to patients and VR after surgery plays an indispensable role to ensure a successful outcome |
| 30    | S. N. Markowitz (2008) | Ontario | Editorial | Not applicable                                                                   | Importance and need of VR in Ontario                                                           | Ophthalmology residents should be trained in VR services while currently practicing professionals can benefit from refresher courses |
| 31    | Nia & Markowitz (2007) | Ontario | Observational case series | 34 patients with LV Mean age = 74 (SD = 16); 61% females                     | Delivery and use of VR services by hospital-based ophthalmology clinics                     | Study participants were dissatisfied with the services, and many of them were not referred to the appropriate VR services |
| 32    | Gilmour (2006) | Saskatchewan | Narrative/opinion piece | Not applicable                                                                   | Provision of VR services in Saskatchewan                                                      | Access to VR services is difficult for those living in rural areas. Specialized counsellors, psychologists, occupational therapists, and social workers can help to address the specific needs of the clients |
| 33    | Coulmont et al. Quebec (2011) | Quebec | Prospective cohort study | 100 older adults (≥65 years) with VL living in the community | Development of a classification system, based on full operating cost, for patients with VL referred to VR programme | A classification system was created based on the patient’s social needs as well as the patient’s physical impairment |
| 34    | Duquette et al. Quebec (2012) | Quebec | Conference paper | Not applicable                                                                   | Tool to assess reading abilities in the Quebec Francophone population with VL                  | The ECLec-DV is an assessment tool in French that can assess ability to read a continuous text by individuals with VL, especially older adults |

(continued)
| S. no. | Source | Study location | Study design | Study population | Study focus | Key finding |
|-------|--------|----------------|-------------|------------------|-------------|-------------|
| 35    | Duquette, Wante-Defalque et al. (2014a) | Quebec | Conference paper | Not applicable | Translation and adaptation of the Melbourne Low-Vision ADL Index for use in the Francophone population | *Mesure de l'impact de la déficience visuelle dans les activités quotidiennes* (MIDVAQ) is a tool in French to measure the impact of VL and VR interventions on the ability to carry out activities of daily living. Evaluation of the MIDVAQ for validity and sensitivity to change is needed |
| 36    | Duquette et al. (2014b) | Quebec | Retrospective chart review | Individuals receiving services from the INLB between 2009 and 2011 for eccentric vision assessment and training | Characteristics and impact of the eccentric vision assessment and training programme on functional autonomy, reading skills, and user satisfaction | The eccentric VR programme helps to improve functioning in activities of daily living and reading. It is effective for both moderate and severe VL |
| 37    | Fraser et al. (2015) | Quebec | Cross-sectional using structured interviews and questionnaire | 749 individuals with VL (aged 26–100 years) | Success factors in awareness of and choice of VR | VR services should be provided early to clients. Individuals also need education about the benefits of services |
| 38    | Fraser et al. (2019) | Quebec | Qualitative study | 21 individuals with VL (aged 38–92 years) who had or had not accessed VL services in Montreal | Factors that shape the social participation of older adults with VL | Stereotypes and stigma negatively influence participation. Improving awareness among public and healthcare providers could reduce stigma. Rehabilitation professionals should assess their own attitudes and encourage clients to attempt strategies to reduce barriers to social participation |
| 39    | Gresset et al. (2005) | Quebec | Qualitative study | Older adults aged 65 years and older awaiting VR services in the Montreal area | Behaviours and feelings of older adults after VL diagnosis | Eyecare specialists often miss to mention about VR services to their clients. Clients must do their own research or obtain help from a family member to get information on VR services. There is a long delay before receiving services |
| 40    | Moore et al. (2015) | Quebec | Case report | A 72-year-old female with right homonymous hemianopia requiring Peli lenses | Assess the benefit of having a LV optometrist on the rehabilitation team | Peli lenses can increase peripheral vision, thereby assisting with orientation and mobility. The optics expertise of an optometrist is useful to create well-fitting lenses |

(continued)
| S. no. | Source | Study location | Study design | Study population | Study focus | Key finding |
|-------|--------|----------------|--------------|------------------|-------------|-------------|
| 41    | Mwilambwe et al. (2009) | Quebec | Hospital-based cross-sectional | 448 patients with LV (mean age: 75 years; 250 females) | Association of demographic, visual, health, and psychological variables with awareness and use of VR services | Patients with less severe visual acuity loss were less likely to know and have participated in LV services |
| 42    | Overbury & Wittich (2011) | Quebec | Hospital chart/record review with a structured demographic interview and standardized questionnaire | 702 patients with vision impairment | Factors impeding older adults from accessing and using rehabilitation services and assistive devices | Service utilization was impacted by biased or late referral by the professionals, patients’ perceived rehabilitation needs, and stigma associated with services for the ‘blind’ |
| 43    | Renaud et al. (2005) | Quebec | Survey | 498 Optometrists | Understanding optometrists’ attitudes and knowledge towards LV patients and concerns related to specialized LV services | A modest proportion of optometrists perform comprehensive LV exams in Quebec. 3 in 5 optometrists reported that their patients often refused to visit a specialized VR centre |
| 44    | Robillard & Overbury (2006) | Quebec | Narrative/opinion piece | Not applicable | LV service model in Quebec | Patients face a delay of up to 6 months to reach a low-vision clinic in Quebec. Personnel and financial capacity need to be built to address the needs of the clients with LV in Quebec |
| 45    | Roy et al. (2009) | Quebec | Qualitative study | Experts in the rehabilitation field | Rehabilitation service bundles and the associated cost for patients with VL | Service bundles can be estimated using a base cost for services that are required for all forms of VL, then adding additional costs such as psychology or occupational therapy services |
| 46    | Southall & Wittich (2012) | Quebec | Qualitative study | 21 patients of ophthalmology clinic (age range: 38–92 years; 14 females) | Barriers to VR services | Barriers to VR services were found to be related at the individual level, vision health professionals’ level, and at the sighted community level |

(continued)
| S. no. | Source                          | Study location | Study design               | Study population | Study focus                                                                 | Key finding                                                                 |
|-------|---------------------------------|----------------|----------------------------|------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------|
| 47    | Témisjian et al. (2013)         | Quebec         | Qualitative study          | 16 people with low vision | Understand participant’s experiences accessing VR services            | Barriers identified were a lack of referrals from professionals and lack of information regarding rehabilitation services |
| 48    | Wittich et al. (2013)           | Quebec         | Review of a satellite office | 35 patients with low vision | Overcoming barriers to the continuum of vision care through piloting a satellite clinic | Ophthalmology departments attached with VR agency may improve triage of patients, a continuum of care and integration of services |
| 49    | Wittich et al. (2014)           | Quebec         | Cohort study               | Nine rehabilitation clients who were not working or in school | Development and adaptation of a pre-employment programme for individuals with VL in Quebec | The pre-employment programme by Centre de réadaptation Lethbridge-Layton-Mackay enabled participants to acquire employment, learn skills, pursue educational training, and understand resources available to them |
| 50    | Wittich et al. (2018)           | Quebec         | Cross-sectional comparison | 60 participants recruited from clients of two VR agencies in Montreal | Comparison of a tablet computer with a portable video magnifier in their use as spot-reading devices | Performance speed and satisfaction (dimensions, ease of use, and effectiveness) were identical between both devices. Preference: 25 for iPad, 33 for the portable closed-circuit television, and 2 for undecided |
| 51    | Yoo et al. (2020)               | Quebec         | Survey                     | 25 occupational therapists | Current occupational therapy practice in VR among patients with acquired brain injury | Evidence-based interventions are mostly being used to address visual acuity and visual field deficits, while very few interventions are used to address oculomotor function and visual stress impairments |

LVR: low-vision rehabilitation; VL: vision loss; VR: vision rehabilitation; AMD: age-related macular degeneration; RVF: Residual visual functions; LV: low vision; CNIB: Canadian National Institute for the Blind; SD: standard deviation; ADL: Activities of Daily Living; INLB: Institut Nazareth et Louis-Braille du CISS de la Montérégie-Centre.
Table 3. Summary of grey literature (policy reports) on vision rehabilitation in Canada \( (n = 11) \).

| Source                                                                 | Type of report                                                                 | Focus                                                                 | Key recommendations                                                                 |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Canadian Association of Optometrists, Canadian Ophthalmological Society, CNIB, Opticians Association of Canada (2015) | Charter of Rights (National)                                                  | Responsibilities of patients and professionals in ensuring the highest standard of vision care across the country | Commits to inclusive, accessible, and coordinated care for VR in Canada based on the essential rights and responsibilities of patients and professionals |
| Canadian National Institute for the Blind (2018)                       | Strategic plan 2018–2022 (National)                                           | Strategic ambitions and solutions to improve participation of individuals with blindness | Suggests improving participation of individuals with VL in paid work, improving access to technology, and removing social stigma against VL |
| Canadian Association of Optometrists, Canadian Council of the Blind, CNIB, The Foundation Fighting Blindness (2017) | Report prepared by vision care providers, rehabilitation professionals, and vision research funders across Canada (National) | Federal role in eye health and vision care | Recommends a framework for action executed by the Public Health Agency of Canada, enhanced funding, inter-professional collaboration, and public information campaign for vision care |
| Dennis (2017)                                                          | Canadian Association of Optometrists Submission to the House of Commons Standing Committee (National) | Eye health and vision care for seniors | Suggests making vision care for older adults priority. Preventive services must include comprehensive eye exams every year and access to affordable corrective treatments, rehabilitation services, and devices |
| Montreal Economic Institute (2014)                                    | Report (National)                                                             | Canada's private eye care sector                                      | Private financing and delivery of eye care in Canada can lead to high competition, which may drive improvements in product quality and price for adaptive devices |
| Access Economics Pty Limited, (2009)                                   | Report (National)                                                             | Costs of vision loss in Canada                                        | Suggests that employment accommodation and rehabilitation services are cost-effective supports to offset the financial and human cost of unavoidable eye disease |

(Continued)
| Source                                      | Type of report                                      | Focus                                    | Key recommendations                                                                 |
|---------------------------------------------|-----------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------|
| Canadian National Institute for the Blind   | Strategic plan 2014–2018 (National)                  | Strategic plan to improve VR services    | Recommends expanding dialogues with all levels of government to generate support and ensure VR services are integrated across continuum of care in Canada |
| National Coalition for Vision Health        | Report (National)                                    | State of vision health in Canada         | Advocates health promotion and education for vision care, improved funding and research to improve access to VR and assistive devices, and greater collaboration among vision health professionals and agreement on standard levels of care |
| Health Intelligence Inc.                    | Report (National)                                    | Costs of uninsured ophthalmological services | Provides an overview of guiding principles for patient billing practices for uninsured services. The report recommends that eye treatment options that are not insured under provincial or territorial health plans should be offered to patients at reasonable fees, and that it must be transparent and optional |
| Health Professions Regulatory Advisory Council (HPRAC) (2010) | Consultation Report submitted to the Minister of Health and Long-term care (Provincial report of Ontario) | Inter-professional collaboration for LV services | Urges the ministry to consider the provision of Ontario Health Insurance Plan coverage for the services of optometrists and ophthalmologists |
| Eye Health Council of Ontario (2015)        | Consultation Report (Provincial report of Ontario)   | Low-vision services in Ontario           | Primary, secondary, and tertiary levels of care are recognized for VR according to WHO guidelines. Financial coverage for comprehensive VR should be provided. |

VR: vision rehabilitation; VL: vision loss; LV: low vision; WHO: World Health Organization.
Table 4. Province-specific vision rehabilitation services.

| Province/ territory | Type of VR services | Funding arrangements |
|---------------------|---------------------|----------------------|
| Quebec              | **Government-Funded Rehabilitation Centres.** The majority of VR services in Quebec are provided through rehabilitation centres (such as Institut Nazareth et Louis-Braille du CISSS de la Montérégie-Centre/INLB and Centre de réadaptation Lethbridge-Layton-Mackay du CIUSSS du Centre-Ouest-de-l’Île-de-Montréal/LLM) and their counterparts throughout the province, the Centres régionaux de réadaptation en déficience physique (Robillard & Overbury, 2006). The 14 rehabilitation centres spread across the province provide VR services (Leat, 2016). The complete list of VR service providers in Quebec is available at: [https://www.quebec.ca/en/health/health-system-and-services/service-organization/cissss-and-ciusss/](https://www.quebec.ca/en/health/health-system-and-services/service-organization/cissss-and-ciusss/) |
|                     | **Hospital/University Clinics.** Some VR services are also available through five hospital-based low-vision clinics (Leat, 2016). Within Montreal, the satellite offices of two agencies (INLB and LLM) are placed within a variety of locations, such as the School of Optometry of the University of Montreal, the Jewish Rehabilitation Hospital, the Department of Ophthalmology of the Jewish General Hospital, and other community-based health centres (Wittich et al., 2013). Also, there are seven resource centres, other than government-sponsored rehabilitation centres, where low-vision devices are available (Robillard & Overbury, 2006) |
|                     | **Vision Assessments and Rehabilitation Services.** Full coverage is provided by Medicare, but only for patients who have been assessed in the government-sponsored rehabilitation centres (Robillard & Overbury, 2006). Vision assessments and aids prescription are completed by optometrists in private practice and other resource centres (Robillard & Overbury, 2006). **Assistive devices.** There is an official list of low-vision devices provided by the government. Devices are provided free on loan when the patient is assessed in one of the 14 centres (Leat, 2016). Devices must be returned to the centre when no longer being used (Robillard & Overbury, 2006) |
| Ontario             | **Vision Loss Rehabilitation Canada.** VLRC is the principal VR service provider in Ontario. It provides services through 24 sites across the province through a network of 24 local offices (VLRC, n.d.). **Hospital/University Clinics.** Low-vision clinics at the university-affiliated teaching hospitals (such as in the University of Toronto, the University of Ottawa, or Queen’s University ophthalmology departments) offer vision loss assessments and training of low-vision/assistive devices (Lapointe, 2006; Mednick et al., 2017). Also, the Centre for Sight Enhancement (CSE) is another university-based VR centre located at the School of Optometry of the University of Waterloo (Lapointe, 2006). **Regional Assessment Centres.** There are also 10 designated Visual Aid Program Regional Assessment Centres, under provincial Assistive Device Program (ADP). They provide high technology device assessments for sight enhancement and sight substitution (Lapointe, 2006). University of Waterloo and University of Toronto have one of these centres and the rest of them are located at different sites of VLRC |
|                     | **Vision Assessments.** Ontario Health Insurance Plan (OHIP) partial coverage of services provided by ophthalmologists, but not by optometrists (Eye Health Council of Ontario, 2015). Full coverage is provided for patients eligible for benefits under the Ontario Disability Support Program (ODSP), the Ontario Works (OW) programme, and by insurance companies for veterans (Lapointe, 2006). **Assistive devices.** Up to 75% of the cost of devices is covered by Ontario Assistive Device Program (ADP) (Lapointe, 2006) |

(Continued)
### Table 4. (Continued)

| Province/ territory | Type of VR services | Funding arrangements |
|---------------------|---------------------|----------------------|
| Alberta, NWT, & Nunavut | **Vision Loss Rehabilitation Canada.** VLRC is a principal VR service provider in Alberta (Harper et al., 2006; Swift et al., 2021). VR services are also delivered by VLRC counsellors both onsite at the CNIB Service Centre (now VLRC) and in clients’ homes. VLRC also works in partnership with local ophthalmologists and optometrists (specialized in low vision) to deliver VR services (Harper et al., 2006; Swift et al., 2021) | Vision Assessments. Generally, assessments are covered by Alberta Health Care; patients aged 19–64 are billed directly (Harper et al., 2006; Swift et al., 2021). Assistive Devices. 75% to 100% cost of the assistive device can be covered (based on financial need and level of vision loss) under Specialized Technical Equipment Program (STEP), a subsidy programme by the government which is administered through CNIB service centres (Harper et al., 2006; Swift et al., 2021) |
| Manitoba | **Vision Loss Rehabilitation Canada.** VLRC is the principal VR service provider in Manitoba. VLRC offers two multidisciplinary clinics where optometrists work in collaboration with other VR providers such as LV specialists, O&M instructors, independent living skills instructors, social workers, counsellors, occupational therapists, and an assistive technology department (Leat, 2016) | Vision Assessment. Optometrists can claim assessment fee if the assessment is done in the low-vision clinics or through the CNIB (Leat, 2016) Assistive Devices. Funding is not available (Leat, 2016) |
| Province/ territory | Type of VR services | Funding arrangements |
|---------------------|---------------------|----------------------|
| Saskatchewan        | Vision Loss Rehabilitation Canada. VLRC is a principal VR service provider in Saskatchewan (Gilmour, 2006) Hospital/University Clinics. VLRC works in close collaboration with vision clinics affiliated with the University of Saskatchewan's Department of Ophthalmology—the Northern Saskatchewan Low Vision Rehabilitation Clinic at Saskatoon City Hospital, and the Southern Saskatchewan Low Vision Rehabilitation Clinic in the CNIB building in Regina, overseen by Regina General Hospital's Department of Ophthalmology (Gilmour, 2006, p. 371) | Vision Assessment. Assessment is covered by Saskatchewan Medicare Insurance Commission for ophthalmologist fees (Gilmour, 2006) Assistive Devices. Standard vision devices are covered by the Saskatchewan Aids to Independent Living (SAIL) programme for those who receive a vision loss assessment within one of the vision loss clinics and who have visual acuity of 6/45 or worse or fields of less than 20 degrees (Gilmour, 2006) |
| Nova Scotia (NS)    | Vision Loss Rehabilitation Canada. VLRC is a principal VR service provider in these provinces (Leat, 2016). VR services provided by VLRC are free, and patients do not pay any fee for these services Independent Providers. Optometrists undertake visual assessment and provision of devices, and in some cases, make referrals to VLRC for other aspects of rehabilitation (Leat, 2016) | Vision Assessment. There is a fee for vision loss assessment by optometrists (Leat, 2016) Assistive Devices. Funding is not available (Leat, 2016) |
| British Columbia (BC) & Yukon\* | Vision Assessment. Balance billing and copayment is allowed; optometrists can bill a modest fee (Leat, 2016) Assistive Devices. Funding is not available (Leat, 2016) | Vision Assessment. Only veterans can claim the assessment fee (Leat, 2016) Assistive Devices. Funding is not available (Leat, 2016) |
| New Brunswick (NB)  | Vision Assessment. There is no fee coverage for vision loss assessment and services (Leat, 2016) Assistive Devices. Funding is not available (Leat, 2016) | |
| Prince Edward Island (PEI), Newfoundland, and Labrador\* | | |

**Table 4.** (Continued)

VR: vision rehabilitation; INLB: Institut Nazareth et Louis-Braille du CISSS de la Montérégie-Centre; VLRC: Vision Loss Rehabilitation Canada; CNIB: Canadian National Institute for the Blind; LV: low vision; VL: vision loss.

\*Some of the territories and provinces were grouped together based on available evidence.
services include some or all of the following services: vision loss assessment, prescribing of devices and training, fitting and dispensing of low-vision devices, orientation, mobility, and other functional training, and psychosocial support (Harper et al., 2006; Lapointe, 2006; Leat, 2016; Robillard & Overbury, 2006; Swift et al., 2021; Wittich et al., 2013). Services are provided through varying multidisciplinary teams that may include optometrists, ophthalmologists, opticians, low-vision specialists, orientation and mobility instructors, independent living skills instructors, counsellors, assistive technology support, psychologists, occupational therapists, and social workers, depending on the provincial regulations and funding arrangements (M. Markowitz, Daibert-Nido & Markowitz, 2018; Moore et al., 2015).

**Independent low-vision service providers.** Reports from two professional organizations, one national (Dennis, 2017) and one provincial (Eye Health Council of Ontario, 2015), noted that optometrists and ophthalmologists, in conjunction with other rehabilitation professionals (often low-vision therapists or occupational therapists), provide VR services in their offices. These services mostly include assessment for and prescription of low-vision devices (Eye Health Council of Ontario, 2015).

**Multidisciplinary rehabilitation centres.** Specific to Quebec, VR services are provided through government-sponsored, multidisciplinary rehabilitation centres. There are 14 rehabilitation centres spread across the province to provide VR services (Leat, 2016). Services include multidisciplinary assessments and interventions, psychosocial support, computer and other technical aid assessment, procurement, and training, reading skills training (Duquette et al., 2014), braille and pre-braille lessons, prescriptions for optical aids (Moore et al., 2015), training with the use of implants (Moore & Wanet-Defalque, 2016), home adaptation assessments and interventions (for aids to daily living), and home care support services (Centre intégré de santé et de services sociaux de l’Outaouais, 2019).

Information on province-specific VR services (Table 4) suggests that VR services vary across Canada. Funding also varies from public funding, private funding, or a mix of public and private funding. Two studies (Leat, 2016; Swift et al., 2021) reported that VR services seem most comprehensive in Quebec, followed by Ontario, Alberta, Saskatchewan, and Manitoba (Table 4). Data for Table 4 were compiled from the 62 included studies and is not a comprehensive list of available public or private VR services.

**Gaps in VR services in Canada**

Gaps in VR provision highlighted in the literature have been grouped by service provider, service user, and system levels.

**Gaps at the level of service providers.** These included poor knowledge of VR services among eye care and other health professionals, lack of collaboration and coordinated services between eye care professionals and VR service providers, and delayed or no referral to VR. Of 51 peer-reviewed sources, 20 studies focused on the utilization, extent of, and barriers to VR service provision. Eight studies were from the perspective of eye care professionals and underscored a lack of awareness of or misconceptions about VR among eye care professionals and poor care coordination (Adam & Pickering, 2007; Basiliou et al., 2019; Gold et al., 2006; Lam et al., 2015; Lam & Leat, 2013; Renaud et al., 2005). For example, a nationwide survey of 459 optometrists in Canada found that many who do not undertake low-vision assessment lacked education, experience, equipment, and devices specific to VR (Lam et al., 2015). These professionals stated that they found low-vision assessments time
consuming and cost prohibitive. This is supported by findings of an earlier survey which concluded that only a modest proportion of optometrists perform comprehensive low-vision exams in Quebec (Renaud et al., 2005). Fraser et al. (2019) discussed the notion of stereotyping individuals with VL in a clinical setting that may lead to assumptions about the challenges and needs of the patient. These may differ significantly from the patient’s intended goals. A study of patients in Montreal also revealed that limited time of ophthalmic consultations and lack of effective communication with service providers were barriers to VLR (Southall & Wittich, 2012).

Timely referral to VR was also a common theme identified by service providers and patients. The Montreal Barriers study found that lack of or late referral by the eyecare professionals impeded older adults from obtaining VR services (Overbury & Wittich, 2011). A second study, investigating barriers to ideal referral practices in the Greater Toronto Area, characterized barriers as misconceptions regarding referral criteria and lack of knowledge of VR services among ophthalmologists (Adam & Pickering, 2007). Patients with vision loss have also expressed dissatisfaction with services and the lack of timely referral to appropriate VR services (Gresset et al., 2005; Lam & Leat, 2013; Nia & Markowitz, 2007; Robillard & Overbury, 2006). However, patient attitudes themselves also influence access to services. Using regression analysis (n = 749 patients with vision loss), Fraser et al. (2015) found that motivation to seek VR services decreased when duration of symptoms exceeded 9 years. After this time, individuals may have found compensatory strategies or habituated to impairment. Therefore, early referral to VR services may be important (Fraser et al., 2015).

Some studies recommended education of eyecare providers to overcome identified gaps. Education for optometrists and ophthalmologists emphasizing identification of clients in need and ideal time for referral to appropriate VR services was proposed in several studies (Adam & Pickering, 2007; Lam & Leat, 2013; Lam et al., 2015; Swift et al., 2021). Adam and Pickering (2007) argued that timely referral could be improved by assisting eye care professionals to focus on overall functional capacity rather than limiting decisions to poor visual acuity or decreased visual fields (Adam & Pickering, 2007). Another author emphasized that rehabilitation, focused on restoration of lost vision-related skills, should occur after optimal residual visual functions are achieved with optical devices (M. Markowitz, 2006). Increasing the number of ophthalmologists specialized in VR (Lapointe, 2006), incorporating aspects of VR into ophthalmology residency training, and providing refresher courses to practicing professionals (S. N. Markowitz, 2008) were also proposed. Fraser et al. (2019) suggested that clinicians be educated on the pitfalls of stereotyping patients with VL in clinical practice, including increasing self-awareness of attitudes and beliefs that can influence care provision.

Four studies emphasized the need for occupational therapy in VR (Gilmour, 2006; S. N. Markowitz, 2008; Simpson-Jones & Hunt, 2019; Yoo et al., 2020) as it improves participation in activities of daily living.

M. Markowitz, Daibert-Nido, and Markowitz (2018) suggested that guidelines for reading skills improvement be updated as several tools have been created in recent years that have not yet been incorporated into the recommendations for VR services. A meta-analysis suggested using VR strategies such as micro-perimetric biofeedback, eccentric viewing training, and microscopes teaching programmes to improve reading skills (Hamade et al., 2016). French-language adaptations of assessment tools have been created for standardized assessment between Anglophone and Francophone populations. Examples include the ECLec-DV tool for reading skills assessment (Duquette et al., 2012) and the MIDVAQ tool to measure the impact of VL and VR interventions on ability to carry out activities of daily living (Duquette et al., 2014).

**Gaps at the level of service users.** Twenty peer-reviewed studies focused on gaps in VR service at the level of service users or patients with vision loss. Lack of awareness, misconceptions, stigma,
difficulty with diagnosis acceptance, and poor or delayed service use were key themes that emerged strongly from these studies. For example, a study in Quebec ($n = 411$ patients with vision loss) found that lack of perceived need for rehabilitation by patients, combined with stigma associated with seeking services for ‘the blind’, was a barrier to service use for older adults (Overbury & Wittich, 2011). Similarly, a survey with 29 ophthalmologists in Ontario indicated a belief that patients may be in denial or confused at the time of diagnosis and may fear being labelled as ‘blind’ because of associated stigma (Adam & Pickering, 2007). However, lack of perceived need is not always associated with stigma. Témisjian et al. (2013) found that general information on low-vision services was not readily available specifically for the Francophone population. Mwilambwe et al. (2009) revealed that patients ($n = 448$) with less severe visual acuity, but who qualified to receive low-vision services, were less likely to know about and have participated in VR services. Often, individuals with a VL diagnosis find it difficult to accept the diagnosis and must do their own research on available services or get help from a family member to obtain this information (Gresset et al., 2005). A review study on barriers to access VR from the patient’s perspective reported factors such as lack of awareness and misconceptions about VR services among patients, presence of comorbidities, level of education and income, and negative societal views and influence of family and friends play a critical role in access to VR (Lam & Leat, 2013).

To address these gaps, an Ontario study (Adam & Pickering, 2007) suggested that education of the general public could diminish stereotypes and stigma and motivate patients to educate their physicians, request referral, or refer themselves to a VR service. Other suggested solutions to improve utilization of VR services were to improve communication among caregivers about the consequences of vision loss and patient education about the benefits of VR services (Fraser et al., 2014; Jackson, 2006). Finally, counselling and peer support were proposed as ways to overcome the stigma related to vision loss and enhance the quality of life for those with vision loss (Harper et al., 2006).

Once VL services are sought, service providers are encouraged to promote device use and reduce barriers to participation for individuals with VL (Fraser et al., 2019). Given that the task of learning how to use new devices can be daunting, especially in the context of a new diagnosis, use of familiar tools is suggested. For example, Wittich and colleagues (2018) discussed adaptation of a tablet for use by persons with low vision. Tablets and smart phones incorporated into mainstream use help to address client fears of being stigmatized.

Gaps at the system level. Gaps that were identified in both the peer-reviewed literature and institutional reports and policy papers included disparities in VR funding and services between provinces; shortage of specialists; inadequacy of insurance coverage; mounting costs of low-vision care; insufficient funding for and training with low-vision devices; outdated training programmes (M. Markowitz, Daibert-Nido, & Markowitz, 2018); the presence of a visual acuity threshold required to provide services (Témisjian et al., 2013); and the need for policies and guidelines on eye health or VR in Canada.

Institutional reports and policy papers specifically reported an insufficient number of VL service providers, inadequate financial coverage for VR assessment and training, outdated provincial assistive devices programme, deficiencies in current models of delivery, and a lack of established educational programmes on VR for occupational therapists (Canadian Association of Optometrists [CAO], Canadian Council of the Blind [CCB], CNIB, The Foundation Fighting Blindness [TFFB], 2017; Dennis, 2017; Eye Health Council of Ontario, 2015; Health Professions Regulatory Advisory Council, 2010; Montreal Economic Institute, 2014; National Coalition for Vision Health, 2010; Swift et al., 2021). A federal report published by the CNIB and other vision care associations highlighted the service gaps for certain populations in Canada, including the young, older adults, and
Indigenous populations (National Coalition for Vision Health, 2010). It was found that technology, though having a promising role to benefit patients with VL, is often not available or used, for instance, Argus II retinal prosthesis in VR or use of technology for braille instruction to older clients (Markowitz et al., 2018; Martiniello et al., 2018).

Of particular note, peer-reviewed studies indicated that access to VR services is difficult for those living in rural and remote areas due to limited transportation, local availability, and distance from the VR care centres (Gilmour, 2006; Gold et al., 2006; Témisjian et al., 2013). For example, one study found that, in Ontario, the geographic distribution of ophthalmological services coincided with the largest patient populations, leaving many other regions of Ontario lacking services (Basilious et al., 2019). A national survey of service users and service providers in Canada underscored the disparities in VR care between rural and urban areas and among provinces, identifying disparities in the availability of, and funding for, services and aids (Gold et al., 2006). Lack of a comprehensive listing of VR services in Canada, particularly for rural communities, was also seen as a barrier to access (Jackson, 2006).

Suggestions to overcome system gaps were made across the included studies and reports. Comprehensive planning, adequate funding, proper classification system for operating costs for VR services, and involvement of all stakeholders are required to ensure province-specific service models meet the needs of those with vision loss (Coulmont et al., 2011; Harper et al., 2006; Roy et al., 2009; Swift et al., 2021). A recent review study from Alberta underscored the need for increased funding for the sustainability of VR programmes and better remuneration for community-based VR services considering the wide geographical distribution of patients across the province (Swift et al., 2021). This review, though limited to the province of Alberta, emphasized simplifying access to provincially subsidized vision devices and increasing multidisciplinary efforts to deliver VR (Swift et al., 2021).

A multidisciplinary team including eye care professionals and VR care providers with specialized counsellors, psychologists, occupational therapists, and social workers can help to address the specific needs of clients with vision loss (Gilmour, 2006; Simpson-Jones & Hunt, 2019). Gordon and colleagues (2015) suggested that ophthalmologists and optometrists should be involved in the assessment and initial VR, while specialized rehabilitation professionals should provide post-VR to restore patients’ independence. Similarly, provincial health coverage of optometric services and better communication with other eye care and VR service providers are suggested to provide better VR services (Lam et al., 2015). A study in Quebec evaluated an alternate referral pathway to VR services by placing an optometrist on a part-time basis within an ophthalmology department to provide VR care to clients (Wittich et al., 2013). Findings suggested that the addition of the optometrist may help triage patients with vision loss and facilitate the continuum of care (Wittich et al., 2013).

With respect to operating costs, several classification systems have been suggested to estimate operating costs for VR services in Quebec. These include a base cost for a given impairment, with additional costs based on functional status (Roy et al., 2009). Alternative systems primarily focus on the social or functional profile of the patient (Coulmont et al., 2011).

Two different models for comprehensive VR, both based on the WHO integrated model of VR care, were proposed for Canada: the SmartSight model, also referred to as the Canadian ophthalmology model of low vision (Jackson, 2006), and the three-tiered model for optometry (Leat, 2016, 2020). The ophthalmology-driven model involves four levels, with ophthalmologists identifying and responding to patients early in their eye disease trajectory (level 1 and 2). At level 3, in this model, ophthalmologists also provide basic and comprehensive low-vision evaluation, followed by rehabilitation with the involvement of other professionals at level 4. The second model, advocated by optometry, includes three levels: level 1 involves screening and triage, level 2
involves management of VI patients at a local optometry office, and level 3 involves comprehensive VR for patients with greater disabilities. Interestingly, we could not find studies where these models have been tested for their suitability, acceptance, and effectiveness within the Canadian context.

Discussion

The review shows that VR services in Canada are delivered via a combination of four service settings: VLRC sites, university-based centres, independent low-vision service providers, and, in Quebec, government-sponsored multidisciplinary rehabilitation centres. Overall, vision care in Canada is provided in a hybrid manner where assessments and prescription of vision aids are undertaken in the hospitals and rehabilitation is predominantly provided by community-based organizations (M. Markowitz, 2006; S. N. Markowitz 2016). Quebec is the exception, where rehabilitation is provided via government-funded rehabilitation centres.

Within the hybrid manner of service delivery, disparities exist across jurisdictions and urban and rural geographies. Variability in VR services exists in the type and volume of patients seen, practice patterns, and remuneration policies (M. Markowitz, Daibert-Nido, & Markowitz, 2018). This appears to be related to the availability of dedicated funding by provincial governments, type of assistive device programme available in the province, and proximity to academic centres of ophthalmology or optometry (M. Markowitz, Daibert-Nido, & Markowitz, 2018). It is also important to note that only a modest number of eye care professionals practice in the VR field due to the limited funding and resources necessary to provide VR services (Basilious et al., 2019; Gold et al., 2006; Lam et al., 2015; Renaud et al., 2005; Swift et al., 2021). Quebec-based studies in this review have underscored that VR resources, such as standardized tests in French language, were often not readily available for the Francophone population. In particular, the need for bilingual screening and assessment tools has been identified. Adaptations to widely used tools have been made; however, the available tools remain fewer than those available in English. In addition, more research is warranted for validation of these tools.

The present review highlighted the existing gaps in VR care at the level of service user, service providers, and the system including lack of collaboration and coordinated services between eye care and VR services, delayed referral to VR, shortage of specialists, and insufficient funding and training for low-vision devices. These gaps are consistent with findings from a previous study on VR elsewhere that also reported lack of awareness of available services, referral pathways and what they offer, misunderstandings by both practitioners and patients on the criteria to qualify for or benefit from VR services, miscommunication between practitioner and patients, and patients not identifying as someone experiencing need of VR (Luu et al., 2020). A review of barriers to accessing VR services from patient’s perspectives also presented similar findings and underscored the need for increased funding and education of patients, their families, and eyecare providers regarding effectiveness of VR services to overcome the service gaps (Lam & Leat, 2013).

Lack of a common definition and conceptual understanding of VR across Canada appears to contribute to gaps in VR service delivery. Although there was a joint effort in 2015 to put together a Canadian Charter of Vision Care that outlines the rights and responsibilities of patients and professionals in ensuring the highest standard of vision care in Canada, there is a lack of gold standard definition for VR that has been validated through research in the Canadian context (Gordon et al., 2015; S. N. Markowitz, 2016). The Eye Health Council of Ontario (2011) described VR from the perspectives of major stakeholders (ophthalmology, optometry, opticians, and CNIB). Later, the definition of ‘comprehensive vision rehabilitation’ as provided by a multidisciplinary panel was intended to foster a common understanding of VR care (Gordon et al., 2015). However, there
remains a need to delineate the interface between VR and (medical) eye care professionals and services, and who should be the main point of contact to facilitate continuation with the rehabilitation care. This is not unique to Canada. At the international level, the lack of consensus about the standards and delivery models for VR services remains a challenge to standardization of services (S. N. Markowitz, 2016) and contributes to lack of proper referral patterns for VR across the globe (Luu et al., 2020; National Academies of Sciences, Engineering, and Medicine, 2016; Ryan, 2014).

Findings from this review support the idea for multidisciplinary teams to provide comprehensive rehabilitation care to those with vision loss in Canada. A multidisciplinary team may include ophthalmologists, optometrists, opticians, low-vision specialists, orientation and mobility instructors, independent living skills instructors, counsellors, assistive technology support, psychologists, occupational therapists, and social workers. As highlighted in the Canadian Patient Charter for Vision Care (2015), successful comprehensive VR care is dependent on patients’ timely referral, access to the full spectrum of care from assessment to rehabilitation, and collaboration among rehabilitation professionals in the development of personalized VR therapy. Two different models proposed for comprehensive VR in Canada are the SmartSight model (Jackson, 2006) and the three-tiered model for optometry (Leat, 2016; 2020). The American Academy of Ophthalmology (AAO) included the SmartSight model in the United States Preferred Practice Pattern (AAO PPP) guidelines that is widely accepted by US and Canadian ophthalmologists to encourage appropriate referrals (S. N. Markowitz, 2016). The three-tiered model of optometry is adopted in the Low Vision Clinical Practice Guideline for Canadian Optometrists by the Canadian Association of Optometrists (Leat, 2020).

However, no further pilot or evaluation studies based on these models have been reported in the literature in the Canadian or US context. More efforts are needed to compare and validate these models on a province-by-province basis and examine their effectiveness in providing care to clients with vision loss (CAO, CCB, CNIB, TFFB, 2017; Eye Health Council of Ontario, 2015). Considering the existing ways in which VR services are currently delivered in Canada (CNIB/VLRC sites, university-based centres, and independent low-vision service providers, and multidisciplinary rehabilitation centres in Quebec), it is imperative to conduct implementation studies using the two proposed models to determine which service delivery model is best suited for each of the provincial jurisdictions.

Overall, the quantity of research evidence on VR is limited. Most studies were descriptive and/or qualitative and were focused on the provision of service delivery; only a few studies measured the effectiveness of service delivery. For example, a systematic review of VR for children reported lack of studies and limited evidence in the Canadian context that could inform clinical practice and policy decisions (Chavda et al., 2014). Within the included studies, there were only a few that discussed the VR service provision at a national level. Except for Ontario and Quebec, only a few studies included provinces of Alberta, Manitoba, and Saskatchewan while no studies were found for the other provinces and territories. However, it is important to note that lack of evidence does not mean that there are no VR services in these regions. Instead, there is a lack of published reports/studies that document the services and their effectiveness. This evidence gap could be attributed to the lack of prioritization of vision health on a population health agenda and lack of dedicated government funding for vision health and rehabilitation research in Canada (Access Economics Pty Limited, 2009; Dennis, 2017; National Coalition for Vision Health, 2010).

Two of the included studies in this review addressed the need for VR services for people with additional health-related conditions (Simpson-Jones & Hunt, 2019; Yoo et al., 2020). The Canadian Survey on Disability (CSD) (2017), a nation-wide survey of Canadians aged 15 and over who experience limitations in everyday activities, indicates that 85.70% (approximately 1.3 million) of Canadians with vision loss live with additional disabilities (CNIB, 2021). Particularly for aging
Canadians with vision loss, the prevalence of co-morbid conditions is extremely high (>90%) and vision loss itself is a strong predictor of falls, cognitive decline, depression, mobility difficulties, injuries, and mortality (Meyniel et al., 2017). Interestingly, only a few studies examined or discussed VR services for those with vision loss in addition to other comorbidities such as those with brain injury (Simpson-Jones & Hunt, 2019; Yoo et al., 2020). This evidence gap may be the result of the fragmentation between VR (often delivered in the community) and other healthcare services and the consequent limitation in communication between providers in the health care and VR settings (National Academies of Sciences, Engineering, and Medicine, 2016). Nevertheless, the impact of comorbidities on the VR plan needs to be considered by service providers and supports the need for multidisciplinary and collaborative modes of care (Leat, 2020; Simpson-Jones & Hunt, 2019; Yoo et al., 2020).

**Implications for research, policy, and practice**

Based on gaps identified in this study, early referral to rehabilitation by eye care practitioners and better awareness among professionals and clients with vision loss about VR services are needed to improve referral patterns and timely access to care (Adam & Pickering, 2007; Basilious et al., 2019; Dennis, 2017; Gold et al., 2006; Lam et al., 2015; Mwilambwe et al., 2009; Overbury & Wittich, 2011). Research also suggests that access to care can be improved by better provincial health coverage of vision loss services including optometry and other VR services, and better communication between VR providers and consumers to facilitate access to VR services (Gold et al., 2006; Lam et al., 2015; Southall & Wittich, 2012).

A stronger research evidence base is needed to better understand the VR-specific needs of all Canadians and to reach a consensus on the most-suited service delivery model of VR that is equitable and accessible for all Canadians – regardless of age, class, gender, ethnicity, indigeneity, socio-economic status, geography, and other factors (National Collaborating Centre for Determinants of Health and National Collaborating Centre for Healthy Public Policy, 2016). This research needs to incorporate diversity in perspectives and socio-demographic characteristics of Canadians with vision loss to include under-represented groups and those with vision loss and comorbidities.

**Limitations**

One limitation of this study is its generalizability beyond Canada. A second limitation is that studies available in scientific databases other than those searched or material in the grey literature may have been omitted. The review, also, did not capture studies on VR among the veteran population as these services are provided separately from general health care services. Finally, although recommended, we did not confirm our study results with experts and other stakeholders, that is, stage 6 of scoping review. Doing this would have provided further validation to our findings.

**Conclusion**

This is the first review to systematically identify literature on VR in Canada, understand its current status, and identify gaps in service delivery to inform delivery of care and future research. Access to care is inconsistent in Canada and services are fragmented. To attain the goals of VR as outlined in the Canadian Patient Charter for Vision Care (2015), it is critical to overcome the service gaps by improving collaboration and communication among VR providers, and dedicating provincial government funding for services, including multidisciplinary team interventions to meet rehabilitation needs of Canadians with vision loss.
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References

Access Economics Pty Limited. (2009). *The cost of vision loss in Canada: Summary report*. CNIB and Canadian Ophthalmological Society. http://www.vision2020canada.ca/en/resources/Study/COVL%20Summary%20Report%20EN.PDF

Adam, R., & Pickering, D. (2007). Where are all the clients? Barriers to referral for low vision rehabilitation. *Visual Impairment Research*, 9(2–3), 45–50. http://doi.org/10.1080/13882350701481033

Aljied, R., Aubin, M. J., Buhrmann, R., Sabeti, S., & Freeman, E. E. (2018). Prevalence and determinants of visual impairment in Canada: Cross-sectional data from the Canadian Longitudinal Study on Aging. *Canadian Journal of Ophthalmology*, 53(3), 291–297. https://doi.org/10.1016/j.jcjo.2018.01.027

Arksey, H., & O’Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19–32. http://doi.org/10.1080/1364557032000119616

Basilious, A., Basilious, A., Mao, A., & Hutnik, C. M. L. (2019). Trends in low vision care provided by ophthalmologists in Ontario between 2009 and 2015. *Canadian Journal of Ophthalmology/Journal Canadien d’ophtalmologie*, 54(2), 229–236. http://doi.org/10.1016/j.jcjo.2018.04.024

Bowen, S., & Graham, I. D. (2013). Integrated knowledge translation. In S. E. Straus, J. Tetroe, & I. D. Graham (Eds.), *Knowledge translation in health care: Moving from evidence to practice* (2nd ed., pp. 14–23). John Wiley. https://doi.org/10.1002/9781118413555.ch02

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Canadian Association of Optometrists, Canadian Council of the Blind, CNIB, The Foundation Fighting Blindness. (2017). *The federal role in eye health and vision care*. https://drupcopy.opto.ca/sites/default/files/resources/documents/federal_role_in_vision_care_final_print.pdf

Canadian Association of Optometrists, Canadian Ophthalmological Society, CNIB, Opticians Association of Canada. (2015). *Canadian patient charter for vision care*. https://opto.ca/sites/default/files/resources/documents/charter-12x18-eng.pdf

Canadian National Institute for the Blind. (2014). *The path to change: CNIB’s bold new direction for 2014 to 2018*. https://cnib.ca/sites/default/files/2018-08/Strategic%20Plan%202014%20-%20National%20English%20-%20Accessible%20PDF.pdf

Canadian National Institute for the Blind. (2018). *Bold dreams, bright futures: CNIB strategic plan 2018-22*. https://cnib.ca/sites/default/files/2018-09/FOUNDATION-STRAT_PLAN_2018 ENG_v4_ACCESS_FINAL-s_790631.pdf

Canadian National Institute for the Blind. (2021). *Our Current projects*. https://cnib.ca/en/sight-loss-info/research/our-current-projects?region=on

Centre intégré de santé et de services sociaux de l’Outaouais. (2019). *Rehabilitation and integration for individuals with a visual impairment*. https://cisss-outaouais.gouv.qc.ca/language/en/accessing-a-service/living-with-a-disability/physical-disability/rehabilitation-and-integration-for-individuals-with-a-visual-impairment-riv/*
Chavda, S., Hodge, W., Si, F., & Diab, K. (2014). Low-vision rehabilitation methods in children: A systematic review. *Canadian Journal of Ophthalmology, 49*(3), e71–e73. http://doi.org/10.1016/j.jcjo.2014.03.011

Coulmont, M., Roy, C., & Fougeyrollas, P. (2011). Development of a classification system for patients referred to a rehabilitation program for visual impairment: A method for analysis and budgetary control. *The Canadian Journal of Program Evaluation, 26*(1), 49–74.

Cruess, A. F., Gordon, K. D., Bellan, L., Mitchell, S., & Pezzullo, M. L. (2011). The cost of vision loss in Canada. 2. Results. *Canadian Journal of Ophthalmology/Journal canadien d'ophtalmologie, 46*(4), 315–318. https://doi.org/10.1016/j.jcjo.2011.06.006

Dennis, M. (2017). Better vision for seniors: A public health imperative. https://drupcopy.opto.ca/sites/default/files/resources/documents/huma_submission_onSeniors_oct_2017_final_en.pdf

Duquette, J., Jean, D., Loiselle, J., & Wanet-Defalque, M.-C. (2014). Caractérisation et impact d’un programme d’intervention clinique québécois en évaluation et en entraînement à la vision excentrique [Characterization and impact of a Quebec clinical intervention program in eccentric vision evaluation and training ] [communication au 12e Colloque d’automne ARIBa, La Rochelle, 15 novembre 2013]. *Bulletin ARIBa, 32*, 6–11.

Duquette, J., Loiselle, J., Lapointe, N., Senécal, M.-J., & Wanet-Defalque, M.-C. (2012). L’évaluation des capacités de lecture en déficience visuelle [Assessment of reading skills in visual impairment] (ECLeC-DV). In M.-C. Wanet-Defalque, O. Overbury, & K. Temisjian (Eds.), *Actes Du 13e Symposium Scientifique Sur l’incapacité Visuelle et La Réadaptation. « Innover pour mieux intervenir »* (pp. 21–26). Institut Nazareth et Louis-Braille et Université de Montréal.

Duquette, J., Wanet-Defalque, M.-C., Boisvert, I., Boutet, M., Normand, M., & Maincner, O. (2014). Traduction et adaptation de la version pondérée du Melbourne low-vision ADL index [Translation and adaptation of the weighted version of the Melbourne Low-Vision ADL Index]. In M.-C. Wanet-Defalque, J. Duquette, & J.-A. Marinier (Eds.), *Le partenariat recherche-clinique, pour une meilleure participation: 16e symposium scientifique sur l’incapacité visuelle et la réadaptation, Montréal, 11 février 2014* (pp. 13–19). INLB; Réseau de recherche en santé de la vision; CRIR; Université de Montréal.

Eye Health Council of Ontario. (2015). *Low vision services in Ontario: Current status, gaps and recommendations for change*.

Fraser, S., Beeman, I., Southall, K., & Wittich, W. (2019). Stereotyping as a barrier to the social participation of older adults with low vision: A qualitative focus group study. *BMJ Open, 9*(9), Article e029940. https://doi.org/10.1136/bmjopen-2019-029940

Fraser, S., Johnson, A., Wittich, W., & Overbury, O. (2015). Critical success factors in awareness of and choice towards low vision rehabilitation. *Ophthalmic and Physiological Optics, 35*(1), 81–89. http://doi.org/10.1111/opo.12169

Gilmour, G. R. (2006). Low vision rehabilitation services: The Saskatchewan experience. *Canadian Journal of Ophthalmology, 41*(3), 370–372. http://doi.org/10.1139/I06-024

Gold, D., Zuvela, B., & Hodge, W. G. (2006). Perspectives on low vision service in Canada: A pilot study. *Canadian Journal of Ophthalmology, 41*(3), 348–354. http://doi.org/10.1139/I06-025

Gordon, K., Bonfanti, A., Pearson, V., Markowitz, S. N., Jackson, M. L., & Small, L. (2015). Comprehensive vision rehabilitation. *Canadian Journal of Ophthalmology, 50*(1), 85–86. http://doi.org/10.1016/j.jcjo.2014.11.009

Gresset, J. A. (2005). *Current and future demographics of low vision and blindness in Canada*. International Congress Series, 1282, 393–396.

Gresset, J. A., Jalbert, Y., & Gauthier, M. (2005). Elderly persons confronted with visual loss and long waiting lists: How do they react? International Congress Series, 1282, 143–146.

Hamade, N., Hodge, W. G., Rakibuz-Zaman, M., & Malvankar-Mehta, M. S. (2016). The effects of low-vision rehabilitation on reading speed and depression in age related macular degeneration: A meta-analysis. *PLOS ONE, 11*(7), Article e0159254.

Harper, K., McFee, C., MacDonald, I., & Jones, M. (2006). Low vision service models in Alberta: Innovation, collaboration, and future opportunities. *Canadian Journal of Ophthalmology, 41*(3), 373–377. http://doi.org/10.1139/I06-028
Health Intelligence Inc. (2016). Valuation of uninsured ophthalmological services. https://www.cosprc.ca/wp-content/uploads/2018/10/Valuation_uninsured_services-2016.pdf

Health Professions Regulatory Advisory Council. (2010). A report to the minister of health and long-term care on interprofessional collaboration among eye care health professions. https://www.hprac.org/en/reports/resources/hprac%20-%20eyes%20report%20final%20July%202010.pdf

Jackson, M. L. (2006). Vision rehabilitation for Canadians with less than 20/40 acuity: The SmartSight model. Canadian Journal of Ophthalmology, 41(3), 355–361. http://doi.org/10.1139/i06-021

Jutai, J. W., Strong, J. G., & Russell-Minda, E. (2009). Effectiveness of assistive technologies for low vision rehabilitation: A systematic review. Journal of Visual Impairment & Blindness, 103(4), 210–222. http://doi.org/10.1177/0145482X0910300404

Lam, N., & Leat, S. J. (2013). Barriers to accessing low-vision care: The patient’s perspective. Canadian Journal of Ophthalmology/Journal Canadien d’ophtalmologie, 48(6), 458–462. https://doi.org/10.1016/j.jcjo.2013.02.014

Lam, N., Leat, S. J., & Leung, A. (2015). Low-vision service provision by optometrists: A Canadian nationwide survey. Optometry and Vision Science, 92(3), 365–374. http://doi.org/10.1097/OPX.0000000000000512

Lapointe, M. L. (2006). Services available to sight-impaired and legally blind patients in Ontario: The Ontario model. Canadian Journal of Ophthalmology, 41(3), 367–369. http://doi.org/10.1139/i06-023

Leat, S. J. (2016). A proposed model for integrated low-vision rehabilitation services in Canada. Optometry and Vision Science, 93(1), 77–84. http://doi.org/10.1040-5488/16/9301-0077/0

Leat, S. J. (2020). 2020 CAO clinical practice guideline: Optometric low vision rehabilitation FULL GUIDELINES. Canadian Journal of Optometry, 82(1), 19–62. http://doi.org/10.15353/cjo.v82i1.1636

Luu, W., Kalloniatis, M., Bartley, E., Tu, M., Dillon, L., Zangerl, B., & Ly, A. (2020). A holistic model of low vision care for improving vision-related quality of life. Clinical and Experimental Optometry, 103(6), 733–741. http://doi.org/10.1111/cxo.13054

Maberley, D. A. L., Hollands, H., Chuo, J., Tam, G., Konkal, J., Roesch, M., Veselinovic, A., Witzigmann, M., & Bassett, K. (2006). The prevalence of low vision and blindness in Canada. Eye, 20(3), 341–346. http://doi.org/10.1038/sj.eye.6701879

Maberley, D. A. L., Walker, H., Koushik, A., & Cruess, A. (2003). Screening for diabetic retinopathy in James Bay, Ontario: A cost-effectiveness analysis. Canadian Medical Journal of Ophthalmology, 168(2), 160–164. http://doi.org/10.1007/978-1-4471-1033-0_12

Markowitz, M. (2006). Occupational therapy interventions in low vision rehabilitation. Canadian Journal of Ophthalmology, 41(3), 340–347. http://doi.org/10.1139/106-020

Markowitz, M., Daibert-Nido, M., & Markowitz, S. N. (2018). Rehabilitation of reading skills in patients with age-related macular degeneration. Canadian Journal of Ophthalmology, 53(1), 3–8.

Markowitz, M., Rankin, M., Mongy, M., Patino, B. E., Manusow, J., Devenyi, R. G., & Markowitz, S. N. (2018). Rehabilitation of lost functional vision with the Argus II retinal prosthesis. Canadian Journal of Ophthalmology, 53(1), 14–22.

Markowitz, S. N. (2006a). Low vision rehabilitation – A new subspecialty in ophthalmology. Canadian Journal of Ophthalmology, 41(3), 263–266. http://doi.org/10.1139/editorial4103

Markowitz, S. N. (2006b). Principles of modern low vision rehabilitation. Canadian Journal of Ophthalmology, 41(3), 289–312. http://doi.org/10.1139/106-027

Markowitz, S. N. (2008). Ontario recognizes low-vision rehabilitation. Canadian Journal of Ophthalmology, 43(4), 398–399. http://doi.org/10.3129/i08-086

Markowitz, S. N. (2016). State-of-the-art: Low vision rehabilitation. Canadian Journal of Ophthalmology, 51(2), 59–66. http://doi.org/10.1016/j.jcjo.2015.11.002

Martiniello, N., Wittich, W., & Jarry, A. (2018). The perception and use of technology within braille instruction: A preliminary study of braille teaching professionals. British Journal of Visual Impairment, 36(3), 195–206.

Mednick, Z., Jaidka, A., Nesdole, R., & Bona, M. (2017). Assessing the iPad as a tool for low-vision rehabilitation. Canadian Journal of Ophthalmology, 52(1), 13–19. http://doi.org/10.1016/j.jcjo.2016.05.015

Meyniel, C., Bodaghi, B., & Robert, P. Y. (2017). Revisiting vision rehabilitation. Frontiers in Systems Neuroscience, 11, Article 82. http://doi.org/10.3389/fnsys.2017.00082
Mick, P. T., Hämäläinen, A., Kolisang, L., Pichora-Fuller, M. K., Phillips, N., Guthrie, D., & Wittich, W. (2021). The prevalence of hearing, vision, and dual sensory loss in older Canadians: An analysis of data from the Canadian Longitudinal Study on Aging. *Canadian Journal on Aging/La revue canadienne du vieillissement*, 40(1), 1–22. https://doi.org/10.1017/S0714980820000070

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLOS Medicine*, 6(7), Article e1000097. http://doi.org/10.1371/journal.pmed1000097

Montreal Economic Institute. (2014). Eye care in the private sector: Innovation at the service of patients. In *The other health care system: Four areas where the private sector answers patients’ needs* (pp. 33–37). https://www.iedm.org/files/chapt4-cahier0115_en.pdf

Moore, V., Dufour, R., Mailhot, A., & Carignan, M. (2015). Le rôle de l’optométriste dans une approche multidisciplinaire de réadaptation pour la cliente aînée atteinte d’hémianopsie homonyme: un cas clinique [The role of the optometrist in a multidisciplinary rehabilitation approach for the elderly clientele suffering from homonymous hemianopsia: a clinical case]. *Canadian Journal of Optometry*, 77(1), 18.

Moore, V., & Wanet-Defalque, M.-C. (2016). L’ère des implants visuels: implication pour la clinique et la réadaptation [The era of visual implants: implications for the clinic and rehabilitation]. *La Technologie Au Service de La Réadaptation Visuelle*, 12. http://inlb.ekloweb.com/wp-content/uploads/2017/05/Acetes_18e_Symposium_v-accessible.pdf#page=22

Morris, S. P., Fawcett, G., Brisebois, L., & Hughes, J. (2018). *A demographic, employment and income profile of Canadians with disabilities aged 15 years and over, 2017*. Statistics Canada/Statistique Canada.

Mwilambwe, A., Wittich, W., & Freeman, E. E. (2009). Disparities in awareness and use of low-vision rehabilitation. *Canadian Journal of Ophthalmology*, 44(6), 686–691. http://doi.org/10.3129/i09-179

National Academies of Sciences, Engineering, and Medicine. (2016). *Making eye health a population health imperative: Vision for tomorrow*. The National Academies Press. http://doi.org/10.17226/23471

National Coalition for Vision Health. (2013). *Vision loss in Canada*.

National Collaborating Centre for Determinants of Health and National Collaborating Centre for Healthy Public Policy. (2016). *Public health speaks: Intersectionality and health equity*.

Nia, K., & Markowitz, S. N. (2007). Provision and utilization of low-vision rehabilitation services in Toronto. *Canadian Journal of Ophthalmology*, 42(5), 698–702. http://doi.org/10.1016/j.cjo.2007.03.002

Overbury, O., & Wittich, W. (2011). Barriers to low vision rehabilitation: The Montreal Barriers Study. *Investigative Ophthalmology & Visual Science*, 52(12), 8933–8938. https://doi.org/10.1177/0145482X11418857

Pérès, K., Matharan, F., Dafien, V., Nael, V., Edjolo, A., Bourdel-Marchasson, I., Ritchie, K., Tzourio, C., Delcourt, C., & Carrière, I. (2017). Visual loss and subsequent activity limitations in the elderly: The French Three-City Cohort. *American Journal of Public Health*, 107(4), 564–569. https://doi.org/10.2105/AJPH.2016.303631

Renaud, J., Baudry, É., & Gresset, J. (2005). Optometrists’ attitudes toward visually impaired patients in the province of Quebec. *International Congress Series*, 1282, 283–287. http://doi.org/10.1016/j.ics.2005.05.105

Robillard, N., & Overbury, O. (2006). Quebec model for low vision rehabilitation. *Canadian Journal of Ophthalmology*, 41(3), 362–366. http://doi.org/10.1139/I06-022

Roy, C., Coulmont, M., & Desrochers, J. (2009). Définition Des Paniers De Services En Réadaptation Et Détermination Des Coûts Associés Pour La Clientèle En Déficience Visuelle [Definition of rehabilitation service bundles and determination of the associated costs for patients with visual impairments]. In *La Place de La Dimension Européenne Dans La Comptabilité Contrôle Audit* [CD-ROM]. https://halshs.archives-ouvertes.fr/halshs-00459418/document

Ryan, B. (2014). Models of low vision care: Past, present and future: Models of low vision care. *Clinical and Experimental Optometry*, 97(3), 209–213. https://doi.org/10.1111/cxo.12157

Scanlan, J. M., & Cuddeford, J. E. (2004). Low vision rehabilitation: A comparison of traditional and extended teaching programs. *Journal of Visual Impairment & Blindness*, 98(10), 601–610. https://doi.org/10.1177/0145482X0409801005
Simpson-Jones, M. E., & Hunt, A. W. (2019). Vision rehabilitation interventions following mild traumatic brain injury: A scoping review. *Disability and Rehabilitation*, 41(18), 2206–2222.

Southall, K., & Wittich, W. (2012). Barriers to low vision rehabilitation: A qualitative approach. *Journal of Visual Impairment & Blindness*, 106(5), 261–274. http://doi.org/10.1177/0145482X1210600502

Swift, A., Hong, Y., Schreiber, C., Luong, M., & Markowitz, S. N. (2021). A review of current low vision services in Alberta. *Journal of Clinical Ophthalmology*, 5(1), 341–346.

Taylor, H. R., Pezzullo, M. L., & Keeffe, J. E. (2006). The economic impact and cost of visual impairment in Australia. *The British Journal of Ophthalmology*, 90(3), 272–275. https://doi.org/10.1136/bjo.2005.080986

Teichman, J. C., & Markowitz, S. N. (2008). Canadian research contributions to low-vision rehabilitation. *Canadian Journal of Ophthalmology*, 43(4), 414–418. http://doi.org/10.3129/i08-065

Témisjian, K., Wanet-Defalque, M.-C., & Overbury, O. (2013). L’accessibilité des services de réadaptation en basse vision: obstacles perçus par la clientèle francophone [Accessibility of low vision rehabilitation services: obstacles perceived by Francophone clients]. In: M.-C. Wanet-Defalque, Témisjian K. and A. Jarry, (eds.) L’accessibilité et ses multiples facettes : 15e symposium scientifique sur l’incapacité visuelle et la réadaptation, Montréal, 12 février 2013 (p. 29–32). Longueuil : INLB ; Montréal : CRIR : Université de Montréal.

Tricco, A. C., Lillie, E., Zarin, W., O’Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garrity, C., . . . Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, 169(7), 467–473. https://doi.org/10.7326/M18-0850

Vision 2020 Canada. (2011). *A snapshot of eye health*. http://www.vision2020canada.ca/en/resources/Pages/default.aspx

Vision Loss Rehabilitation Canada. (n.d.). Services. https://on.visionlossrehab.ca/en/patients-families/pages/services.aspx

Wanet-Defalque, M.-C., Machabée, L., & Hubert, G. (2009). *Les déterminants de la non-utilisation des aides techniques* [The determinants of the non-use of technical aids]. Institut Nazareth & Louis-Braille.

Wittich, W., Canuto, A., & Overbury, O. (2013). Overcoming barriers to low-vision rehabilitation services: Improving the continuum of care. *Canadian Journal of Ophthalmology*, 48(6), 463–467. http://doi.org/10.1016/j.jcjo.2013.05.013

Wittich, W., Jarry, J., Morrice, E., & Johnson, A. (2018). Effectiveness of the Apple iPad as a Spot-reading Magnifier. *Optometry and Vision Science*, 95(9), 704–710.

Wittich, W., Sikora, L., Watanabe, D. H., & Martinez, M. (2012). Canadian research contributions to low vision rehabilitation: A quantitative systematic review. *Canadian Journal of Optometry*, 74(3), 30–37. https://doi.org/10.15353/cjo.74.558

Wittich, W., Watanabe, D., Scully, L., & Bergevin, M. (2014). Développement et adaptation d’un programme d’intégration en emploi pour des personnes ayant une déficience visuelle au Québec. [Development and adaptation of an employment integration program for people with visual impairments in Quebec]. In: M.-C. Wanet-Defalque, Témisjian K. and A. Jarry, (eds.) L’accessibilité et ses multiples facettes : 15e symposium scientifique sur l’incapacité visuelle et la réadaptation, Montréal, 12 février 2013 (p. 20–25). Longueuil : INLB ; Montréal : CRIR : Université de Montréal.

World Health Organization. (2013). *Universal eye health: A global action plan 2014-2019*. https://www.who.int/blindness/AP2014_19_English.pdf?ua=1

World Health Organization. (2019). *World report on vision*. https://www.who.int/publications/i/item/world-report-on-vision

Yoo, P. Y., Scott, K., Myszk, F., Mamann, S., Labelle, A., Holmes, M., Guindon, A., & Bussieres, A. E. (2020). Interventions addressing vision, visual-perceptual impairments following acquired brain injury: A cross-sectional survey. *Canadian Journal of Occupational Therapy/Revue canadienne d’ergotherapie*, 87(2), 117–126. https://doi.org/10.1177/008417419892393