The Arrival of Healthcare 2.0 in British Columbia:

an evaluation of telemedicine and eHealth literacy as a barrier to access

by

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Abstract

Telemedicine has grown exponentially in the wake of the COVID-19 pandemic and has demonstrated the benefits of a virtual healthcare system. In British Columbia, third-party providers are currently meeting the demand for telemedicine, but legislation and policies are lagging behind. Telemedicine's growth in the private sector within a policy vacuum may allow for barriers to develop as not all patients are equipped for the transition to virtual healthcare. eHealth literacy has been identified as an obstacle to equitable and accessible telemedicine and requires consideration in virtual care delivery. This study examined how eHealth literacy affected patients' perspectives on telemedicine and compared it to the current landscape of third-party providers in British Columbia. The results informed the development of policy options for decision-makers in government. The recommendations are the development of standards for providers, the creation of a provincial telemedicine program and the establishment of clear leadership in virtual care.

Keywords: Telemedicine; eHealth Literacy; Virtual Health

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Table of Contents

Declaration of Committee ii
Ethics Statement iii
Abstract iv
Acknowledgements v
Table of Contents vi
List of Tables viii
List of Figures ix
Executive Summary x

Chapter 1. Introduction 1
1.1. Telemedicine in British Columbia 1
1.2. Research Objectives 2

Chapter 2. Background 4
2.1. Telemedicine in British Columbia: Status Quo 5
2.2. Literature Review 7
Current Frameworks, Policies and Standards 7
Telemedicine Use 10
eHealth Literacy & Telemedicine Use 13

Chapter 3. Methodology 16
3.1. Survey 16
3.2. Data Analysis & Hypothesis 17
3.3. Environmental Scan 19

Chapter 4. Results 21
4.1. Survey 21
Socio-demographic Profile 21
eHealth Literacy and Telemedicine Perspectives 23
Logit Regression Model 27
4.2. Environmental Scan 30
Key Findings 35
4.3. Discussion 37

Chapter 5. Policy Options 41
5.1. Option 1 - Standards 41
Telemedicine Standards for Third-Party Providers 41
5.2. Option 2 – Provincial Telemedicine 42
Provincial Telemedicine Program 42
5.3. Option 3 - Leadership 43
Establishment of Lead Organization 43
5.4. Policy Objectives and Criteria 45

Chapter 6. Policy Analysis & Evaluation 49
6.1. Evaluation of Option 1 49
Telemedicine Standards 49
6.2. Evaluation of Option 2 51
Provincial Telemedicine Program 51
6.3. Evaluation of Option 3 53
Establishment of Lead Organization 53
6.4. Policy Evaluation Summary & Recommendation 55

Chapter 7. Conclusion 57
7.1. Future Considerations 57
7.2. Limitations 58

References 59

Appendix Survey Questions 66

List of Tables

Table 1. Current BC legislation, policies and resources 8
Table 2. Environmental Scan Questions 20
Table 3. Descriptive Statistics Summary 22
Table 4. EHL Individual Scores by TMP Group 24
Table 5. Health Behaviours 26
Table 6. Logit Regression Result 29
Table 7. Summary of Environmental Scan 32
Table 8. Policy Objectives and Criteria 48
Table 9. Policy Evaluation Summary 56

List of Figures

Figure 1. Distribution of TMP and EHL Scores..... 27
Figure 2. Odds Ratio of Positive Outlook of Telemedicine (1 = high TMP) 30

Executive Summary

Background: Telemedicine has grown exponentially in response to the global pandemic, and consequently legislation and policies are slowly catching up. In British Columbia, third-party providers are meeting the demand for virtual health services, but it is unclear whether patient-centered barriers are being addressed due to limited standards and policies. eHealth literacy is the most prominent barrier for patients to properly benefit from telemedicine.

Methodology: Telemedicine in BC was explored through an online survey of 178 young adults (19-34 years old) that measured their eHealth literacy using the eHEALS scale and perspectives of telemedicine using an adapted satisfaction questionnaire. eHealth literacy and sociodemographic variables were recorded to determine their impact on perspectives of telemedicine. Survey results were analyzed using a logit regression to determine the odds of a positive outlook towards telemedicine. An environmental scan of 6 third-party providers in BC was done and results were discussed in relation to their accessibility to patients of varying eHealth literacy levels.

Results: eHealth literacy (OR 3.71, $p<0.01$), gender (female: OR 2.24, $p<0.05$), and ethnicity (White/Caucasian: OR 1.96, $p<0.1$) were significantly associated with the odds of having an increasingly positive outlook towards telemedicine. Third-party providers were not standardized across key evaluation criteria (choice in doctors, triage process, languages, in-person follow-up) and not aligned to service patients of lower eHealth literacy levels.

Conclusion: To ensure positive patient experiences and greater accessibility, action is required from policy-makers. The BC government should implement a set of telemedicine specific standards for providers that increases usability for patients with low eHealth literacy in the short term. In the medium to long term, the appointment of a lead organization and creation of a provincial program provides a sustainable future for virtual care in BC.

Chapter 1.

Introduction

1.1. Telemedicine in British Columbia

Digital technologies are revolutionizing healthcare provision across the globe, and standards of care are evolving to reflect these technological shifts (Shaw et al., 2018). In Canada, provincial healthcare systems have been gradually integrating these emerging technologies over the past few decades (Strehle & Shabde, 2006). Telemedicine is one of the most prominent healthcare innovations, a virtual consultation with a physician, which can be conducted over computer or mobile device, has the potential to revolutionize primary care. In the recent years before the COVID-19 pandemic, the use of telemedicine was unconventional as only 3% of Canadians reported using virtual healthcare services and as few as 1 in 6 physicians conducted online consultations (Canada Health Infoway, 2020). In 2020, telemedicine's integration into current healthcare infrastructures was crucial to provide healthcare services during the pandemic. Telemedicine's implementation has been fast-tracked, and primary care in Canada has transformed in a few short months whether or not health systems are ready. Virtual healthcare has numerous benefits with promises to reduce costs, wait times, and provide better access to rural and underserved communities (Kim & Xie, 2017).

In British Columbia, private third-party providers have been essential to answer the growing demand for telemedicine services. Third-party providers surely improve access to healthcare but are currently operating with limited standards and policies. Consequently, British Columbia's dependence on the private sector for virtual health delivery raises concerns. Telemedicine in its current state may not align with the Canadian Health Act's principles of administration, portability, and universality. Further, the Canadian Medical Association has highlighted electronic health literacy (eHealth literacy) as a potential barrier to access and highlighted the need for further research (CMA, 2019). Differences in eHealth literacy may disproportionately affect some Canadians more than others, fuelling concerns of a digital divide extending into healthcare services (Magnani & Smith, 2019).

The status quo for telemedicine delivery in British Columbia is not standardized across third-party providers. This lack of standardization can lead to poor patient experiences with regards to accessible and equitable virtual healthcare as not all Canadians are equipped to benefit from telemedicine services (Pierce & Stevermer, 2020; Uscher-Pines et al., 2016). The development of a clear provincial and overall national strategy for telemedicine is crucial, especially while the policy window is open. A definitive path forward can promote sustainable growth for private and public initiatives to succeed within Canada's healthcare structures and create consistency in telemedicine care. Policies, standards and a comprehensive framework will ultimately ensure that no Canadians are left behind in the transition to healthcare 2.0, post-pandemic and beyond.

1.2. Research Objectives

This paper explores telemedicine's current status in British Columbia and its implementation within existing healthcare structures. eHealth literacy has been identified as a patient-centred barrier to telemedicine use, and it is unclear how patient experiences differ according to their level of eHealth literacy. A literature review provides the most current understanding and evidence on telemedicine use, its effectiveness and potential barriers, with eHealth literacy being a central focus. Firstly, the study uses a survey to establish the current level of eHealth literacy in British Columbia and quantifies how it affects patients' views on telemedicine. Patient perspectives are used to estimate perceived accessibility as currently telemedicine is not widely used. Secondly, an environmental scan explores the status quo for telemedicine providers available in British Columbia. The research objectives for this study are:

- Determine the eHealth literacy level of a sample of British Columbians and quantify how it affects their perspectives of telemedicine
- Assess the status quo of telemedicine in British Columbia and determine whether it is accessible to patients of varying levels of eHealth literacy
- Identify gaps in telemedicine standards and policies

In British Columbia, young adults are the most frequent telemedicine users and will be the survey's sample population (Terekhova et al., 2017). The expectation is that the findings in younger adults will only be amplified in more vulnerable populations like

seniors and ethnic minority groups according to previous literature (Diviani et al., 2015; Kim & Xie, 2017). As for telemedicine delivery, the private sector is the leading provider of virtual services and will be the focus of the environmental scan. Exploring eHealth literacy as a barrier to virtual care will provide insights into long-term growth strategies that improve conventional healthcare inequities. Further, to the author's knowledge, there is limited literature explicitly connecting telemedicine and eHealth literacy, especially within a Canadian context.

Overall, the goal is to assess patients' and providers' preparedness for the widespread implementation of telemedicine in British Columbia. The study's results will inform policy options and subsequent recommendations for the provincial government, health authorities and third-party providers to collaborate and develop telemedicine strategies for accessible virtual health care.

Chapter 2.

Background

The idea of telemedicine was first practiced in North America in the 1960s when some experimental consultations were done through radio waves (Strehle & Shabde, 2006). A contemporary definition of telemedicine is “the provision of medical expertise for the purpose of diagnosis and patient care by means of telecommunications and information technology (i.e. internet, mobile applications), where the patient and provider are separated by distance” (Norman & Skinner, 2006). It is often interchangeably used with telehealth and is a form of virtual care that can be practiced across different fields of medicine (Shaw et al., 2018). Despite rapid changes, the primary driver for telemedicine that has persisted through the years is providing medical services over long distances, which is especially important in Canada’s expansive geography. Telemedicine is regarded as a solution to provide healthcare to underserved rural communities, including indigenous communities (Muttitt, Vigneault & Loewen, 2004). The global pandemic has exposed gaps in the Canadian healthcare system and consequently led to the rapid implementation of telemedicine services across the nation as a solution. The Government of British Columbia has been responsive to change, as billing codes for virtual consultations have been updated since 2012, while Alberta and Ontario have recently followed suit (CMA, 2019). A recent report by Canada Health Infoway (2020) demonstrated healthcare’s reliance on telemedicine at the onset of the pandemic, as virtual visits peaked at 60% of all healthcare visits. Of those virtual visits, 64% were done through a third-party provider, further demonstrating the private sector’s importance in virtual healthcare. Telemedicine consultations have since plateaued to around 30% of healthcare visits across Canada, entering into the latter part of 2020, a significant shift from historical trends.

There are points of friction with telemedicine implementation, and other countries have provided valuable insights for its adoption. In the United States, telemedicine is further along in widespread adoption, with a prominent healthcare provider, Kaiser Permanente, reporting that in 2017 approximately half of their medical consultations were done virtually (CMA, 2019). The American Telemedicine Association (ATA) has done significant work to develop policies, standards, and initiatives to support

telemedicine's growth as a tool in the American healthcare system. In 2016, Australia established a Digital Health Agency to oversee a national strategic plan that included telemedicine's widespread implementation. Australia Digital Health works with all state governments to broaden telemedicine services across the country and avoid healthcare silos.

Telemedicine has the potential to augment health services in Canada, but developing an optimized framework that is patient-centred is critical, or pre-existing health inequities could further exacerbate any existing adverse health outcomes and experiences (Kim & Xie, 2017). Further, in 2008, a Canadian expert panel found that 60% of adult Canadians (16 years and older) are estimated to have low health literacy (Rootman & Gordon-El-Bihbety, 2008). A decreased health status and quality of care have been linked with low levels of both health and eHealth literacy (Vincente & Madden, 2017). The state of telemedicine is at different checkpoints across Canada, but the exponential demand and growth do not allow for adequate time for policymakers and governments to stay ahead.

2.1. Telemedicine in British Columbia: Status Quo

The government of British Columbia amended physician billing codes to allow telemedicine services to be charged under public insurance as early as 2012 (CMA, 2019). This update was integral to providing public healthcare via telemedicine to all British Columbians and created opportunities for third-party vendors. Private sector companies such as Maple, Babylon, EQ Care, Tia health recruit physicians to provide virtual consultations to patients covered under the Medical Services Plan (MSP); These private providers offer direct-to-consumer (DTC) telemedicine. Other private providers, such as Lumino Health or Dialogue, offer virtual care through employee benefits and are not publicly available. Before the updated billing codes, patients had to pay out-of-pocket for virtual services, which is still the case in some other provinces (Virtual Care Task Force, 2020). Alternatively, physicians can independently connect with patients using their own approved devices or online platforms (Zoom, Skype, mobile devices) (PHSA, 2020). Third-party providers are available in other provinces, but some provincial health authorities and governments have taken more significant strides in digital health. The Ontario telemedicine network (OTN) is one of the largest providers in Canada and globally. The OTN has over 2,000 sites across Ontario and is funded by the Ontario

government as a part of their digital health initiative (O'Gorman et al., 2015). The OTN's comprehensive coverage and quality of care has resulted in 92% of users being satisfied and 87% stating telemedicine was comparable to an in-person visit (Brown, 2013). Elsewhere, Alberta, Manitoba and Saskatchewan also have government telemedicine programs but focus on connecting patients to specialists across the country as necessary to broaden access. In British Columbia, the Provincial Health Services Authority (PHSA), Doctors of BC and the College of Physicians and Surgeons of British Columbia have served as prominent organizations to promote telemedicine implementation but ultimately rely on third-party providers for delivery. HealthLink BC is a public health program by the BC government that connects patients with nurses, pharmacists, dieticians and others to provide non-emergency health advice over the phone or through online resources (HealthLinkBC, 2021). Across BC, different health authorities such as Fraser Health have set up their own virtual care options for patients. A prominent example is the First Nations Health Authority (FNHA) development of a provincial-wide service prioritizing Indigenous patients to respond to COVID-19 (FNHA, 2021; Fraser Health, 2021). Telemedicine services can connect British Columbians across the province to physicians but are currently operating within siloed health systems.

There is limited data on telemedicine's current use among BC patients, especially since the onset of COVID-19. Prior to the pandemic, a study analyzing patient use between 2013 – 2015 reported that the average age of telemedicine users in B.C. was 31.5 years old. Additionally, 51.5% of users resided in Metro Vancouver, while the most frequently cited reason for a visit was anxiety and depression (Terekhova et al., 2017). McGrail and colleagues replicated similar findings among B.C. users, being that most users were younger (20-44 years older) and using for mental disorders. However, their study added that users were most likely to have no pre-existing major diagnoses, and 93% of users were satisfied with their visit (McGrail et al., 2017). These results in B.C. have been replicated in other countries implementing telemedicine, as age is often cited as a barrier and mental health is among the most common fields of medicine used (Kruse et al., 2018; Neufeld et al., 2008). Young adults appear to be the most frequent telemedicine users, and examining their experiences could provide valuable insights for developing a virtual health framework for British Columbia.

2.2. Literature Review

Current Frameworks, Policies and Standards

In Canada, telemedicine services are governed and regulated similarly to other clinical practices. Provincial governments' ministries of health, health authorities, medical associations and regulatory bodies (college of physicians and surgeons) are essential to telemedicine governance. Together they collaborate to ensure telemedicine is practiced professionally and consistently with evidence-based clinical guidelines and current legislation. In BC, The College of Physicians and Surgeons of B.C. (CPSBC) and Doctors of BC have released guidance documents, set-up guides and a Practice Standard for primary care physicians to navigate telemedicine (Doctors of BC, 2020). The CMA has put together The *Virtual Care Playbook,* and the Federation of Medical Regulatory Authorities of Canada (FMRAC) has released a framework with standards and recommendations for physicians. These documents are comprehensive and set clear expectations for physicians practising virtual care in Canada. Overall, the Provincial Health Services Authority (PHSA), Canada Infoway Health, Doctors of BC and the CPSBC have promoted and supported telemedicine in British Columbia with resources and information (see *Table 1*). However, there is no apparent authority when it comes to all the different stakeholders involved. To date, the majority of work has been directed towards physicians, which is essential, but there is little in terms of standards and policies for third-party providers. The private sector plays a vital role in virtual care, but standards and policies for providers may be warranted to ensure consistent experiences for patients in virtual spaces.

In November 2020, the government of Ontario responded to the policy vacuum in the virtual care sphere by implementing a virtual visits solution verification. As a part of their Digital First for Health strategy, Ontario Health created a non-compulsory self-attestation process for vendors to become verified on their website. This process ensures a set of standards (recommended and required) are met, including a privacy impact assessment and legal terms and conditions to receive approval (Ontario Health, 2020). This program is a significant first step in the standardization of telemedicine services and could serve as a stepping stone for other provinces.

Foundational work was done in 2003 by the National Initiative for Telehealth Framework (NIFTE) was developed and marked a milestone for telemedicine in Canada. The NIFTE framework is a comprehensive set of guidelines that aim to help develop telemedicine policies, procedures and standards (NIFTE, 2003). It includes guidance for practicing physicians, as well as any telemedicine provider, public or private. It is centred on five components: Clinical standards and outcomes (CSO), human resources (HR), organizational readiness (OR), organizational leadership (OL), and technology and equipment (TE). Several suggested guidelines, such as CSO-11, are centred around collecting and evaluating healthcare data or HR-9 that ensure staff have the necessary qualifications or competencies to provide care. NIFTE is currently the only resource to help guide various stakeholders in delivering telemedicine services and was used to develop Accreditation Canada's *Telehealth standards* and BC's *telehealth guidelines*. These standards are non-compulsory for businesses and organizations, but in the 2015 Canadian telehealth report, all provinces (except territories) were either accredited or in the process of becoming accredited (COACH, 2015). Recommendations from the NIFTE guidelines and the CMA's virtual care task force have called for creating a pan-Canadian governance structure, as healthcare is a provincial mandate, but the nature of telemedicine extends beyond physical boundaries. Other resources include Digital Health Canada's maturity framework model that grades a virtual health system based off a user experience, type of technology, governance structure, sustainability, legislation and the benefits it provides (Digital Health Canada, 2020). The PHSA's office of virtual health and Doctors of BC have offered a tool kits that cover the basic of telemedicine for physicians and patients.

Table 1. Current BC legislation, policies and resources

Legislation, Policy, Framework	Description	Organization	Application
Practice Standard - Telemedicine	• Regulations for practising physicians and surgeons to use telemedicine. Extension of Health Professional Act	The College of Physicians and Surgeons of BC (CPSBC) and FMRAC	• **Mandatory** Regulations for all licensed physicians in BC

Legislation, Policy, Framework	Description	Organization	Application
Telemedicine Accreditation	• Set of standards for the assessment of safety, quality and efficacy of telemedicine • Criteria include accessibility, safety, efficiency, client-centred, continuity	Accreditation Canada and Health Standards Organization (HSO)	• **Voluntary** accreditation for an organization offering telemedicine programs; to date, all provincial health authorities are accredited
Virtual Care Maturity Model Framework	• Tracks maturation of virtual health programs on three levels: 1. Basic 2. Emerging 3. Advanced • Key domains: user experience, technology, governance, sustainability, legislation, benefits	Digital Health Canada	• **Educational resource** for organizations to help with virtual care implementation
Telehealth Framework	• Pan-Canadian project to establish standards, guidelines and procedures for telehealth • Guidelines are centred on five principles: Clinical Standards and Outcomes, Human Resources, Organizational Readiness, Leadership and Technology and Equipment	National Initiative for Telehealth (NIFTE)	• Set of standards and guidelines for telemedicine programs and providers; **voluntary** • Used for the development of telemedicine accreditation

Legislation, Policy, Framework	Description	Organization	Application
Virtual Care Playbook	• Working group developed recommendations for scaling up virtual care in Canada and address current barriers • Main areas of focus: Interoperability and Governance, Licensure and Quality of Care, Payment Models, and Medical Education	Canadian Medical Association and Royal College of Physicians and Surgeons of Canada	• Recommendations for federal and provincial governments to adopt • **Educational resource** for decision-makers
Virtual Care Toolkit	• Resource for physicians to start and conduct virtual care • Documents other applicable virtual solutions, policies and guides	Doctors of BC – Doctors Technology Office (DTO)	• **Educational resource** for physicians
Virtual Health Policy / Toolkit	• Specifies standards for virtual healthcare services • Toolkit provides resources for both physicians and patients	Provincial Health Services Authority (PHSA) – Office of Virtual Health	• **Educational resource** for physicians and patients

Telemedicine Use

Telemedicine is a promising tool to help Canada modernize its healthcare system in the 21st century. Canada's universal healthcare system suffers from inefficiencies, and a significant issue is decreased access due to long wait times and costs associated with access to primary care (CIHI, 2017). Telemedicine provides an immediate solution to

rural communities and provides an affordable option for access. Infoway Canada estimated annual savings of $595 million in travel expenses and 11.5 million hours in time to Canadians accessing primary care virtually in 2017 (Canada Health Infoway, 2020). Further, all the decreased travel has led to a projected annual savings of 97 thousand metric tons of CO2 emissions.

Further, there is a growing demand for telemedicine, even before the coronavirus pandemic, as 41% of Canadians wanted to communicate with their healthcare provider through video consultation (CMA, 2019). However, some documented barriers limit telemedicine's effectiveness, such as access to technology or the internet (bandwidth), affordability, and ehealth literacy (Kruse et al., 2018; Magnani & Smith, 2019). The CMA identified eHealth literacy as a poorly understood barrier with limited data on Canadians in their 2019 virtual care report. The demand for telemedicine is justified as the literature shows how similar virtual care can be to in-person physician visits.

Effectiveness of Telemedicine

Across different types of specialties, telemedicine has proven beneficial to patients, especially in dealing with chronic disease management (Hersh et al., 2001). Diabetes is among the most prevalent chronic diseases in Canadians, and telemedicine has proved effective in its management (Baillot et al., 2013). An international meta-analysis review determined on average telediabetes management resulted in improvements in glucose levels, blood pressure and LDL cholesterol; It was comparable to in-person visits while providing more cost-effective treatment, especially for older rural patients (Bashshur et al., 2015). A significant component of that meta-analysis was the American initiative for telediabetes, Informatics for diabetes education and telemedicine (IDEATel) project, a randomized control trial (RCT) of 1,500+ participants that yielded insights on patients and healthcare providers (Bashshur et al., 2015). Another area where telemedicine has proven effective is in mental health consultations. Patient evaluations were done via video with similar levels of patient satisfaction and quality as in-person visits while providing specialty services not typically available in rural communities (Neufeld et al., 2008; Hyler et al., 2005). Additionally, telemental health appears to be a better-suited modality for the practice. Patients across several sociodemographic and diagnostic groups demonstrate improvements to their quality of life and decreased incidence of depression and anxiety (Bashshur et al., 2016).

While there are promising developments across different areas of medicine, there is still a need for further research in areas like intensive care and acute pediatric care. While virtual care reduced the average length of stay and improved the quality of care for patients, there is a lack of empirical evidence in the form of quality RCT studies (Nadar et al., 2018; Chen et al., 2018). That is one point of friction towards further growth as telemedicine requires specific evidence in each field of medicine to gauge appropriateness, and the literature is still emerging. Other than biological indicators to measure the effectiveness in specific areas of medicine, recent research has developed methods to gauge general patient experiences while using telemedicine

Barriers to Access

Telemedicine has room for improvement, but there is already demonstrated potential in some fields of medicine, and patients are becoming increasingly familiar with this modality of healthcare. Aside from the concerns of higher quality evidence, there is also the concern of the digital divide between young and old, where certain levels of electronic-based skills and literacies are required to take full advantage of emerging digital health technologies (Smith & Magnani, 2019; Kontos et al., 2012). Consequently, further research is focused on documenting the patient experience while using telemedicine services through questionnaires. Yip and colleagues developed a patient satisfaction questionnaire for telemedicine to capture patient experiences and is an excellent tool for evaluating virtual health programs (2003). More recent versions of satisfaction surveys have accounted for modern technology and generated questions focused on telemedicine's usability (Parmanto et al., 2016). Other concerns surrounding access to the internet or equipment, appropriate skills and privacy over data highlight that telemedicine program design should consider several factors to ensure a comprehensive patient-centred approach (McLean et al., 2013). As discussed, eHealth literacy is a patient-related barrier, but more systemic hurdles can slow telemedicine’s growth within Canada. The CMA identified physician licensures to practice telemedicine across provinces and overall interoperability across different health systems and platforms (CMA, 2019). Telemedicine program design requires considerations to accommodate varying levels of competencies, as measured by eHealth literacy, to decrease the prevalence of health inequities and not contribute to the digital health divide.

eHealth Literacy & Telemedicine Use

ehealth literacy is becoming an increasingly important skill in the emerging digitized world of the 21st century (Chan & Kaufman, 2011). eHealth literacy can be defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" (Norman & Skinner, 2006). The lily model for eHealth literacy specifies six core literacies divided into two types, Analytical: (1) traditional, (2) media, (3) information, and Context-Specific: (4) scientific, (5) media and (6) computer (Norman & Skinner, 2006). Telemedicine can improve healthcare access for some but may reinforce barriers and exacerbate health inequities for others. Telemedicine is an innovation that requires patients to have high-level literacy, including some medical terminology, familiarity with navigating online platforms and basic access (Smith & Magnani, 2019). Smith & Magnani developed a set of 18 *universal precautions* that highlight the intersection of virtual care and eHealth literacy; Key precautions include: identifying opportunities for improvement, making health literacy a standard in development, provide access to health information, determine access to technology and solicit patient feedback (2019). These are essential steps to understand the relationship between eHealth and telemedicine.

Differences in eHealth literacy levels

Patients accessing virtual health services will have different experiences depending on their eHealth literacy (Kreps, 2017). Low eHealth literacy levels are associated with a diminished ability to evaluate health information online and even impacts patients' level of trust in the information (Diviani et el., 2015). Deficits in eHealth literacy are also considered a primary component of the digital divide, as many older adults are unfamiliar with new health technology or unable to develop the capacity to adapt (Choi & DiNitto, 2013; Chan & Kaufman, 2011). However, the necessary skills are not limited to age-related concerns as many patients who do not have regular access to quality internet, or electronic devices are also susceptible to decreased eHealth literacy (Levin-Zamir & Bertschi, 2018). Lower educational attainment and ethnic minority groups (i.e. African-Americans and Latinos in the U.S.) have been associated with lower participation in positive eHealth behaviours like diet tracking, logging physical activity data) or the use of online patient portals (Smith & Magnani, 2019). Within a Canadian

context, the concerns of digital barriers have fuelled several telemedicine pilot projects in rural and indigenous communities to ensure comprehensive virtual care for vulnerable populations (Muttitt, Vigneault & Loewen, 2004).

While a significant amount of research focuses on the deficiency of eHealth literacy in older adults, other relevant factors should be considered. Younger adults, in general, have increased levels of computer literacy and familiarity with online information, but that has not always translated to strong levels of eHealth literacy. Increased use of online information sources does not seem strongly correlated with increased ehealth skills among college students (Stellefson et al., 2011). Additionally, young adults' eHealth literacy can vary depending on their education level, familiarity with health concepts, and the source of the online health information (Vincente & Madden, 2017; Kim & Xie, 2017; Giudice et al., 2018). Interestingly, work by Powell and colleagues establishes an alternative view of the typical digital health citizen. After analyzing their survey results, they developed six types of health information users in their mixed-methods study: 1. Learners, 2. pragmatists, 3. skeptics, 4. worriers, 5. delegators and 6. adigitals (1-4 use online sources, and 5-6 do not use online sources for information) (Powell et al., 2019). These nuances can explain differences in eHealth literacy within younger populations, while other differences can be attributed to life experience such as working or studying in a health-related field (Giudice et al., 2018).

Additionally, a Canadian expert panel discovered that 60% of adult Canadians (16 years and older) are estimated to have low health literacy points to existing issues prior to telemedicine widespread use, which could only exacerbate healthcare experiences for some patients (Rootman & Gordon-El-Bihbety, 2008). Health literacy is an essential component of eHealth literacy, and deficiencies in either can lead to a decreased health status and quality of care (Vincente & Madden, 2017). Telemedicine may lead to decreased continuity of care and fragmented relationships with primary care physicians, which could otherwise improve patients' eHealth literacy. Ultimately, eHealth literacy can represent the degree to which patients can participate within the digitized healthcare system, as it is integral to interpreting and actioning vital health information (Kreps, 2017; Sorenson et al., 2012).

Measurement of eHealth Literacy

There have been several developments in measuring eHealth literacy, as it is the combination of several underlying forms of literacies (Karnoe et al., 2018). One of the earliest and most used tools to measure eHealth literacy is the eHEALS questionnaire developed by Canadian researchers Norman and Skinner in 2006. The instrument was derived from the lily model that conceptualizes eHealth as three contextual literacies: science, health and computer and three analytical literacies: traditional, information and media (Norman & Skinner, 2006). It has been reproduced in several international studies across the US, China, Italy, and Germany and accurately captures respondents' eHealth competency (Norman, 2011). More recent developments have led to further modernized instruments that account for social and cultural contexts as well as the emergence of newer technologies. Kayser and colleagues developed a more comprehensive eHealth literacy questionnaire with seven dimensions that incorporates users' experiences and captures the intersectionality of technology and health (2018). The digital health literacy instrument by Van der Vaart & Drossaert (2017) expands on previous instruments by incorporating a performance component to test the skills of respondents. These instruments are being improved upon, and all develop a better understanding of individuals' eHealth literacy capacities.

It is unknown whether telemedicine companies are identifying or aware of eHealth literacy as a patient-related barrier. Amendments to telemedicine websites or processes could be integral to improving the capacity of eHealth deficient patients. Telemedicine providers need to be proactive in dealing with barriers to access because it might result in a fragmented healthcare system for eHealth deficient patients.

Chapter 3.

Methodology

Telemedicine is an emerging sector in British Columbia and has accelerated in growth due to the global pandemic starting in 2020. Knowledge and expertise in this field is expanding and significant research is beginning to better understand telemedicine's role within healthcare in Canada. The use of a survey and an environmental scan are useful in measuring telemedicine's barriers to access. Time constraints and the recency of telemedicine did not allow for other methods such as expert interviews to guide and inform the current research.

3.1. Survey

An online survey composed of 42 questions was created using Qualtrics software and was distributed to British Columbians from December 2020 to January 2021. The survey was divided into four sections: 1. baseline questions on participants' familiarity and telemedicine use; 2. Questions on their perceptions of telemedicine (TMP), which were adapted from Yip and colleagues' (2003) telemedicine satisfaction survey, were changed to reflect opinions on telemedicine without having used it prior to the survey; 3.eHealth literacy is measured by the eHEALS questionnaire, which was developed by Norman & Skinner (2006); 4. Socio-demographic questions (List of questions can be found in *Appendix*). Both the eHEALS scale and telemedicine perceptions questions were measured using a 5-point Likert scale on their agreement. The eHeals scale was selected due to its demonstrated accuracy and accessibility in use (Norman, 2011). Survey invitations were sent through various online platforms, Facebook, Instagram and Reddit and further distributed by convenience and snowball sampling. At the start of the survey, there was an exclusion criteria question to only record responses from 19-34 year old residents of British Columbia. Additionally, there is a question about respondents' awareness of telemedicine services in B.C., if answered yes, there were follow-up questions within section 1.

3.2. Data Analysis & Hypothesis

The current study explores the relationship between young adults' perspectives of telemedicine and eHealth literacy. Recent literature supports the expectation that participants with lower eHealth scores will have a poorer outlook of telemedicine (Diviani et al., 2015; Smith & Magnani, 2019). There are not many explicit links between telemedicine and eHealth literacy, but as a prominent digital health technology, a significant relationship is expected. Other key variables such as age, gender, ethnicity, education, city of residence and type of employment or education were identified in the literature review and complete the logit model present in *figure 1*. The current model quantifies the log odds of a respondent's negative or positive views based on the predictor variables explained below.

Telemedicine Perspectives (TMP)

Telemedicine perspectives were based on the satisfaction survey developed by Yip and colleagues. These questions gauged the quality of care, ability to use and the similarity of telemedicine to in-person visits but were adapted to accommodate non-users (see *Appendix*). Specifically, respondents were asked whether they agree or disagree (with a five-point Likert scale) with the following statements:

- I believe I could easily communicate with a physician using telemedicine
- I consider telemedicine similar to an in-person visit
- I do/would not need assistance using telemedicine services
- I believe telemedicine can provide consistent/reliable healthcare service
- I would feel comfortable communicating with the physician using telemedicine
- I believe telemedicine provides great access to healthcare services
- I would use telemedicine for future physician visits
- Overall, I believe telemedicine can provide satisfactory healthcare services

The total scores of respondents' perspectives on telemedicine (TMP) were tallied up and a dummy variable was created for statistical modelling. As the dependent variable, TMP was split into two groups, one comprised of respondents greater than or equal to the mean TMP score ($Y=1$), and the other group is the reference group, which is comprised of scores below the mean ($Y=0$). These groups are referred to as *High* and *Low* TMP groups and represent the differences in respondents' perspectives on

telemedicine use. This dependent variable is the primary method of determining how respondents interact with telemedicine.

eHealth Literacy (EHL)

The eHEALS questionnaire is self-administered and measures respondent's eHealth literacy with the eight questions listed below:

- I know what health resources are available on the internet
- I know where to find helpful health resources on the internet
- I know how to find helpful health resources on the internet
- I know how to use the internet to answer my questions about health
- I know how to use the health information I find on the internet to help me
- I have the skills I need to evaluate the health resources I find on the internet
- I can tell high quality health resources from low quality health resources on the internet
- I feel confident in using information from the internet to
- make health decisions

Responses were quantified by a five-point Likert scale ranging from strongly agree (=5) to strongly disagree (=1) and total scores were tallied up. A similar treatment is done to eHealth literacy scores (EHL), as this variable was transformed into a dummy variable. The questions gauged respondents' confidence with online health information (see *table 4* and *Appendix*). Scores were separated based on being greater than or equal to the mean (=1), and the other group was comprised of scores less than the mean (=0).

Socio-demographic variables

Age was measured as a continuous variable as respondents imputed responses in years. Gender was comprised of four options: male(=0), female(=1), gender x, and prefer not to answer, and it was divided into two groups (male and female) for analysis as there were not enough gender x responses. Ethnicity and place of residence were selected from a list of options mirroring the Canadian Census format including an "other" option. The White /Caucasian group was compared to other ethnicities, while the subsequent three most selected responses were combined as another comparison group (South Asian, East Asian and Southeast Asian) to represent a visible minority

group. The multi-ethnic group was also a frequent answer but not included in the combined group as there was no further specification to draw precise conclusions on its results. The variable city of residence was divided between Vancouver residents (=1), where the sample was concentrated, and non-Vancouver residents (=0). Education was a numeric variable with ascending options from a high school diploma (1) to a doctorate degree (6). The field of study/work responses were dichotomized to reflect whether respondents studied/worked in a health-related field (=1) or not (=0) and were expressed as the variable *FOSW*.

A final independent variable, *awareness,* was important in the survey sample due to telemedicine's recent growth in BC. The entire survey sample was not familiar with virtual health services, and the variable had a potential confounding effect.

Hypothesis

A Logit model is employed to analyze the relationship between telemedicine perspectives and eHealth literacy, controlling for other confounding factors discussed above. The statistical formula for the Logit model is specified below,

$$\log\left(\frac{Prob(TMP=1)}{Prob(TMP=0)}\right)$$

$$= \beta_0 + \beta_1 EHL + \beta_2 age + \beta_3 gender + \beta_4 ethnicity + \beta_5 education + \beta_6 city + \beta_7 FOSW + \beta_8 Aware + \varepsilon$$

where β_0 *is the intercept,* β_i *is the coefficient of each variable.*

The study hypothesizes that a person's perspectives on telemedicine (TMP) is positively associated with their eHealth literacy level (EHL) (H_1: β_1>0), holding constant the control variables.

3.3. Environmental Scan

An evaluation of telemedicine companies operating in British Columbia was done using the questions in *table 1*. A key objective was to document areas that may serve as barriers to patients, especially with varying levels of eHealth literacy. Information was sourced from their online websites and resources to form a final table for the environmental scan. Keywords – *telemedicine*, *telehealth* and *virtual care* were searched online, while other companies were found through local health authority websites.

Companies were included if they provided synchronous primary care, services were available to British Columbians and were available direct to consumers (DTC). Several other telemedicine services specialize in mental health, allied health services, or technology solutions for physicians to virtualize their clinics; these companies were not included in the scan. The development of these questions was informed partially by the NIFTE Telemedicine Guidelines, and all information was compiled from publicly available resources (i.e. websites, patient portal).

Table 2. Environmental Scan Questions

Questions	Details
Selection of doctor pre-appointment?	An important factor in primary care is continuity. Selection of a familiar physician can help with continuity of care and overall quality of care.
What are the hours of operation?	Telemedicine is supposed to cover gaps in coverage that traditional clinics cannot meet, is after-hours care available or on weekends?
Connection with a specialist?	Is it possible to get a connection with a referred specialist within the platform?
Modality of services: desktop, phone application, telephone call?	Do the telemedicine services have options for delivery on desktops, smartphones and by phone calls?
Is there a physical location for a follow-up?	Physicians may not accommodate over video consultation, is there a physical clinic available or recommendations for one?
What are the associated fees?	MSP covers telemedicine consultations, but if not covered, what fees are charged for general services?
How are triages completed?	How are patients describing their symptoms, by static explanation, conversation with medical staff, or AI triage
Advertised treatable conditions?	What are the listed treatable conditions for telemedicine services? What are patients' expectations?
Are prescriptions available?	Can patients take care of orders or refills for prescription drugs within their platform?
Are services available in other languages?	What are the other available languages for telemedicine services?
Telemedicine related standards or certifications?	Accreditation Canada is one of the few accreditations available specifically related to telemedicine services. What are third-party providers aligning their services with?

Chapter 4.

Results

4.1. Survey

The survey's objectives were two-fold, establish an eHealth literacy score for young adults in British Columbia and quantify the relationship between ehealth literacy and perspectives on telemedicine. Overall, 202 responses were recorded, with eight respondents not meeting the inclusion criteria (over 34 years old). A further 16 responses were incomplete (missing full sections) and removed from the analysis. In total, 178 responses were used for the logit regression using the model described in the methodology.

Socio-demographic Profile

At a glance, *Table 3* provides a summary of the survey sample's sociodemographic profile, divided by their TMP score, in high and low groups (mean = 3.9). The majority of respondents were from Vancouver (44%), and overall, 73.9% were from the Metro Vancouver region (Burnaby, Coquitlam, Surrey). Considering the overall sample size of respondents and the concentration of responses within Metro Vancouver, conclusions from the survey analysis are not representative of British Columbia as other regions are underrepresented.

The current sample had more female respondents (57.0%) versus male (43.0%) and predominantly White/Caucasian (48.6%), with English being the most common first language among respondents (86.3%). East Asian and South Asian origins were the most prominent ethnicity other than White/Caucasian. Respondents were also comprised of other ethnicities such as Black/African, Arab, Indigenous and Latin American, all of which were below 5% of the sample. The average age was 25.7 years old, and most respondents were currently employed in full-time work (49.7%). In terms of education, a substantial majority of respondents had a post-secondary education with bachelor's, master's and doctorate degrees comprising 77% of the sample. Across fields of work and fields of study, a strong majority of respondents (69%) were not in health-

related fields. Some differences in characteristics between the TMP groups point to areas of interest: EHL scores (high TMP: 4.0 vs low TMP: 3.6), female (high TMP: 63.3% vs low TMP: 36.7%), White (high TMP: 60% vs low TMP: 40%), Vancouver (high TMP: 59% vs low TMP: 41%) and awareness (high TMP: 60.3% vs low TMP: 39.7%).

Table 3. Descriptive Statistics Summary

Dependent Variables	**High TMP** (N=97)	**Low TMP** (N=81)	**Total** (N=178)
EHL Average Score			
Mean (SD)	4.0 (0.58)	3.6 (0.74)	3.8 (0.69)
Range	2.4 - 5.0	1.4 - 5.0	1.4 - 5.0
Age			
Mean (SD)	25.8 (2.6)	25.7 (3.2)	25.8 (2.9)
Range	20.0 - 34.0	20.0 - 33.0	20.0 - 34.0
Gender			
Male	31 (41.9%)	43 (58.1%)	74 (100%)
Female	62 (63.3%)	36 (36.7%)	98 (100%)
Education			
High school diploma	7 (41.2%)	10 (58.8%)	17 (100%)
Professional Degree/Certificate	4 (50.0%)	4 (50.0%)	8 (100%)
College Diploma/Certificate	10 (66.7%)	5 (33.3%)	15 (100%)
Bachelor's degree	49 (48.0%)	53 (52.0%)	102 (100%)
Master's degree	24 (80.0%)	6 (20.0%)	30 (100%)
Doctorate degree	1 (33.3%)	2 (66.7%)	3 (100%)
City			
Vancouver	46 (59.0%)	32 (41.0%)	78 (100%)
Outside Vancouver	49 (51.0%)	48 (49.0%)	97 (100%)

Ethnicity			
White / Caucasian	51 (60.0%)	34 (40.0%)	85 (100%)
East Asian	16 (51.6%)	15 (48.4%)	31 (100%)
South Asian	14 (58.3%)	10 (41.7%)	24 (100%)
Southeast Asian	2 (33.3%)	4 (66.7%)	6 (100%)
Other	12 (41.4%)	17 (58.6%)	29 (100%)
Employment Status			
Full-time Employment	47 (54.0%)	40 (46.0%)	87 (100%)
Part-time Employment	7 (43.8%)	9 (56.2%)	16 (100%)
Full-time Student	16 (55.2%)	13 (44.8%)	29 (100%)
Part-Time Student	0 (0.0%)	1 (100.0%)	1 (100%)
Employed Student (FT or PT)	19 (59.4%)	13 (40.6%)	32 (100%)
Unemployed	6 (60.0%)	4 (40.0%)	10 (100%)
Health Related Field of Work/Study			
Health-related	28 (54.9%)	23 (45.1%)	51 (100%)
Non health-related	60 (53.1%)	53 (46.9%)	113 (100%)
Awareness			
No	21 (40.4%)	31 (59.6%)	52 (100%)
Yes	76 (60.3%)	50 (39.7%)	126 (100%)

eHealth Literacy and Telemedicine Perspectives

The survey sample yielded overall more positive scores for the eHEALS questionnaire (mean = 3.8; mean total = 30.2) and the telemedicine perspectives questionnaire (mean = 3.9; mean total = 31.4). Answers were arranged on a 5-point Likert scale, with 1 denoting strong disagreement and 5 denoting strong agreement. The

positive scores in eHealth literacy are not surprising considering the sample was concentrated in young adults, and most respondents had at least a bachelor's degree. These results were expected based on previous literature identifying higher levels of education and younger age as good predictors of higher EHL levels (Kim & Xie, 2017; Alami et al., 2017). In terms of telemedicine perspectives, the more positive outlook aligns with the high percentage of respondents who were aware of this modality of healthcare (70.8%). The relationship between telemedicine perspectives and eHealth literacy is a primary focus and yielded a moderate correlation value of 0.32. This correlation demonstrates that higher eHealth literacy levels are associated with more positive perspectives of telemedicine. Despite the overall high EHL scores, there are differences in TMP scores within subgroups of younger adults, which indicates that age and education are not the only important variables.

In *Table 4* , the eHEALS questionnaire responses are also organized by high and low TMP groups. Across all the questions, the low TMP group's scores fall below the sample average, indicating a lack of familiarity and efficacy with online health information. The lowest score across both groups was question 8 and may demonstrate the lack of confidence in using health information from the internet among young adults. In contrast, the highest average score across both groups was question 4 and indicated confidence in using the internet to find answers even in the low TMP group.

The ability to find, evaluate and action health information from online sources is an implicit skill to use telemedicine. It seems to be equally relevant among younger adults who are expected to be more familiar with computers and other technology (Choi & DiNitto, 2013).

Table 4. EHL Individual Scores by TMP Group

	High TMP (N=97)	Low TMP (N=81)	Total (N=178)
1. I know what health resources are available on the internet			
Mean (SD)	3.9 (0.85)	3.4 (0.98)	3.7 (0.95)
2. I know where to find helpful health resources on the internet			

	High TMP (N=97)	Low TMP (N=81)	Total (N=178)
Mean (SD)	3.8 (0.85)	3.5 (1.00)	3.655 (0.94)
3. I know how to find helpful health resources on the internet			
Mean (SD)	4.1 (0.71)	3.7 (0.93)	3.9 (0.83)
4. I know how to use the internet to answer my questions about health			
Mean (SD)	4.4 (0.58)	4.0 (0.79)	4.2 (0.70)
5. I know how to use the health information I find on the internet to help me			
Mean (SD)	4.1 (0.77)	3.6 (0.89)	3.9 (0.86)
6. I have the skills I need to evaluate the health resources I find on the internet			
Mean (SD)	4.1 (0.84)	3.7 (1.05)	3.908 (0.96)
7. I can tell high quality health resources from low quality health resources on the internet			
Mean (SD)	4.2 (0.74)	3.9 (0.91)	4.0 (0.83)
8. I feel confident in using information from the internet to make health decisions			
Mean (SD)	3.7(0.95)	3.3 (0.97)	3.5 (0.99)

Additionally, the differences in health behaviours between the TMP groups are displayed in *Table 5*. Respondents were not asked further health behavioural questions related to telemedicine if they indicated they were not aware of its services. Both groups have similar frequencies in annual medical visits (telemedicine and in-person) and have a high percentage of family physicians (high TMP: 53.1% and low TMP: 46.9%). However, despite the high percentage of respondents having a family physician, the high TMP group had an increased tendency to consult with a new physician (66.7%) versus

the low TMP group (33.3%) while using telemedicine services. The level of awareness of telemedicine services between high (60.3%) and low (39.7%) TMP groups is expected and may explain the differences EHL scores.

This difference in awareness was not highlighted in the literature review but will be added to the logit model as it could be a confounding variable. A key finding is the difference between the two groups and their EHL scores, with the high TMP group scoring an average of 4.0 while the low TMP group scored 3.6. Overall, these preliminary results demonstrate a strong relationship between EHL and perspectives on telemedicine. Many underlying factors have not been accounted for and cannot explain preliminary differences between High and Low TMP groups. The logit regression will further explore the relationship between these two variables while controlling for sociodemographic characteristics.

Table 5. Health Behaviours

	High TMP (N=97)	**Low TMP** (N=81)	**Total** (N=178)
Family Doctor			
No	28 (58.3%)	20 (41.7%)	48 (100%)
Yes	69 (53.1%)	61 (46.9%)	130 (100%)
Number of Visits to Clinic (in-person)			
Mean (SD)	2.49 (2.2)	2.96 (3.0)	2.71 (2.6)
Range	0 - 12	0 - 15	0 - 15
Have used telemedicine in the past year			
No	45 (47.8%)	49 (52.2%)	94 (100%)
Yes	52 (61.9%)	48 (49.0%)	84 (100%)
Type of Physician Visited with Telemedicine			
New Physician	20 (66.7%)	10 (33.3%)	30 (100%)

Previously Visited Physician	3 (60.0%)	2 (40.0%)	5 (100%)
Family Physician	12 (54.5%)	10 (45.5%)	22 (100%)
Mixture of Physicians	17 (62.9%)	10 (37.1%)	27 (100%)
Covid-19 Related Visit (telemedicine)			
No	51 (63.0%)	30 (37.0%)	81 (100%)
Yes	1 (33.3%)	2 (66.7%)	3 (100%)
Enrolled in MSP			
No	7 (31.8%)	15 (68.2%)	22 (100%)
Yes	87 (57.2%)	65 (42.8%)	152 (100%)

Logit Regression Model

The scatterplot of EHL and TMP (figure 1) suggests a non-linear relationship between the two variables. Further, the responses are clustered. These patterns of distribution make it challenging to fit a linear regress model. Therefore, a logit regression is performed to examine the relationship between TMP and EHL.

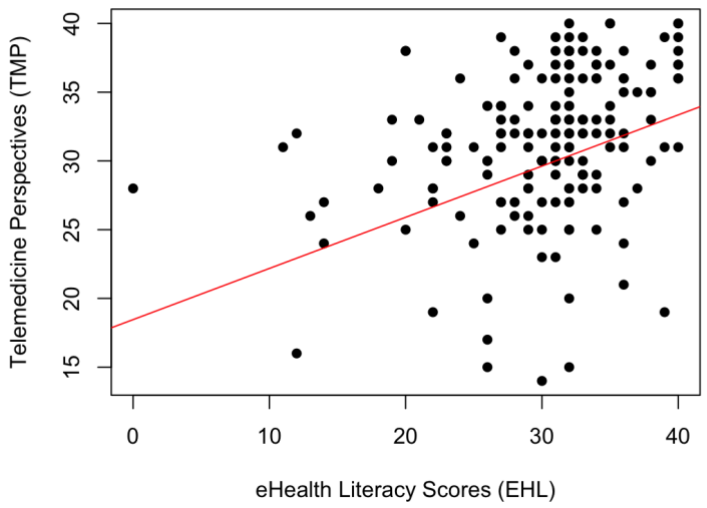

Figure 1. Distribution of TMP and EHL Scores

The logit model was developed using R version 4.0.3 and was comprised of the dependent variable, TMP and the predictor variables of age, gender, ethnicity, education, city of residence, field of study/work and awareness. A logit regression was used to determine the odds ratio of respondent recording high TMP scores as opposed to low TMP scores. As the research was exploratory, no variables were removed for a best fit model in order to test the variables identified in the literature.

The logit model results are summarized in *Table 6* and ranked according to the predictor variables' odds ratios in *Figure 2*. The variables of female (OR 2.24, $p<0.05$), EHL (OR 3.71, $p<0.01$) and white ethnicity (OR 1.96, $p<0.1$) were determined to be significant in predicting a positive outlook in telemedicine. Respondents with the higher EHL scores saw a 271% increase in their odds of having a positive outlook towards telemedicine than the lower EHL group. Females were associated with a 124% increase in their odds of having a more positive telemedicine outlook than males. Further, respondents that identified as white were associated with a 96% increase in the odds of having a positive outlook on telemedicine compared to other ethnicities.

Interestingly, while not significant, the ethnicity - Asian group (OR 2.07) was also associated with a more positive outlook towards telemedicine compared to all other ethnicities. The other predictor variables of age, field of study/work, city of residence and awareness were not significant in determining the odds of being in the high or low TMP group. Education was likely skewed due to the overrepresentation of university students in the convenience sample. Differences in the city of residence were also skewed, with the substantial majority of the sample located in the Metro Vancouver area. Besides age and field of work/study, most predictor variables are positively associated with the high TMP group and are visualized in *Figure 2*. The wide confidence intervals are a result of the small sample size of the survey. Overall, the model's results confirm the hypotheses as the independent variables of EHL was significant and positively associated with TMP. While gender and to a lesser degree ethnicity (white) are significant in predicting perspectives on telemedicine.

Table 6. Logit Regression Result

Dependent Variable: Telemedicine Perspectives (1= high TMP)		
Variable	**Log Odds (SE)**	**Odds Ratio**
Constant	1.05 (1.66)	0.09
Female	0.81** (0.36)	2.24
Age	-0.01 (0.07)	0.99
EHL (ref = low EHL)	1.31**** (0.40)	3.71
Education	0.24 (0.19)	1.27
City (ref = outside Vancouver)	0.32 (0.38)	1.37
Ethnicity		
- *White* (ref = other groups)	0.67* (0.40)	1.96
- *Asian (south, east and southeast)* (ref = other groups)	0.73 (0.57)	2.07
Health Related studies/work (ref = not health related)	-0.15 (0.40)	0.86
Awareness (ref = not aware)	0.04 (0.44)	1.04
Adjusted Pseudo R^2	**0.046**	
AIC	**214.25**	
* = $p < 0.1$, ** = $p < 0.05$, *** = $p < 0.01$, **** = $p < 0.001$		

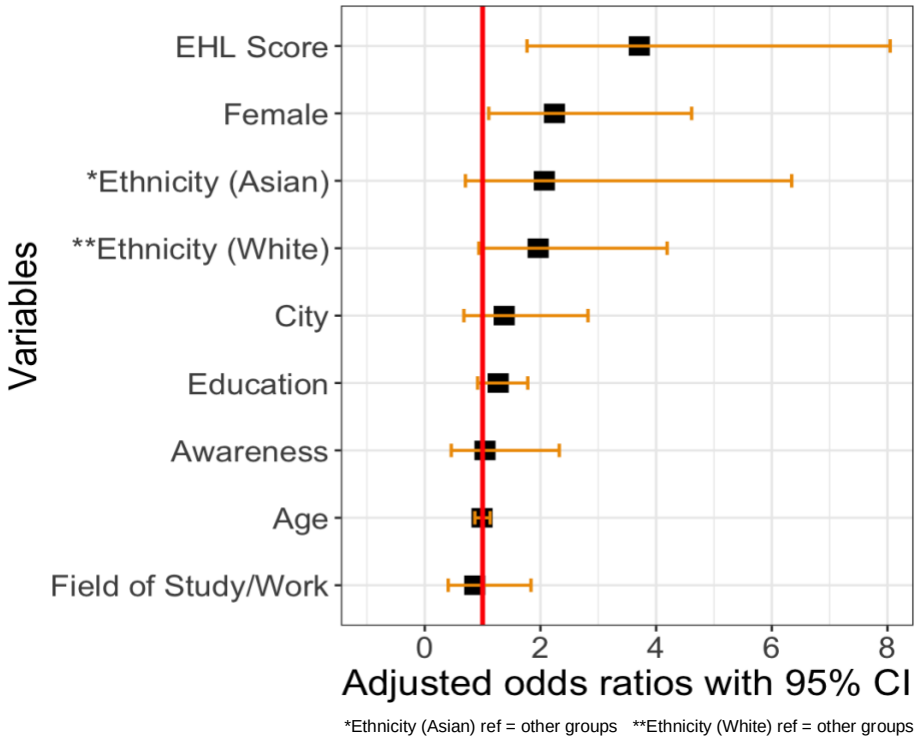

Figure 2. Odds Ratio of Positive Outlook of Telemedicine (1 = high TMP)

4.2. Environmental Scan

A total of six providers were identified through an online search, and all the information was sourced from their public websites. A summary of the findings is found in *Table 7* and provides a snapshot of telemedicine services available in BC. To the author's knowledge, there is no comprehensive patient guide for telemedicine services available in British Columbia. The primary inclusion criterion was that companies offered telemedicine services with general practitioners directly to patients or direct-to-consumer (DTC). Several other telemedicine companies specialize in mental health, allied health services, or technology solutions for physicians to digitize their clinics and were deemed out of scope.

The environmental scan's objective is to document the differences across third-party providers due to their significant role in telemedicine services for British

Columbians. The literature review determined that there are currently no binding policies or regulations for telemedicine services outside of practicing physicians. There have been concerns about telemedicine being used solely as short-term episodic care, limiting the quality and continuity of care in the long-term (Chaet et al., 2017). The current telemedicine environment may not support patients with varying eHealth literacy levels and could be a barrier to patients seeking healthcare online. The current environmental scan captures the patient experience for accessing telemedicine services in British Columbia.

Table 7. Summary of Environmental Scan

DTC Providers	Maple	Babylon	CloudMD	EQ Care	Tia Health	Vivacare
Choice in Doctor	- Selection (broad) of type of physician only	- No pre-selection	- No pre-selection	- No pre-selection	- Selection of specific physician available	- Limited selection of specific physician available
Hours of Operation	- Available 24/7	- Available weekdays: 8am – 10pm Weekends: 8am – 6pm	- Available 8am to 8pm every day	- Available 24/7	- Variable; dependent on physician	- Available 8am - 9pm every day
Specialist	- Referrals provided; several specialists available in-app - Direct consultations available	- Referrals provided; no specialists in-app - Counsellors and dieticians available	- Referrals provided; no specialists in-app - Therapists available through a partner company	Referrals provided; no specialists in-app - consultations with physicians or nurse practitioners	- Referrals provided - Several specialists available in-app	- Referrals provided - Several specialists within their network clinics
Modality	Desktop and mobile app	Mobile app only	Desktop and mobile app	Desktop and mobile app	Desktop	Desktop
In-person Clinic	No	Yes	Yes	No	Yes	Yes

DTC Providers	Maple	Babylon	CloudMD	EQ Care	Tia Health	Vivacare
Service Fees	Free for MSP; otherwise multiple options: $49 - $99 per visit varies by hours	Free for MSP; otherwise $70 per visit	Free for MSP; no service available otherwise	Free; no specific details provided	Free for MSP; Otherwise $40 per visit	Free for MSP; Otherwise $150 for initial visit, $45 for subsequent/ $50 no shows fee
Triage Process	Self-described, select symptoms are showcased	AI-assisted, in-app described symptoms	Self-described; no assistance	Questionnaire, followed by staff (nurse or support staff) meeting	Selection of appointment type based on symptoms; practitioner chosen accordingly	Self-described symptoms for reason of visit
Treatable Conditions	Expansive list provided; doctors will determine if appropriate	Expansive list provided; doctors will determine if appropriate	Limited list provided	Expansive list provided; doctors will determine if appropriate	Moderate list provided	No list provided; Type of visits that do not qualify
Prescriptions	Yes; delivery to home or sent to pharmacy of choice	Yes; sent to pharmacy of choice	Yes; sent to pharmacy of choice	Yes; delivery to home or sent to pharmacy of choice	Yes; sent to pharmacy of choice	Yes; delivery to home or sent to pharmacy within network

DTC Providers	Maple	Babylon	CloudMD	EQ Care	Tia Health	Vivacare
Other Languages	Yes; Options in French are available - interface and appointments	Yes; Upon request French, Mandarin, Farsi, Punjabi, Spanish, - only for appointments	No; no additional languages are advertised	Yes; Options in French are available - interface and appointments	Yes; Expansive list of available languages - interface and appointments	Yes; Cantonese, French, Hindi, Korean, Mandarin, Punjabi, Tagalog, Urdu. - only for appointments
Listed Standards & Certifications	None listed - standard data and clinical procedures are met	None listed - standard data and clinical procedures	None listed - standard data and clinical procedures are met	ISO 9001:2015 certified - Quality management systems	Legitscript (telemedicine) certified - Legality, safety and transparency	None listed

Key Findings

Choice

Choice in doctor was limited in most cases, with only two providers allowing patients to read doctor biographies before making a selection. This process may explain the high percentage of patients citing new physicians as an answer (*Table 4*) when using telemedicine. Allowing for the selection of a doctor may help build better relationships while engaging in virtual care by adding familiarity to the process and overall positive health outcomes (Kamimura et al., 2020).

Hours of operation

The hours of operations for providers available to consult were 24/7 availability or at least 12 hours per day and open on weekends. This flexibility is an advantage over traditional clinics as telemedicine fills a gap for after-hours care that is not comprehensive outside of ER visits (Peckham et al., 2018).

Specialist Referrals

The referral system is a strength of telemedicine and allows for increased access to more scarce professionals across British Columbia. All providers allowed for physician referrals to a specialist (i.e. dermatologist, endocrinologist) if necessary, but one provider allowed for direct consultations for a fee.

Modality/in-person clinic

There are documented differences in the skills required for using mobile and desktop applications, and an in-person option for follow-up is considered necessary for patients with low levels of eHealth and computer literacies (Free et al., 2013). There was no consensus among providers, as some made services available on desktop, on mobile app or both, with three having both options. Two out of six providers were only available online, and it was not clear what options for in-person follow-ups were available under those circumstances. Overall, only CloudMD offered the most flexibility with desktop, mobile applications and partner in-person clinics for follow-up. It should be noted that physicians may refer patients to local clinics at the time of appointments, but some providers offered no official in-person clinic.

Service fees

All telemedicine providers have complimentary services to British Columbians enrolled in MSP, but standard fees varied from provider to provider if that was not the case. To access telemedicine services with no MSP costs ranged from $40-$150 per visit, and Maple provides several services not covered by MSP on a subscription basis. Further, in some cases, it was not always clear what services were covered under MSP, and if patients forgot to enter MSP details, there was the risk of getting charged.

Triage process

The triage process varies but can be divided by assisted or self-directed experiences with patients typing their symptoms in a text box or having a conversation with medical staff (nurse or care manager). eHealth literacy is a factor in determining how well patients can describe their symptoms and interact overall with virtual health systems.

Treatable conditions

The CPSBC and other health organizations have made clear the limitations in telemedicine, and most doctors understand how to utilize virtual health best. However, half of the companies provided comprehensive lists for treatable conditions online, and there was tremendous overlap between the listed conditions, while the other half had limited lists or none at all. This difference is a similar area of concern as the triage process, as sufficient education is crucial for patients in a new virtual environment.

Prescription drugs

Comprehensive connections across health services are vital, and prescription drugs are a massive component of the healthcare system. All providers allowed physicians to write prescriptions and even allowed patients to select a pharmacy for delivery or to have it sent right to their home at no additional cost.

Languages

The majority of providers, five out of six, had at least French as an alternative language to use their website or as an option to communicate with physicians. Language is a common barrier for immigrant populations and could be an important consideration to increase accessibility (Pierce & Stevermer, 2020). Other than French, three providers had an expansive list of options of languages for patients to select: Cantonese, Hindi,

Mandarin and Punjabi, which are common within the Lower Mainland (City of Vancouver, 2020); Tia health also made these additional languages as options for navigation of their website.

Listed standards/certifications

As mentioned, there are currently no industry standards for telemedicine policies and certifications, but some providers still showcased some forms of certification. Tia health is certified by Legitscript, which verifies credibility for digital health-related merchants or providers. EQ Care is certified by the International Standards Organization (ISO 9001:2015), which certifies that an organization delivers quality services or products for customers. Meanwhile, Maple, Babylon and CloudMD mention they meet all the standards for Data protection and privacy and Clinical procedures.

4.3. Discussion

The current findings demonstrate young adults in British Columbia generally have high eHealth literacy scores, but not all have confidence in accessing online health information. A significant finding is that higher EHL scores are associated with more positive perspectives of telemedicine when controlling for several socio-demographic factors. This relationship confirms concerns surrounding eHealth literacy and telemedicine use and demonstrates its importance as a consideration for implementing virtual health services. Despite previous literature demonstrating the positive relationship between older age (over 65 years) and lower EHL skills, the current logit regression model deemed age to be insignificant (Kim & Xie, 2017). However, these findings are not unexpected considering the targeted age group of the sample (19-34 years) and can confirm there is no age effect among young adults, meaning the digital divide is a generational problem (Smith & Magnani, 2019). Another significant finding was the difference between males and females, with the latter more likely to have positive views of telemedicine (OR 2.24, $p<0.05$). Minor gender differences in telemedicine use have been documented in other studies but are not well understood (Uscher-Pines et al., 2016; Pierce & Stevermer, 2020). Mixed evidence has suggested females are more likely to consult online sources for health information and may explain the higher likelihood of a positive disposition in the current sample (Stellefson et al., 2011). The other significant sociodemographic variable was ethnicity, as white respondents were

associated with a higher likelihood (OR 1.96, $p<0.1$) of being in the high TMP group compared to other ethnic groups.

In contrast, the aggregated group of visible minorities of Asian descent (East/Southeast/South Asian) was not significant in predicting respondent's perspectives of telemedicine relative to other ethnic groups. The sample distribution for ethnicity closely mirrors Metro Vancouver's 2016 census data, with 95% of the population having European/White or Asian origins, suggesting ethnicity may not be as relevant for younger age groups. However, it is important to note that 86.3% of the sample indicated English as their first language; This signals that the lack of language options among telemedicine providers likely was not a barrier for respondents as it has been documenting in other studies (Kim & Xie, 2017). Increases in education level (OR 1.27) and living in Vancouver (OR 1.37) had a positive association with the high TMP group. The sampling method may explain these relationships with most of the sample located in the Metro Vancouver area (73.9%) and having a post-secondary education (78.4%). As a result, the sample group was not a proper comparison for urban and rural/underserved communities or educational attainment, so differences between the two groups are limited in scope.

The environmental scan demonstrated some differences among telemedicine providers that may worsen patient experiences across varying levels of EHL. The choice of doctor is an important component in order to build strong patient-provider relationships. Recent literature has demonstrated that the lack of a physician relationship is associated with poorer health outcomes and lower EHL levels (Kamimura et al., 2020). If prospective patients are cycling between physicians, then continuity of care would be expected to decrease in a virtual care environment. This trend was replicated in our sample, with new physicians being the most commonly visited during a telemedicine consultation (35.7%). Interestingly, consultations with a new physician were more common in the high TMP group (66.7%) than the low TMP group (33.3%). This lack of consistency will decrease opportunities does not create a favourable environment for patients with lower EHL levels, and appears to be an area of growth for telemedicine services (Kamimura et al., 2020; Smith & Magnani, 2019). Third-party providers could aid with the shortage of Canadians with a family, which ultimately help foster patient learning of EHL skills through strong patient-provider connections. The differences in triage methods highlighted the need for competent EHL skills as patients were expected

to self-describe symptoms online with little to no prompts in some cases. The previously documented challenges with health literacy in conventional medical settings are layered with computer literacy necessary to navigate and type out symptoms online (Rootman & Gordon-El-Bihbety, 2008; Choi & DiNitto, 2013). Third-party providers should consider having flexibility between assisted and self-directed triage processes, which could improve telemedicine access.

The list for treatable conditions was relatively similar across providers but not identical. Patients should have a clear idea about telemedicine's strengths and weaknesses so that their expectations are reasonable, although that responsibility partly falls with physicians. Regardless, educational resources available on each online platform that are consistent across providers would help build patients' EHL capacity (Smith & Magnani, 2019). Prescription drugs were similar across all providers with convenient pick or delivery options to a patient's residence or local pharmacy. Language options were lacking in consistency and were not always reflective of the communities' populations. English and French were the most likely languages to be offered as options to use the platform and for physician consultations. Only one provider (Tia health) had various options for languages to access the platform and physician consultations which could be a vital component to immigration populations with lower EHL levels (Chan & Kaufman, 2011; Coffman et al., 2016). Despite Accreditation Canada's telemedicine certification availability to all programs, not one of the third-party providers listed it as a certification; This is in contrast to all provincial health authorities and associated regional programs being certified by Accreditation Canada (Coach, 2015). Further, there was no single certification or policy that was shared among providers. This does not imply that providers are not doing their due diligence to ensure the best care for patients, but there is no clear framework for providers to reference.

The survey results provided insights into the relationship between telemedicine and eHealth literacy in British Columbia, as EHL and gender were significant in explaining differences in young adults' perspectives. These findings demonstrated that EHL is significant in determining how prospective patients view telemedicine even in a young adult population. This study's replication on a grander scale would likely demonstrate the difficulties for more senior and ethnic minority groups to benefit from telemedicine, who are considered more vulnerable to the impacts of decreased eHealth literacy (Kontos et al., 2014; Akhlaq et al., 2016). The environmental scan showcased

third-party providers in BC are not consistent in their provision of health services, a concern for patients with lower EHL levels. The current study highlighted some areas for growth in telemedicine delivery, making it evident that the time is now for the BC government to set expectations for the future.

Chapter 5.

Policy Options

The current state of telemedicine in British Columbia is dynamic and allows for an opportunity to shape an emerging sector into an optimal situation for patients. The state of telemedicine is continually shifting as Canada's response to the pandemic is ongoing. The study uses the survey data and environmental scan to highlight how an absence of standards among third-party providers may allow barriers to impede access to virtual care. Consequently, three policy options are developed and informed by the best practices from the most current literature and the study's key findings.

5.1. Option 1 - Standards

Telemedicine Standards for Third-Party Providers

In British Columbia, telemedicine visits can vary depending on what provider is selected, the access to electronic devices, and eHealth literacy, which may affect patient experiences. There is a standardization of clinical practice for physicians, but there are no formal standards or policies to guide third-party providers in providing care. In BC, telemedicine is exclusively growing in the private sector within a policy vacuum. A set of standards for telemedicine providers in BC can be developed from previous research and adjusted to fit the healthcare system. There has already been foundational work done by NIFTE and the subsequent development of a telemedicine accreditation by HSO to draw from and to further adapt for the private sector. A particular focus should be placed on patient-centred needs and outcomes as covered in HSO's guideline sections: 3 - service meets the needs of patients, 4 - patients are informed about virtual health service and 5 - emphasis on patient engagement, relationship and quality of care. Additionally, Smith & Magnani have compiled universal digital health standards to promote patient eHealth (2019). Highlights from the *Universal Precautions* include: identifying opportunities for improvement, making health literacy a standard in program development, providing access to health information, determining access to technology and solicit patient feedback (Smith & Magnani, 2019). A model of implementation could follow what Ontario Health has recently done, as it invites virtual health providers to

apply to get verified. This non-prescriptive approach allows for flexibility as the telemedicine sector is still maturing and provides an opportunity to scale accordingly. Based on previous research, below are key standards for telemedicine providers to meet in order to deliver quality virtual care:

- Selection of Doctor pre-appointment; an opportunity for relationships
- Evaluation of patient experiences and outcomes; satisfaction surveys, consultations
- Access and interoperability of patient data between other providers, health authorities and patients
- Provide alternatives to services or suggestions for patients; in-person clinics for follow-up, other local healthcare services
- Educational resources on service platform and connections to others
- Options for triage process; flexibility between self-directed and assisted
- Options for service languages; English and French, plus more community-based availability
- Established partnerships/connections with in-person clinics for follow-up

Basic standards such as these for telemedicine services create a better patient experience by being accessible to patients of varying eHealth literacy levels. These standards would also create better continuity and a more connected health system, shaping telemedicine into an effective tool within the healthcare system, not a separate entity. Telemedicine is still emerging, and this will be an iterative process as it becomes a staple in the Canadian healthcare system.

5.2. Option 2 – Provincial Telemedicine

Provincial Telemedicine Program

Third-party providers are currently the most prominent option for British Columbians to access telemedicine services. Medical services are a public service, and its virtual iteration should not diverge from the principles of the Canadian Health Act. The private sector is an important stakeholder in the provision of telemedicine, but British

Columbia is lagging behind other provinces. Ontario has fully embraced telemedicine with the OTN's large-scale operations across the province, while Alberta, Saskatchewan and Manitoba have also established a substantial public presence in virtual health. The PHSA and BC's Ministry of Health have supported initiatives, but presently almost every local health authority provides its own version of telemedicine. The only current public provincial-wide telemedicine service is carried out by the FNHA, which caters to indigenous communities' needs. A provincial program similar to the OTN could serve as a great compliment to the private sector, cover any service gaps, and set the standard of care. HealthLink BC already has limited telemedicine services available to patients with hearing and speaking disabilities. A prospective provincial program could leverage existing regional health authority facilities and create a streamlined and consistent telemedicine experience for patients. This program would also allow the province to correct direct data on telemedicine use and identify populations with barriers. Additionally, a provincial program would also link existing health information from HealthLink BC to all users, acting as a vessel for better health education. Standardized telemedicine services by a provincial program would set expectations for other providers in the sector. Further, the development of a telemedicine provider for all British Columbians could ensure barrier-free access and become a staple in the sector.

5.3. Option 3 - Leadership

Establishment of Lead Organization

A major finding of the NIFTE recommendations was the need for *organizational leadership* that creates a stable governance structure for all telemedicine stakeholders. The expansion of telemedicine was sudden and rapid, which did not allow for significant organization and planning. As a result, most health organizations in British Columbia offer their own version of virtual healthcare services, including local health authorities, physician associations and the provincial government. The status quo is a network of different programs and strategies across British Columbia with no defined direction. This approach is replicated across the country as each province has a slightly different environment for telemedicine services, and there is limited Pan-Canadian collaboration to date. Other OECD countries have established national organizations to allow for a strong and unified message for a telemedicine strategy. Australia established the digital

health agency, a branch of government that leads all national eHealth initiatives, while the United States has the ATA to provide guidance and support to all states for telemedicine programs and initiatives.

At the provincial level, BC has no clear leadership in telemedicine, and it is likely the reason for its reliance on the private sector for virtual care delivery. The PHSA has taken strides towards providing guidance and support with resources for patients and physicians but ultimately does not influence telemedicine providers. Through their office of virtual health, tremendous work has been done to familiarize physicians and patients with telemedicine. Additionally, some regional telemedicine programs such as FNHA's, are only confirmed for the duration of the pandemic. The long-term prospects of publicly administered telemedicine are unclear. As mentioned, the government of Ontario has collaborated with the OTN to provide some oversight and standardization of virtual health services with their *Virtual Visit Solutions* Verification program. To move toward a model like Ontario's, the government of British Columbia needs to have greater oversight over the virtual care environment. Investments into a dedicated department similar to eHealth Ontario or eHealth Saskatchewan would establish clear leadership for telemedicine strategies. This new proposed provincial body could connect regional health authorities to build a comprehensive network of public telemedicine providers. This prospective provincial organization could streamline investments to ensure telemedicine is ubiquitous across British Columbia, and not a temporary measure to combat the COVID-19 pandemic. Presently, the PHSA serves as the best candidate as it already handles provincial healthcare delivery in specialized fields such as cancer, transplant, mental health & substance abuse. Telemedicine could be newest form of healthcare under their mandate and represents a great option for the short-term to fill the void of leadership.

A future consideration for this option are the Pan-Canadian implications. Creating a provincial organization to lead virtual health in the short-term allows for greater Pan-Canadian collaboration in the long-term. The Canadian federal government has funded Canada Health Infoway, an independent not-for-profit organization, since 2001 with $2.45 billion to support and invest in digital health initiatives across the country (Canada Health Infoway, 2020). The organization collaborates with provinces and territories to promote digital health initiatives, but there is a limit to their influence. If each province has clear leadership for virtual health services, organizations such as Canada Health

Infoway or Health Canada could handle regulatory duties to create and lead virtual health initiatives across Canada. Like Australia's Digital Health Agency, Canada would benefit from a statutory authority specializing in virtual healthcare. Virtual care extends beyond provincial boundaries, and Pan-Canadian collaboration will be necessary to address patient barriers (eHealth, internet access), physician barriers (licensures, education) and standardization of virtual health services. All those issues cannot be addressed unless clear leadership is established in British Columbia while the window of opportunity is open.

5.4. Policy Objectives and Criteria

This section outlines the objectives that will be used to evaluate each policy option. The status quo of telemedicine in British Columbia is assessed using a blend of five societal and governmental objectives to discuss each policy option in detail. The following are the five objectives to guide the policy analysis:

- Equity (key)
- Development
- Cost
- Administrative Complexity
- Stakeholder Acceptance

Policy options will be discussed and evaluated under the context of these objectives, and the individual criteria are derived from the literature and the current study's findings. The final evaluation is based on the expected impacts of each option according to the five objectives. The recency of telemedicine as a common form of healthcare has led to limited indicators to measure success and advancements. As the maturity model by Digital Health Canada indicates, British Columbia and Canada as a whole is in the early stages (basic to emerging phase) of maturity (Digital Health Canada, 2020). Quantitative indicators are used when possible, but the main objective is to discuss strengths and weaknesses of each option. In order to frame the results, a rating system of excellent, satisfactory and poor is used, with excellent denoting a positive impact, satisfactory denoting a moderate impact, and poor denoting little to no

impact. The policy environment for telemedicine is still developing, resulting in non-precise measures for these policy outcomes. The current evaluation aims to discuss the policy options based on their strengths and weaknesses (see Table 8).

Equity

Equity is considered the key objective as telemedicine services should be accessible to all British Columbians. The criterion for this objective is an increase in telemedicine access for patients of varying levels of eHealth literacy. Each option is measured by the expected increases to telemedicine access in more vulnerable populations (older, less educated, minority groups). Despite the current study's findings, older, less educated patients and ethnic minority groups are less likely to use telemedicine and more likely to have decreased EHL levels (Kim & Xie, 2017). Increased telemedicine use in these populations would signal telemedicine use is becoming more accessible. In terms of ratings, an excellent rating denotes a significant increase in telemedicine use, medium denotes a satisfactory increase in telemedicine use, and poor denotes little to no increase in telemedicine use.

Development

Development is an objective that considers how options deal with patients' familiarity and confidence using telemedicine services as a criterion for success. As the future of healthcare, British Columbians require an updated set of skills to benefit from a virtual healthcare system fully. This criterion will be measured by expected changes in the population's eHealth literacy and whether it helps develop this essential skill. In terms of ratings, an excellent rating denotes a significant increase in the population's eHealth literacy, satisfactory denotes a moderate increase in the population's eHealth literacy, and poor denotes little to no increase in the population's eHealth literacy.

Cost

Cost is tracking the amount of public funding or investment necessary for each policy option to be implemented at the provincial level. This objective serves as a projected cost to develop and implement each policy and is not exhaustive in scope. In 2019-2020, the government of British Columbia spent $21.8 billion on total health expenditures, which includes regional hospitals, physicians' salary and health authority funding (CIHI, 2020). There is no perfect comparison, but costs will be compared to the recent $18

million funding received as part of the bilateral agreement for Pan-Canadian Virtual Care priorities signed with the federal government (Health Canada, 2020). This initiative was created to allow provincial governments to develop virtual care strategies to combat COVID-19, and the $18 million funding will serve as a benchmark cost. The nature of the funding is a response to COVID, and related costs will be judged in the short term. In terms of ratings, an excellent rating denotes a cost below the benchmark, a satisfactory rating denotes a cost around the benchmark, and a poor rating denotes a cost above the benchmark.

Administrative Complexity

The degree of coordination among different government departments (federal and provincial), health organizations and associations, and private sector organizations are important to consider. This objective is measured by how many actors are necessary to implement the proposed option with the federal and provincial government, local health authorities, physician associations and telemedicine providers in consideration. In terms of ratings, excellent denotes low complexity with little coordination, satisfactory denotes medium complexity with moderate coordination, and poor denotes high complexity with significant coordination.

Stakeholder Acceptance

There are several stakeholders involved in telemedicine and are essential to consultations processes for the provincial government. Private organizations are central to the delivery of virtual care, but patients are also a key stakeholder to consider. The options will be evaluated based on the expected reaction and support from different stakeholders, and will be rated as an aggregated measure of private (telemedicine providers), physician associations and patient group sentiments. Excellent denotes strong/majority support, satisfactory denotes mixed/unclear support, and poor denotes weak/minority support.

Table 8. Policy Objectives and Criteria

Objective	Criteria	Measure	Rating
Equity (key)	Increase access telemedicine to vulnerable populations	Expected increase in telemedicine use by vulnerable populations (lower EHL levels)	Excellent = significant increase in telemedicine use Satisfactory = moderate increase in telemedicine use Poor = little to no increase in telemedicine use
Development	Building public familiarity and confidence in telemedicine services	Expected increase in eHealth literacy	Excellent = significant increase in eHealth literacy Satisfactory = moderate increase in eHealth literacy Poor = little to no increase in eHealth literacy
Cost	BC government funding of telemedicine initiatives	Cost in Canadian dollars; relative to the benchmark cost ($18M)	Excellent = costs that are below the benchmark cost ($18M) Satisfactory = costs around the benchmark cost ($18M) Poor = costs above the benchmark cost ($18M)
Administrative Complexity	The magnitude of coordination between public departments and other relevant stakeholders	The expected level of coordination between governments, health authorities, private sector and others	Excellent = low complexity, little coordination Satisfactory = medium complexity, moderate coordination Poor = high complexity, significant coordination
Stakeholder Acceptance	Reception by all relevant stakeholders	Aggregated support from private, physicians and patient groups	Excellent = strong/majority support Satisfactory = mixed/unclear support Poor = weak/minority support

Chapter 6.

Policy Analysis & Evaluation

6.1. Evaluation of Option 1

Telemedicine Standards

Equity

The expectation is that establishing standards across third-party telemedicine platforms would create consistency and familiarity for patients in the virtual health space. These standards would be administered by the provincial government and set expectations for all telemedicine providers. Key components of HSO's accreditation and Ontario Health's virtual verification process are patient-focused policies such as documenting patient experiences, interoperability of electronic health records or having service available in other languages. Further, the environmental scan highlighted differences in the process for patients to access telemedicine services, with some platforms relying on assisted triages and others self-directed triages. Other considerations like the ability to select a physician, access to patient data, the option to follow up in person will aid in meeting different patient needs. Establishing a set of telemedicine service standards will create familiarity and comfort for patients of varying eHealth literacies. Access to different platforms would hopefully increase telemedicine use among more vulnerable populations in British Columbia, but more targeted approaches would also be necessary. Telemedicine standardization would reduce barriers for patients and generate better experiences. Consequently, this option receives a rating of excellent for equity.

Development

Telemedicine services should not require a certain skill level to access its benefits. The development of standards would address concerns over continuity of care, language barriers, and consistent experience across platforms. Government oversight of telemedicine providers would help ensure a patient-centred approach in the virtual environment. Patients accessing telemedicine with a familiar physician, assisted triage process, multiple languages, health resources online and in-person options would create better opportunities for all levels of eHealth literacy. There would a limited direct impact

in raising the eHealth literacy scores of British Columbians but could facilitate changes in the long-run as patients become acclimated to virtual care. As a result, this option receives a rating of excellent for development.

Cost

The development and implementation of standards for telemedicine would require government resources, research and consultations. Additionally, if these standards were enforced in a similar method as Ontario Health's model, it would also require an administrative component to sort through applicants' attestations. The staff necessary for both these processes could be done by reallocating existing resources. It is expected to be relatively inexpensive compared to total health spending by the Government of British Columbia and falls below the benchmark cost ($18M) and receives a rating of excellent.

Administrative Complexity

The complexity of developing standards would likely depend on the consultation process between the government, telemedicine providers and patients. The provincial government would spearhead development and implementation, and their approach towards consultation could be either informing stakeholders or engaging stakeholders. Beyond consultation, there is also the potential for reallocating resources to process applications for verification. The best-case scenario is moderate complexity with the potential for significant complexity considering the research and enforcement aspects. Consequently, this option receives a rating of satisfactory for administrative complexity.

Stakeholder Acceptance

The development of standards would help patients the most and allow the government some oversight over telemedicine providers. Physicians already adhere to clinical guidelines for virtual care, and standards would help with patient interactions. Telemedicine standards would have the most significant impact on providers as their platforms may require significant changes. These standards could also be seen as a burden to an emerging market that may inhibit innovation for newer firms. The expectation is that even with extensive consultation of private third-party providers, there will still be some disagreement. Overall, support would be met with mixed acceptance and receives a rating of satisfactory.

Equity	Development	Cost	Administrative Complexity	Stakeholder Acceptance
Excellent	Excellent	Excellent	Satisfactory	Satisfactory

6.2. Evaluation of Option 2

Provincial Telemedicine Program

Equity

British Columbia currently does not provide a public option for patients seeking out telemedicine. The current reliance on third-party providers for equitable access to virtual care may not suffice. Other provinces have developed a provincial option to provide telemedicine that responsive to government objectives. A provincial telemedicine program would allow direct control to make amendments necessary for all patients across the province. Leveraging local health authorities' facilities and reach would ensure that patients have better options catered to regional needs. The provincial program offered through local health regions would provide innovation through familiar infrastructure and is expected to increase telemedicine use significantly. The presentation of telemedicine services in a consistent manner would facilitate a better environment for all patients (Smith & Magnani, 2019). This consistency brings healthcare innovation directly to communities and is expected to increase telemedicine use, even in more vulnerable groups. This option receives a rating of excellent for equity.

Development

The introduction of a new health service that is directly embedded within existing health structures would help patients of all eHealth literacy levels, especially the most vulnerable (seniors, less educated, ethnic minority groups). While the current study's findings had overall high scores, a more representative sample would have likely revealed lower EHL scores. It is difficult to predict the magnitude of increases to British Columbians' EHL levels, but an introduction to telemedicine through an existing public health program would ensure services are patient-centred (HSO accredited). Patients are likely to be already familiar with public healthcare programs and could synergize with

existing provincial programs and software to create a comprehensive virtual care experience. This option receives a rating of excellent for development.

Cost

The creation of a new provincial program is a tremendous task and would require a significant amount of resource allocation, time, planning and funding. Local health authorities like Fraser Health already have some capacity, and the BC government's existing platform, Health Gateway, makes patient data accessible. The Ontario Telemedicine Network serves as a comparator in terms of future funding. In 2019 – 2020, their total funding of $44 and $37 million, most of which was from the Ontario government ($37M and $30M). Ontario has a larger population than British Columbia, but the initial start-up costs for BC may be higher due to investments into technology and other capital. An estimated $40 million could be necessary for the operating costs and could be higher due to start-up costs. Further, long-term spending for the proposed program would likely lead to increased funding as the program expand. Further considerations of long-term costs would make this option expensive as it would not be a one-time investment. As it relates to the benchmark cost of $18M, this option receives a rating of poor.

Administrative Complexity

The creation of a new provincial program would entail significant effort across several provincial ministries and local health authorities. Physician associations such as Doctors of BC and CPSBC would also require engagement to coordinate staffing considerations. Other administrative staff could be reallocated from other departments in government, but it is expected that many would be new hires and would require training as well. Overall, the expectation is that this option would require significant coordination across several levels of government. This option receives a rating of poor for administrative complexity.

Stakeholder Acceptance

The expectation is that the public would likely support this initiative to increase access to healthcare services. The creation and implementation of this large-scale operation would likely draw scrutiny for its high costs but telemedicine would save the government in money in the long-run (Canada Infoway Health, 2020). Third-party providers would likely

not support this option as it would redirect prospective patients away from their services. The aggregated support is expected to be mixed with high costs and entering into competition with the private sector. This option receives a rating of satisfactory for stakeholder acceptance.

Equity	Development	Cost	Administrative Complexity	Stakeholder Acceptance
Excellent	Excellent	Poor	Poor	Satisfactory

6.3. Evaluation of Option 3

Establishment of Lead Organization

Equity

Establishing a clear leader in virtual care would serve an important role for all British Columbians familiarizing themselves with telemedicine. The current scattered network for resources and information is not streamlined and may not foster great patient experiences online. A centralized provincial presence for all relevant online health resources, available services and virtual tools that teach patients about virtual care and its benefits. There is a willingness from many Canadians to use virtual care, and a designated entity can foster that public interest into accessible health services (Canada Health Infoway, 2020). A provincial organization such as the PHSA can ensure all telemedicine services are standardized and more accessible for British Columbians. This option similarly may not directly cause increased telemedicine use in vulnerable populations but has the opportunity to connect with a broader audience to deliver a consistent message on virtual care. This option receives a rating of satisfactory for development. This option receives a rating of satisfactory for equity.

Development

An established leader for telemedicine and other digital health initiatives would serve as the primary source for online health information. Additionally, educational campaigns could be streamlined through this prospective organization to build awareness of

eHealth literacy as a skill. The PHSA is an established organization that collaborates with regional health authorities and has capacity for the delivery health services. In contrast, the status quo has many telemedicine providers across public and private platforms offering their own version of resources which may be confusing to patients (Giudice et al., 2018). A consistent message and strong leader is also a key suggestion from the NIFTE guidelines, which could fast-track telemedicine adoption if carried out federally. In turn, as patients become more familiar and comfortable with telemedicine, EHL levels could increase, but as studies demonstrated, it may not be sufficient for vulnerable populations as a more direct approach is warranted (Diviani et al, 2015). This option receives a rating of satisfactory for development.

Cost

The cost of designating a lead organization for digital health is dependent on the path forward. As an estimate for cost can be derived from similar organizations' budgets from other jurisdictions. eHealth Ontario represents an accurate comparison due to their narrow scope in digital health, and their budget in 2017-2018 was $443 million. Further funding and designation of specific responsibilities could add to costs as additional infrastructure will be required (employees, building, equipment). As mentioned, it could be sufficient to designate an existing organization such as the Provincial Health Services Authority then re-evaluate in future years as telemedicine and other digital health technologies expand. Even if this case, the PHSA's budget would require a large increased to meet all the responsibilities of digital health leadership. The price model for eHealth Ontario presents a close projection for cost and is well above the benchmark cost of $18M. This option receives a rating of poor for cost.

Administrative Complexity

The expected coordination necessary to designate or develop leadership for virtual care would likely involve significant provincial government deliberation. A lead organization would also need to coordinate with existing regional health authorities and physician associations, even if the PHSA accepted the role. This approach would likely not be a top-down approach as this requires careful consideration to execute effectively. In the short-term, this organization would stay focused provincially, but ultimately future Pan-Canadian considerations would have to be discussed to ensure effective telemedicine

rollout nationwide. This option receives a rating of satisfactory for administrative complexity.

Stakeholder Acceptance

The PHSA has already established relationships with the regional health authorities and the BC's Ministry of Health making them a familiar organization. The key for continued provincial support would be sufficient engagement moving forward. As for other relevant stakeholders, clear leadership is likely to be supported by patients and private companies as it would further legitimize their sector. Further, the presence of clear leadership in British Columbia can coordinate all stakeholders, allowing for communication across the industry. This option receives a rating of excellent for stakeholder acceptance.

Equity	Development	Cost	Administrative Complexity	Stakeholder Acceptance
Satisfactory	Satisfactory	Poor	Satisfactory	Excellent

6.4. Policy Evaluation Summary & Recommendation

Below, *Table 9* summarizes each option's policy evaluation and demonstrates their strengths and weaknesses. The status quo for telemedicine in British Columbia is composed of limited policies, and either of these options could address the barriers to access virtual care. For that reason, the policy ratings will be used to discuss a prospective timeline for implementation as telemedicine services continue to grow at an exponential rate. At a glance, option 1 appears to be a significant first step in the immediate future (within next 5 years) as a set of standards for telemedicine providers would create immediate consistency in virtual care. Telemedicine standards in British Columbia, derived from Smith & Magnani's (2019) *universal precautions* and NIFTE guidelines, provide a foundation for patient-centred health services that are considerate of all eHealth literacy levels.

Similarly, a lead organization's appointment would complement the option by having clear leadership for British Columbia to push forward initiatives and strategies to

improve virtual care. In the medium to long term (5-10 years), a lead organization could develop standards further and enforce them among telemedicine providers, in similar fashion to Ontario health's current system. Option 2 is the most hands-on approach to deal with telemedicine barriers but poses complex hurdles to organize and would likely be the most costly option. A provincial telemedicine program is likely a long-term goal as standards and leadership are established in the nearer future. A provincial program allows the government to directly impact patient experiences and provides a dependable alternative for virtual health regardless of the economic climate. Option 1 is a straightforward solution for standardizing telemedicine in British Columbia, as the status quo puts the sole responsibility on practising physicians. It would be important to establish standards early in the development of the telemedicine sector before more third-party providers enter the market. Overall, all three options are interconnected and cohesive. All the options are increasingly more effective if each one is implemented, and in isolation would likely not be entirely successful long-term. Eventually, a singular organization that provides telemedicine and sets standards for the sector would be the ideal state of virtual care in British Columbia.

Table 9. Policy Evaluation Summary

Criteria	Option 1: Telemedicine Standards	Option 2: Provincial Telemedicine	Option 3: Lead Organization
Equity (key)	Excellent	Excellent	Satisfactory
Development	Excellent	Excellent	Satisfactory
Cost	Excellent	Poor	Poor
Administrative Complexity	Satisfactory	Poor	Satisfactory
Stakeholder Acceptance	Satisfactory	Satisfactory	Excellent

Chapter 7.

Conclusion

7.1. Future Considerations

Telemedicine's emergence signals rapid changes are coming to healthcare in the near future. The current environment of Canadian virtual care is very different across the country and partially challenges the principles of the Canada Health Act of 1984. The ideas of portability and universality are challenged by the disruptive nature of digital services growing within a brick and mortar health system. British Columbia has deferred telemedicine duties to private third-party providers for most delivery. These services have been vital during the pandemic, but it is unclear how virtual services will evolve post-pandemic. In the present study, eHealth literacy was influential in how patients view telemedicine services even in a younger demographic with high levels of education. While the study did not explore patterns in older adults, the expectation is that eHealth literacy's influence on perspectives of telemedicine is magnified (Kim & Xie, 2017). While further research is ongoing to determine telemedicine's impact on Canadians, examining the status quo demonstrated a lack of consistency in standards within British Columbia. From provider to provider, services varied in triage methods, physician selection, and available languages, all of which may decrease accessibility for vulnerable populations (Smith & Magnani, 2019). The correlation between eHealth literacy and telemedicine perspectives, and the environmental scan demonstrated the need for standardization. The foundational work for standardization was started with the NIFTE guidelines, Digital Health Canada's model for virtual care and most recently Ontario Health's verification program.

The government of British Columbia may not have a better opportunity than now to establish standards for telemedicine companies, especially considering there is no comparable public alternative at the moment. Digital health tools such as telemedicine provide a golden opportunity to rectify some existing issues within Canada's healthcare system, but planning and research are necessary to ensure appropriate implementation. Healthcare 2.0's arrival to British Columbia has been accelerated because of the pandemic, and now is the time for the provincial government to be proactive. Evidence-

informed actions now will guarantee no one is left behind in the emerging digital age of healthcare.

7.2. Limitations

The pandemic was instrumental to the expansion of telemedicine across British Columbia and the rest of Canada but resulted in study limitations. The current increased use of telemedicine may only be temporary while most clinics were not open. More explicit links to telemedicine use and the reason for the visit were likely not captured as virtual care was the sole method of accessing primary care for periods of 2020. Future research may more accurately capture patient behaviours with telemedicine post-pandemic. The use of the eHEALS scale was selected for its adequate measurement of eHealth literacy but was self-reported. Large-scale studies should consider the use of performance-based instruments for more accurate depictions of eHealth literacy scores (Van der Vaart & Drossaert, 2017). The convenience sample led to a concentrated urban population, which was not representative of British Columbia in terms of education and city of residence. Additionally, the small sample size limited the results' generalizability to other populations. However, these results are expected to be magnified in more vulnerable populations according to previous research. As mentioned, the survey results can signal the importance of eHealth literacy for future research to build off. Some survey questions were not fully incorporated in the analysis due to the small sample size. A final consideration is the online nature of survey distribution, which may have excluded populations with decreased access to technology and potentially lower eHealth literacy scores. This decision may have fostered inflated eHealth literacy scores, and future studies should consider other approaches such as in-person surveys of targeted populations.

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Appendix

Survey Questions

This survey is interested in the experiences of young adults in British Columbia.

Are you between the ages of 19 and 34 years old?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If This survey is interested in the experiences of young adults in British Columbia. Are you between... = No

In this survey, the following definition is used for telemedicine:
The provision of medical expertise for the purpose of diagnosis and patient care by means of telecommunications and information technology (i.e. internet, mobile applications) where the patient and provider are separated by distance.

The focus is on video consultations with physicians (general practitioners or specialists) through telemedicine platforms available in B.C. Additionally, for the purposes of this survey, text messaging and/or e-mail with a physician (asynchronous) is not within the scope of this study.

In a typical year (pre-Covid-19), how often would you visit a physician in-person? (numeric format, e.g. 1)

_____

Do you have a family doctor?

- ○ Yes (1)
- ○ No (2)

Are you aware of telemedicine services that are available in British Columbia?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Are you aware of telemedicine services that are available in British Columbia? = Yes

Have you used telemedicine to consult with a physician in the past year?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Have you used telemedicine to consult with a physician in the past year? = Yes

How many times have you used telemedicine in the past year? (numeric format, e.g. 1)

_____

Display This Question:

If Have you used telemedicine to consult with a physician in the past year? = Yes

During my telemedicine visit(s) I consulted with...

my family doctor (1)
a new physician (5)
a previously visited physician (2)

Display This Question:

If Have you used telemedicine to consult with a physician in the past year? = Yes

Was your telemedicine visit primarily concerned with COVID-19?

- ○ Yes (1)
- ○ No (2)

Display This Question:

If Have you used telemedicine to consult with a physician in the past year? = Yes

Have you paid to use telemedicine services in the past year?

- ○ Yes (1)
- ○ No (2)

Which electronic devices do you have reliable access to? (select all that apply)

Desktop/laptop computer (1)

Smart phone (2)
Tablet (3)
None (4)

This section is focused on your perceptions and opinions of telemedicine. Please provide answers on whether you agree or disagree with the following statements:

I believe I could easily communicate with a physician using telemedicine

- Strongly agree (1)
- Agree (2)
- Unsure (3)
- Disagree (4)
- Strongly disagree (5)

I consider telemedicine similar to an in-person visit

- Strongly agree (1)
- Agree (2)
- Unsure (3)
- Disagree (4)
- Strongly disagree (5)

I do/would not need assistance using telemedicine services

- Strongly agree (1)
- Agree (2)
- Unsure (3)
- Disagree (4)

- ○ Strongly disagree (5)

I believe telemedicine can provide consistent/reliable healthcare service

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I would feel comfortable communicating with the physician using telemedicine

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I believe telemedicine provides great access to healthcare services

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I would use telemedicine for future physician visits

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I would use telemedicine for addressing medical conditions such as: (select all that apply)

- Back/Spine pain (1)
- Bone fracture (15)
- Chronic Illnesses (i.e. diabetes) (2)
- Cough (3)
- Covid-19 (4)
- Depression or Anxiety (12)
- Dermatitis (i.e. skin rash, irritation) (5)
- Earache (6)
- Fever (13)
- Headache (7)
- Pharyngitis (sore throat) (10)
- Prescription Drug Renewal (14)
- Urinary Tract Infection (11)

Overall, I believe telemedicine can provide satisfactory healthcare services

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

This section is focused on your familiarity with online health information. Please provide answers based on whether you agree or disagree with the following statements:

I know **what** health resources are available on the internet

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I know **where** to find helpful health resources on the internet

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I know **how** to find helpful health resources on the internet

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I know **how to use** the internet to answer my questions about health

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disgree (4)
- ○ Strongly disagree (5)

I know how to use the **health information** I find on the internet to help me

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I have the skills I need to **evaluate** the health resources I find on the internet

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

I can tell **high quality** health resources from **low quality** health resources on the internet

- ○ Strongly agree (1)

- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly agree (5)

I feel **confident** in using information from the internet to make health decisions

- ○ Strongly agree (1)
- ○ Agree (2)
- ○ Unsure (3)
- ○ Disagree (4)
- ○ Strongly disagree (5)

Demographics

What gender do you identify as?

- ○ Male (1)
- ○ Female (2)
- ○ Gender X (3)
- ○ Prefer not to say (4)

What is your age? (numeric format, e.g. 23)

_____

What Ethnicity do you best identify with?

- ○ Arab (15)
- ○ Black / African (23)
- ○ East Asian (18)
- ○ Indigenous (7)
- ○ Latin / Hispanic (21)
- ○ Multi-ethnic (20)
- ○ South Asian (8)
- ○ Southeast Asian (16)
- ○ White / Caucasian (13)
- ○ Other (12) _____

What city do you live in?

- ○ Abbotsford (1)
- ○ Burnaby (2)
- ○ Chilliwack (3)
- ○ Coquitlam (4)
- ○ Delta (5)
- ○ Hope (6)
- ○ Kamloops (7)

- ○ Kelowna (8)
- ○ Langley (9)
- ○ Mission (10)
- ○ Nanaimo (11)
- ○ New Westminster (12)
- ○ Port Moody (13)
- ○ Richmond (14)
- ○ Surrey (15)
- ○ Vancouver (16)
- ○ Victoria (17)
- ○ Whistler (18)
- ○ White Rock (19)
- ○ Other (20) _____

What is the highest level of education you have completed?

- ○ High school diploma (1)
- ○ College Diploma/Certificate (2)
- ○ Professional Degree/Certificate (5)
- ○ Bachelor's degree (3)

- ○ Master's degree (4)
- ○ Doctorate degree (6)

What is your first language?

- ○ Cantonese (1)
- ○ English (2)
- ○ Farsi (3)
- ○ French (4)
- ○ German (5)
- ○ Japanese (6)
- ○ Korean (7)
- ○ Mandarin (8)
- ○ Punjabi (9)
- ○ Spanish (10)
- ○ Tagalog (11)
- ○ Other (12) _____

Are you currently enrolled in British Columbia's Medical Services Plan (MSP)

- ○ Yes (1)
- ○ No (2)

What is your current employment status?

- ○ Full-time Employment (1)
- ○ Part-time Employment (2)
- ○ Unemployed (3)
- ○ Full-time Student (4)
- ○ Part-Time Student (5)
- ○ Employed Student (full or part time studies and employment) (6)

Display This Question:

If What is your current employment status? = Full-time Student

Or What is your current employment status? = Part-Time Student

Or What is your current employment status? = Employed Student (full or part time studies and employment)

What is your field of study

▼ Agriculture and Environment (1) ... Social Sciences & Humanities (10)

Display This Question:

If What is your current employment status? = Full-time Employment

Or What is your current employment status? = Part-time Employment

Is your field of work health related?

- ○ Yes (1)
- ○ No (2)