Developing Quality Indicators for Home-based Teleconsultation in Secondary Stroke Prevention

by

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Author’s Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contribution

Guangxia Meng (GM) was the sole author of Chapters 1 and 5, with supervision and guidance from Dr. Helen Chen and Dr. Carrie McAiney. These chapters were not written for publication.

This thesis is partially comprised of three manuscripts written for publication. Exceptions to sole authorship are as follows:

Research presented in Chapter 2 was published in BMC Health Service Research in 2022:

Meng G, McAiney C, Perlman CM, McKillop I. Tisseverasinghe T & Chen H. Service process factors affecting patients' and clinicians' experiences on rapid teleconsultation implementation in out-patient neurology services during COVID-19 pandemic: a scoping review. BMC Health Serv Res, 2022, 22(1): 534. https://doi.org/10.1186/s12913-022-07908-4

This scoping review was conducted under the supervision of Drs. Helen Chen (HC) and Carrie McAiney (CM). CM and HC provided guidance in study design. Guangxia Meng (MC) coordinated all aspects of this study. Tisseverasinghe T (TT) assisted in the search strategy and performed literature search, GM performed data extraction, selection, and synthesis. All co-authors engaged in interpreting the findings, and GM drafted the manuscript. CM, HC, Drs. Ian McKillop (IM) and Christopher Perlman (CP) reviewed the manuscript. GM is the first and corresponding author who made significant contributions to the study and the publication.

Research presented in Chapter 3 was published in JMIR Cardio in 2024.

Meng G, McAiney C, McKillop I, Perlman CM, Tsao SF, & Chen H. Factors that Influence Patient Satisfaction with the Service Quality of Home-Based Teleconsultation During the COVID-19 Pandemic: Cross-Sectional Survey Study. JMIR cardio, 2024, 8: e51439. doi:10.2196/51439.

The study was conducted at two Ontario hospitals by GM under the supervision of CM and HC. CM, HC, and GM conceived and designed the study. GM conducted the literature review, obtained ethical approval, acquired data, and designed the survey. Tsao SF(S-FT) and GM performed statistical tests and building models. GM did the data analysis and drafted the manuscript, and S-FT engaged in critiquing the analysis and checking the coding. CM, HC, IM and CP reviewed the manuscript drafts

and provided valuable feedback. GM is the first and corresponding author and made significant contributions to the development and refinement of this manuscript and its intellectual content.

Research presented in chapter 4 was submitted to the American Heart Association Journal Stroke and under review:

Meng G, McAiney C, McKillop I, Tsao SF, & Chen H. "Developing Home-based Teleconsultation Quality Indicators for Quality Improvement in Secondary Stroke Prevention Clinics: A Modified Delphi Study". Submitted to Stoke.

GM, CM, and HC conceived and designed the study. GM oversaw and coordinated all aspects of this study. GM coded the entire data set for phase one and the focus group, with S-FT performing code checking. GM drafted the initial rounds of the surveys, while CM and HC were actively involved in revising them. Survey results were discussed in team meetings with CM, and HC. GM drafted the manuscript, and CM, HC, IM, and S-FT critically reviewed the manuscript. GM is the first author and made significant contribution to the development and refinement of the manuscript and its intellectual content.

Abstract

Introduction

The COVID-19 pandemic disrupted services at Ontario Stroke Prevention Clinics (SPCs), leading to the widespread adoption of home-based teleconsultation practices. However, the service quality and patient satisfaction of these practices were clearly measured. The rapid shift to home-based teleconsultation during the pandemic underscored the urgent need to understand service quality and patient satisfaction, and to develop quality indicators (QIs) for assessing the service quality of home-based teleconsultation in stroke prevention care. This thesis addresses this gap through three comprehensive studies.

Methods

This thesis utilized multiple research methods to understand service quality and patient satisfaction, and to develop teleconsultation-specific quality indicators. Study 1: This scoping review aimed to identify service process factors affecting patients' and clinicians' teleconsultation experiences in out-patient neurology services. The study used thematic analysis, following the methods of Arksey and O'Malley. Study 2: The cross-sectional patient survey aimed to determine the patient-identified factors influencing satisfaction with the service quality of home-based teleconsultation at SPCs. The study recruited patients who had teleconsultations between January and November 2021 in two Ontario SPCs. Data collection was conducted using both web-based and telephone surveys. The study employed binary logistic regression and qualitative content analysis to compare difference between low and high satisfaction groups. Study 3: The modified Delphi study aimed to develop and achieve SPC expert consensus on a set of QIs to measure the quality of home-based teleconsultation in SPCs. We invited Ontario SPC clinicians with teleconsultation experiences to participate in the study. Building on the findings from the first two studies, data synthesis from literature review and focus group discussion, we identified 15 initial quality indicators. These indicators were refined through two survey rounds. Group consensus was established using the Average Percentage of Majority Opinion (APMO) cuff-off rate, resulting in nine indicators achieving consensus. These methods ensured comprehensive analysis and understanding of the context.

Results

Study 1: In the scoping review, nineteen studies published between January 1, 2020, and April 17, 2021, were identified. The most common service process factors affecting the patients' and clinicians' experiences of teleconsultation were technical issues, addressing logistical needs, communication, and ability to perform clinical activities, appropriate triage, and administrative support. Study 2: In the survey study, the web survey had a response rate of 35.9% (104/290) and 44% (24/54) for the telephone survey. Quantitative analysis was based on 110 responses, and qualitative analysis included 97 responses. The mean patient global satisfaction score was 3.9/5. Logistic regression identified that responsiveness (AOR 0.034, 95% CI 0.006-0.188; P<.001) and empathy (AOR 0.116, 95% CI 0.017-0.800; P=.03) were significant factors negatively associated with low satisfaction (scores of 1-3 out of 5). Conversely, having consent provided by a substitute decision-maker was positively associated with low satisfaction (AOR 6.592, 95% CI 1.452-29.927; P=.02). Qualitative analysis revealed that both low and high satisfaction groups cited dissatisfaction with assurance, reliability, and empathy, primarily due to missing clinical activities, inadequate communication, administrative issues, and lack of personal connection. High-satisfaction respondents highlighted positive feedback on these factors and additionally praised clinician competence, appropriate patient selection, and strong communication and empathy skills. Study 3: In the Delphi study, four staff members from three SPCs participated in the focus group. Thirteen staff from 13 SPCs responded to the first survey round, representing 32% (13/41) of Ontario SPCs. The literature review and focus group data synthesis produced 15 quality indicators. After the first round, eight indicators surpassed the APMO threshold, and two new indicators emerged. The second survey round had a response rate of 92% (12/13). One of the two new indicators from the first round surpassed the threshold. In total, nine indicators achieved group consensus. These indicators comprehensively cover all six domains of healthcare quality are (1) the SPC uses a virtual triage algorithm for new referrals; (2) proportion of patients with TIA/stroke were revisited ED or admitted to hospital due to recurrent stroke within 30 and 90 days after using teleconsultation modalities; (3) Patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsultation; (4) proportions of patients who received their preferred model of consultation monthly; (5) collecting patients' perception of therapeutic relationship after teleconsultation; (6) proportions of patients who have been given the choice of teleconsultation monthly; (7) the SPC uses a patient pre-visit checklist for teleconsultation; (8) proportion of patients were unable to receive video consults due to barriers to access or use

technology; (9) Proportion patients were seen within targeted time as per Triage Algorithm for Stroke Prevention Clinic Referrals[2] when using teleconsultation.

Contribution and Impact of Research

The studies in this dissertation have identified service process factors and patient-identified factors that influence home-based teleconsultation experiences. Additionally, a preliminary set of quality indicators, specifically designed to measure the quality of home-based teleconsultation for secondary stroke prevention care, has been developed. The dissertation has successfully met its research objectives and answered the research questions. Moreover, it has significantly contributed to the existing body of knowledge, with the potential to transform current stroke prevention practices and improve the quality of secondary stroke prevention care for all patients.

Acknowledgements

My family, friends, and colleagues have supported me throughout my PhD journey, and I am deeply grateful for their unwavering encouragement.

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Dedication

This thesis is dedicated to my husband, sons, parents, and in-laws. I am forever grateful for your love and support.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

AOR: adjusted odds ratio

COVID-19: Coronavirus disease of 2019;

CSBPR: Canadian Stroke Best Practice Recommendations;

EMR: Electronic medical record.

KHSC: Kingston Health Science center;

MS: Multiple sclerosis;

NMOSD: Neuro-myelitis optica spectrum disorders;

OTN: Ontario's Telemedicine Network;

PD: Parkinson's Disease;

PRISMA: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses;

REDCap: Research Electronic Data Capture

SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2;

SDM: substitute decision maker

SERVQUAL: Service quality model;

SERVPERF: service performance model

SPCs: Stroke Prevention Clinics;

SPPIWG: The Stroke Prevention Provincial Integrated Working Group.

TIA: transient ischemic attack

Chapter 1 Introduction

1.1 Problem Statement

Stroke is the second leading cause of death and disability worldwide, with 90% of strokes linked to ten major modifiable vascular and lifestyle risk factors [1]. As a result, the reduction of exposure to these risk factors is essential for both primary and secondary stroke prevention. Subsequently, the World Stroke Organization has put stroke prevention as the number one key advocacy priority [1].

Pre-COVID teleconsultation in secondary stroke prevention care was limited to small pockets across rural Ontario and one pilot study. In Ontario, there are 11 Regional Stroke Networks with 41 secondary stroke prevention clinics (SPCs) that are integral to publicly funded health systems [2]. These clinics provide in-person rapid assessments, diagnostic tests, treatments, prevention, and education for patients with stroke-like symptoms to reduce the risk of recurrent strokes [3]. Before COVID-19, care in Ontario SPCs was primarily delivered through in-person consultations. Teleconsultations were limited to small pockets across rural and northern Ontario, where they supported community-based stroke rehabilitation or secondary prevention services for patients visiting local satellite clinics with help from allied healthcare professionals [4]. The only home-based teleconsultation in Ontario SPC was a pilot study conducted at a regional stroke centre for southeastern Ontario, offering follow-up home-based video visits in their SPC from August 2018 to September 2019 [5]. However, the COVID-19 pandemic served as a catalyst for the widespread adoption of home-based teleconsultation for out-patient services throughout the province.

Home-based teleconsultation in secondary stroke prevention care emerged during the COVID-19 pandemic and has remained a common practice in some clinics post-pandemic. Defined as synchronous telephone or video consultations between healthcare providers and patients at home, this approach supports secondary prevention assessment, management, and ongoing follow-up for individuals who have experienced a stroke or transient ischemic attack [6,7]. The COVID-19 pandemic accelerated the adoption of home-based teleconsultation in secondary prevention care with 97% of Ontario SPCs surveyed incorporating some degree of home-based teleconsultation in 2020-2021[8]. Some SPCs in district stroke centers or non-stroke centers have continued to use home-based teleconsultation as part of their routine practice post-pandemic.

Despite the widespread adoption of home-based teleconsultation, there has been no scientific evaluation of the efficacy of this type of service model for secondary stroke prevention care;

therefore, we do not know the quality of such service. Assessing stroke patients via home-based teleconsultation poses challenges for clinicians, particularly; stroke patients have unique characteristics that often differ from other patients. These patient demographic factors and disease profiles can significantly affect the quality of technology-based remote medical services. First, stroke patients are often older, as eighty percent of all strokes happen to people over age sixty [9]. Second, they have multiple comorbidities with an average of five chronic diseases [9]. According to the unweighted data from the Canadian Longitudinal Study on Aging in the COVID-19 study, the elderly individuals showed lower telehealth service utilization [10]. A literature-based framework identified four key barriers to the usability of mHealth in the geriatric population: cognition, motivation, physical ability, and perception [11]. These factors enable further evaluation of teleconsultation utilization and service quality in older adults. Teleconsultation may add complexity to evaluating stroke care quality [12]. Ongoing monitoring of quality becomes increasingly important, given the relatively limited experience with teleconsultation in stroke prevention care in this context [12].

To assess the service quality of teleconsultation for secondary stroke prevention, we need rigorous quality indicators. There are quality indicators developed for secondary stroke prevention in Canada nationally and provincially, but none specifically address home-based teleconsultation. Nationally, the Canadian Stroke Best Practice Recommendation (CSBPR) has updated key quality indicators of stroke care in 2021 [13]. This document was developed with 60 QIs through a rigorous Delphi process [13]. However, most key quality indicators are developed for inpatient settings [13] and cannot be applied in a teleconsultation model because of different patient acuity, settings and health resources. Of the 60 QI, only seven QIs for secondary stroke prevention can be used during a teleconsultation but none have been specifically designed for teleconsultation and their efficacy in this scenario is unknown. In 2018, Ontario updated its provincial stroke prevention quality indicators by consulting the 2017 quality indicators from the CSBPR. The Stroke Prevention Provincial Integrated Working Group (SPPIWG) developed 45 quality indicators, but only one QI related to access to clinical-based telemedicine [14]. There were no standardized QIs specifically designed for home-based teleconsultation in stroke prevention care to measure the service quality. With the implementation of home-based teleconsultation for complex older patients in the post-pandemic area, and the absence of standardized QIs for such service, there is an urgent need to assess the patient satisfaction and service quality of home-based teleconsultation and develop appropriate QIs for this specific type of care.

To understand the service quality of home-based teleconsultation in secondary stroke prevention care, we need to address two critical gaps in this care model. First, research into service quality factors and patient satisfaction with home-based teleconsultation in secondary stroke prevention is necessary. Second, developing quality indicators for home-based teleconsultation will facilitate evidence-based decision-making. By addressing these gaps, we can ensure the right care is provided in the right setting at the right time with the right model, which is essential for effective healthcare delivery [15]. Furthermore, this will drive the transformation of secondary stroke prevention care into the digital era.

1.2 Research Aims and Objectives

The overarching goal of this dissertation is to improve the service quality of home-based teleconsultation for secondary stroke prevention care. To achieve this, the dissertation addresses three specific aims, each with associated research questions and methodology.

Aim 1: To identify service process factors affecting patients and clinicians' teleconsultation experiences in out-patient neurology services (study 1, chapter 2)

Research questions: "What service process factors of teleconsultation are perceived to have the most impact on patients' and clinicians' teleconsultation experiences in outpatient neurology clinics following the rapid shift to teleconsultation during the early stages of COVID-19 outbreak?"

Methodology: To achieve this aim, the scoping review was structured using the Arksey and O'Malley framework. The reporting of the study was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for scoping reviews. The Service Quality Model (SERVQUAL) was applied to conduct a deductive thematic analysis, identifying, analyzing, and reporting the patterns (themes) of key service process factors affecting patients' and clinicians' teleconsultation experiences..

Aim 2: To determine the patient–identified factors that influence patient satisfaction with the service quality of home-based teleconsultation at SPCs (study 2, chapter 3)

Research question: "What are the patient-identified factors influencing patients' satisfaction with service quality in stroke prevention clinics' home-based teleconsultation service?"

Methodology: To achieve this aim, we conducted a cross-sectional survey of patients who received telephone or video consultations at two Ontario SPCs in 2021. We applied the Service Performance Model (SERVPERF) to develop the patient questionnaire with open-ended questions.

Aim 3: To develop and seek SPC expert consensus on a set of indicators to measure the quality of home-based teleconsultation in SPCs (Study 3, chapter 4)

Research question: "What are the quality indicators for home-based teleconsultation in Ontario stroke prevention clinics?"

Methodology: To achieve this aim, the study applied a three-phased modified Delphi method to identify potential QIs for home-based teleconsultation for SPCs. The six domains of Health care quality framework were utilized for data analysis. In phase one, a literature review informed the development of the focus group discussion guide. In phase two, SPC clinicians were invited to participate in the focus group to verify and identify quality considerations and QIs. Phase three consisted of two survey rounds to achieve group consensus on the initial list of Qis.

1.3 Dissertation Structure

The chapters of this dissertation are structured and styled according to the guidelines of Graduate Studies and Postdoctoral Affairs at the University of Waterloo. The first chapter provides foundational information, including the introduction of the problem statement, aims and objectives, a review of the theoretical foundation, and a description of the methodology and research roadmap. Following this are three manuscripts: Chapters 2 and 3 have been published, and Chapter 4 is currently under peer review. Chapter 2 presents the scoping review of service process factors affecting patients' and clinicians' experiences with rapid teleconsultation implementation in outpatient neurology services during the COVID-19 pandemic, published in BMC Health Services Research. Chapter 3 is a manuscript identifying factors influencing patient satisfaction with the service quality of home-based teleconsultation in Ontario Stroke Prevention Clinics during COVID-19, published in JMIR Cardio. Chapter 4 is a manuscript on developing quality indicators for home-based teleconsultation to improve service quality in secondary stroke prevention clinics, submitted to the Journal of Stroke by the American Heart Association. Chapter 5 offers recommendations for improving service quality in home-based teleconsultation, discussing implications for practice, research, and health policy. This chapter also includes the conclusion and suggestions for further research.

1.4 Methodology Consideration

The dissertation employs multiple methods to address real-world problems, utilizing diverse research approaches to comprehensively understand the study phenomenon [16]. Using multiple methods in the thesis stems from the need to explore different aspects of service quality and patient satisfaction across the three studies, while keeping the methodologies distinct for each phase of research. Study 1 (Scoping Review) aimed to identify key service process factors affecting teleconsultation experiences from both patient and clinician perspectives. The scoping review, following the Arksey and O'Malley framework, was appropriate because it allowed for a broad exploration of existing literature on teleconsultation and synthesized diverse findings. Study 2 (Patient Satisfaction Survey) focused on determining patient-identified factors influencing satisfaction with teleconsultation services. A cross-sectional survey using the SERVPERF model was chosen to assess patient satisfaction and provide concrete data on the performance of teleconsultation services. Study 3 (Quality Indicator Development) aimed to develop quality indicators for teleconsultation in secondary stroke prevention clinics. The modified Delphi method was ideal for gathering expert consensus and refining these indicators through structured rounds of feedback from clinicians. By using multiple methods, each study can rigorously address its specific research questions using the most appropriate tools, without blending methodologies unnecessarily. The decision to use multiple methods in my thesis is justified by the need to rigorously and appropriately address different research aims across the three studies. This approach maintains clarity and methodological integrity while allowing each study to contribute uniquely to the overarching goal of improving service quality in home-based teleconsultation for secondary stroke prevention.

We applied two levels of service quality frameworks to understand the essence of service quality in this dissertation. At the system level, we used six domains of the healthcare quality framework to identify the quality considerations for developing the quality indicators. At the individual level, we employed the Service Quality Model (SERVQUAL) and its derivative Service Performance Model (SERVPERF) to capture the perspective of patients and clinicians. Table 1-1 displays different frameworks/models used in different studies of this dissertation.

Table 1-1. Service quality framework/models used in the dissertation

Name	Application	Dimensions	Used in the studies
SERVQUA[1] Developed by Parasuraman, Zeithaml, and Berry in the late 1980s [17].	Measures service quality based on the gap between customer expectation and perceptions of the actual service received. Diagnose service quality gaps and areas for improvement.	Tangibles Reliability Responsiveness Assurance Empathy	Study 1
SERVPERF[2] Developed by Cronin and Taylor in the early 1990s Derivative SERVPERF [18]	Focuses solely on the performance aspect of service quality, arguing that perceptions of performance alone can accurately measure service quality	Tangibles Reliability Responsiveness Assurance Empathy	Study 2
Six domains of healthcare quality[3] Developed by the Institute of Medicine (IOM), and provide a comprehensive framework to evaluate healthcare quality [19]	Apply broadly across healthcare settings to ensure comprehensive quality care. Guide policy-making, healthcare delivery, and quality improvement initiatives.	Safe Effective Efficient Patient-centred Equity Timely	Study 3

[1] Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing, 64(1), 12-40. [17]

[2] Cronin, J. J., & Taylor, S. A. (1992). "Measuring service quality: A reexamination and extension." Journal of Marketing, 56(3), 55-68. [18]

[3]Agency for Healthcare Research and Quality (AHRQ): Six Domains of Healthcare Quality [19]

In Studies 1 and 2, SERVQUAL and SERVPERF were used as the primary models to assess service quality and patient satisfaction in home-based teleconsultation for secondary stroke

prevention. These models were chosen because they provide a structured and validated approach to evaluating service quality from the perspective of both patients and clinicians. SERVQUAL and SERVPERF assess five core dimensions of service quality: tangibles, reliability, responsiveness, assurance, and empathy [17,18]. These dimensions are particularly relevant for teleconsultation, where both the technological and interpersonal aspects of service delivery are critical. The models allow for a broad evaluation of how well services meet both technical and personal needs, which is essential when assessing new healthcare modalities like teleconsultation. Next, The SERVQUAL and SERVPERF frameworks are designed to measure service quality from the customer's perspective, making them ideal for understanding the experiences of both patients and clinicians during teleconsultation [17,18]. In Study 1, these models were used to explore how process factors like communication, triage, and administrative issues impacted patients' and clinicians' satisfaction with teleconsultation during the COVID-19 pandemic. Study 2 extended this framework to directly assess patient satisfaction, as patient perceptions of service quality are key indicators of the overall success of teleconsultation services. In addition, in Study 2, the SERVPERF model was used to focus specifically on actual service performance rather than the gap between expectations and perceptions, making it a direct measurement of patient satisfaction [18]. This model is more efficient in assessing how well the home-based teleconsultation service is performing according to patients, which was important in the cross-sectional survey used in Study 2 to evaluate patient satisfaction with home-based teleconsultation services during the pandemic.

The six domains of healthcare quality—safe, effective, efficient, patient-centered, equitable, and timely—were used as the foundation for developing quality indicators for home-based teleconsultation in secondary stroke prevention This framework, widely accepted for healthcare evaluation, offers several advantages [19]. The six domains ensure that all aspects of care delivery are assessed. This framework goes beyond the SERVQUAL and SERVPERF model used in previous studies, which primarily focused on service process factors like responsiveness, empathy, and reliability. The six domains cover broader healthcare principles, such as safety (avoiding harm), effectiveness (scientific knowledge), and equity (consistent care regardless of personal characteristics), ensuring a more thorough assessment of teleconsultation quality [19]. One of the key domains is patient-centered care, which overlaps with the empathy and responsiveness aspects in SERVQUAL and SERVPERF. However, it broadens the focus to explicitly prioritize individual patient needs and values, and preferences in clinical decision-making, thus enriching the service

quality model by embedding patient perspectives into each domain. The framework also incorporates the domain of efficiency—focusing on reducing waste—and timeliness, addressing delays in care [19]. These are vital for teleconsultation, where technical delays or inefficiencies in the workflow can significantly impact the patient's experiences. This domain directly ties back to the clinical activities, administrative support and triage concerns raised in the scoping review and patient satisfaction studies, further emphasizing on the importance of measuring clinical outcomes alongside service delivery. These domains expand on the scope of SERVQUAL and SERVPERF, which primarily focuses on service delivery and customer satisfaction.

Below is a summary of the roadmap for each section of the dissertation (Figure 1-1).

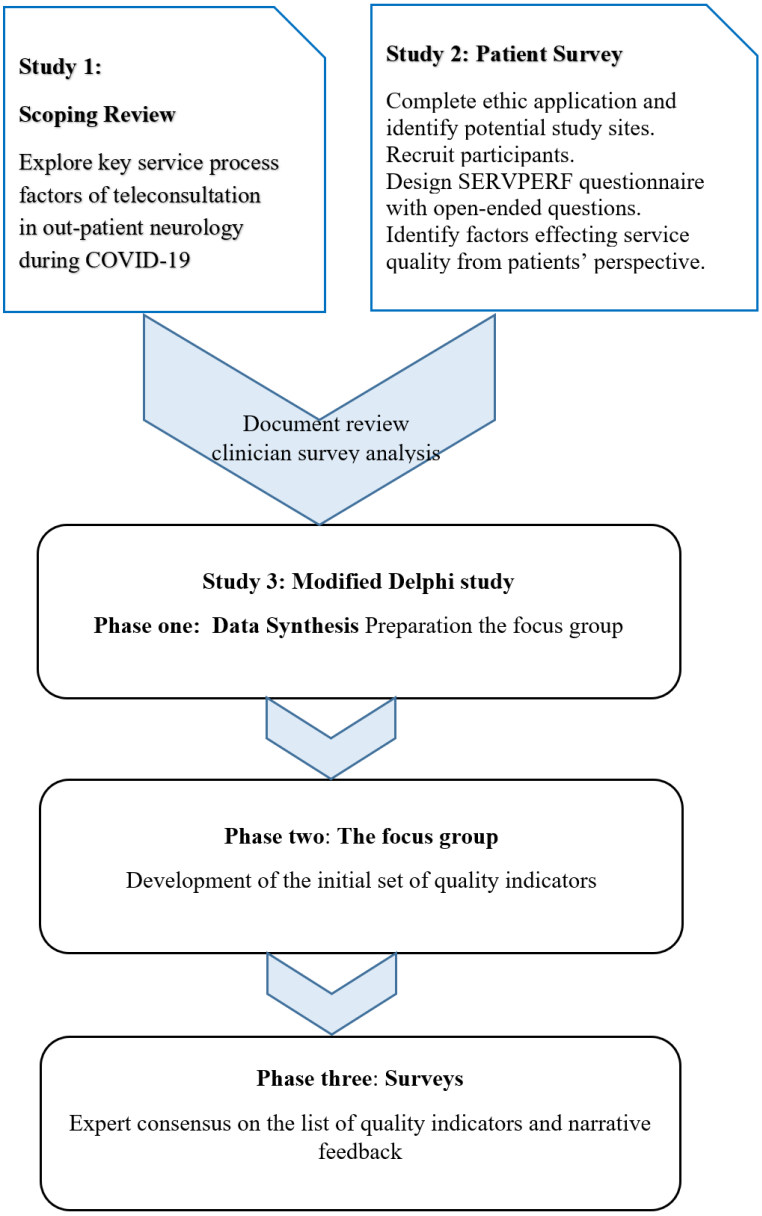

Figure 1-1: The research road map

Chapter 2 Service Process Factors Affecting Patients' and Clinicians' Experience on Rapid Teleconsultation Implementation in Out-patient neurology Services during COVID-19 Pandemic: a Scoping Review

Status: Published

Citation: Meng G, McAiney C, Perlman C M, et al. Service process factors affecting patients' and clinicians' experiences on rapid teleconsultation implementation in out-patient neurology services during COVID-19 pandemic: a scoping review. BMC Health Services Research, 2022, 22(1): 534.

In Chapter 1, we introduced the evolving landscape of home-based teleconsultation in secondary stroke prevention care and outlined the significant transformations within ambulatory care, particularly the rapid adoption of teleconsultation services in response to the COVID-19 pandemic. This shift introduced new challenges and opportunities for improving care delivery, particularly in the outpatient setting. It remains unclear how this change has impacted patients' and clinicians' perceptions of service quality. We emphasized the need to evaluate both patient and clinician experiences to ensure that teleconsultation continues to meet the high standards of service quality traditionally offered in-person. These considerations form the foundation of the research journey we are undertaking in this thesis.

Building upon these initial insights, we now turn our attention to a comprehensive scoping review designed to explore the key service process factors that impact teleconsultation in outpatient neurology services. Conducting this scoping review is essential for identifying existing gaps in the literature and understanding the broader context of home-based teleconsultation's impact on service quality. Specifically, the review will help illuminate areas where home-based teleconsultation processes, such as triage and administrative pathways, could be standardized to improve service quality.

This chapter will focus on synthesizing the findings from the scoping review, providing a detailed analysis of the factors that shape patient and clinician experiences in teleconsultation. These findings will serve as a critical stepping stone for the subsequent chapters, where we will delve deeper into

patient satisfaction and service quality in teleconsultation, especially in the context of stroke prevention. This scoping review examined 19 peer-reviewed studies to identify process factors influencing patients' and clinicians' experiences of outpatient teleconsultation services during COVID-19. Key findings from this review are essential for understanding how teleconsultation can be optimized for secondary stroke prevention clinics. This chapter begins with the study's abstract, followed by the full-text manuscript.

2.1 Abstract

Background: The adoption of teleconsultation for outpatient neurology services was limited until the onset of the COVID-19 pandemic which forced many outpatient neurology services to rapidly switch to virtual models. However, it remains unclear how this change has impacted patients' and clinicians' perceptions of service quality. The purpose of this scoping review is to identify process factors that influence patients' and clinicians' experiences of outpatient teleconsultation services during COVID-19.

Methods: Arksey and O'Malley scoping review framework was used to search PubMed, Scopus, CINAHL, and PsycInfo for original peer-reviewed research studies that examined the experiences of synchronous teleconsultation between a clinician and patient in a home-setting since the World Health Organization announced the COVID-19 global pandemic. The service quality model SERVQUAL was used to conduct a deductive thematic analysis to identify the key factors that impacted the patients' and clinicians' perception of teleconsultation services.

Results: A total of nineteen studies published between January 1, 2020, and April 17, 2021, were identified. The most common service process factors affecting the patients' and clinicians' experiences of teleconsultation were technical issues, addressing logistical needs, communication, ability to perform clinical activities, appropriate triage, and administrative support.

Conclusions: Our findings identified six key service process factors affecting the patients' and clinicians' teleconsultation experiences in outpatient neurology services. The need for improvement of triage process and standardizing administrative virtual care pathway are identified as important steps to improve patients and clinicians' teleconsultation experiences compared to pre-COVID era. More research is needed to assess outpatient neurology teleconsultation service quality from patients' and clinicians' perspectives.

2.2 Background

With approximately 3.6 million Canadians currently suffering from neurological conditions access to neurology-specific care has become an urgent need within the healthcare system [1]. Currently, the use of telemedicine in neurology is still in its infancy [2]. Before COVID-19, the most notable application of teleconsultation in neurology was telestroke, which provides acute stroke management care in underserved communities [3, 4]. However, the utilization of teleconsultation in other areas of neurology is not as clear [5]. Research in synchronous telemedicine for outpatient services is imitated to studies mainly in solving access issues, follow-up patients or patients with a confirmed diagnosis, or in a satellite clinic setting [6–11]. A Canadian pilot project initiated by Kingston Health Science Center (KHSC) stroke prevention clinic in August 2018 evaluated teleconsultation with stroke patients in a home setting. However, the virtual visits were exclusively for follow-up clinical activities such as reviewing investigations, symptoms management, and medication titrations [1]. Additionally, two separate clinical trials were published much earlier, examining the safety and feasibility of teleconsultation in new but non-urgent neurological patients [12,13]. However, in both studies, the patients were consulted from a satellite clinic with a healthcare professional as the telepresenter to facilitate examination and demonstrate findings [12,13]. The significant barriers to a large-scale adaptation of teleconsultation in outpatient neurology might be due to a lack of evidence for its efficacy and understanding of the proper place of teleconsultation in traditional practice [2]. Tere is no publication on teleconsultation regarding new patient referrals from a home setting prior to the COVID outbreak.

Traditional face-to-face consultation is a cornerstone of neurology practice. Tus, in-person visits during the COVID-19 pandemic have been deemed both unwise and unsafe [14]. The rapid altered outpatient delivery included deferred elective visits, modified face-to-face consultations, and increased use of teleconsultation since the COVID-19 pandemic [15]. For example, the outpatient neurology consultations for multiple sclerosis (MS) and neuromyelitis optica spectrum disorders (NMOSD) decreased by approximately 50% during COVID-19 in Argentina, Chile, Colombia, and Brazil [16]. The COVID-19 pandemic has catalyzed telemedicine in outpatient neurology specialties, as evidenced by how quickly many neurology clinics implemented some forms of teleconsultation [17]. For instance, since the onset of the pandemic, only 8% of Norway's hospital based neurologists maintained regular in-person visits in their outpatient clinics, while 87% of their colleagues shifted to telemedicine [18]. Similarly, an outpatient neurology clinic in a large academic medical center in the

United States converted more than 90% of its in-person visits to telemedicine since the start of the COVID-19 outbreak [19]. A global survey involving 40 countries on telemedicine utilization for movement disorders between March and April 2020 indicated a global increase in telemedicine usage among all surveyed countries, even those with little or no prior use [20]. For instance, only 19.4% of neurologists in Latin American countries had experience using telemedicine before COVID-19, whereas, between March and July 2020, 79.8% were using this technology [16].

The rapid expansion of teleconsultation in outpatient neurology services during the COVID-19 pandemic occurred within a few weeks or even days, and has since permeated into various sub-specialties in neurology, offering patients access to care virtually from their homes, or from anywhere with an internet connection using their mobile devices. The rapid expansion of teleconsultation in outpatient neurology care occurring without clear scientific evidence to guide this change could result in diminished service quality. Healthcare service quality is complex due to its intangible, heterogeneous, and subjective characteristics in some aspects [21]. With the current shift towards "person-centeredness" healthcare, this review will identify the service quality process factors from clinicians' and patients' experiences [22]. By focusing on clinicians' and patients' experiences in teleconsultation, we align with the quadruple aim framework, which specifies the following four principles: enhancing patient experiences, improving population health, reducing cost, and improving the work-life of health care providers [23]. Our review focuses on assessing the teleconsultation's service process factors that affect clinicians' and patients' experiences during the rapid change of service delivery model in outpatient neurology during COVID-19. Process factors in service quality are all the acts of caregiving, such as diagnosis, treatment, and patient interactions [24], which are also relevant factors in assessing teleconsultation services. The most widely used process-orientated approach is the service quality (SERVQUAL) model [25]. The SERVQUAL model includes five dimensions: tangibles (the appearance of physical facilities, equipment, and personnel), reliability (the ability to perform the promised service dependably and accurately), responsiveness (the willingness to help customers and provide prompt service), assurance (the knowledge and courtesy of employees and their ability to inspire trust and confidence), and empathy (the provision of individual care and attention to customers) [26,27]. There are altogether 22 service attributes listed within the five service dimensions in the SERVQUAL model, which can be adapted to fit the characteristics of a particular service [28]. An additional table shows this in more detail (see Additional file 1). We consider attributes as the process factors in our review. There are many instances of varying uses of

the SERVQUAL model to assess service quality in telemedicine. For example, the SERVQUAL questionnaire was used to assess the service quality of a telehealth program in a hospital setting [29]. The theory-driven analysis allows the researcher to identify the service process factors, reveal existing predispositions about study results, and assist in data coding and interpretation [30].

Despite the rapidly accumulating experience with the high volume of teleconsultation adoption in outpatient neurology services during the COVID-19 pandemic, currently, there has not been any scoping review conducted to examine the existing evidence about service process factors from patients and clinicians experiences to our knowledge. Tus, the purpose of this scoping review is to examine existing literature on patients' and clinicians' experiences in outpatient neurology teleconsultation during the COVID-19 pandemic to identify key service process factors that impact their experiences. With the ongoing impact of the pandemic, identification of the key service process factors is the first step in gathering new evidence and acquiring new knowledge in service quality during the rapid expansion of teleconsultation, especially since teleconsultation is likely to evolve into common practice in outpatient neurology. In this review, teleconsultation is defined as synchronous consultation between a physician or advanced practice provider and a patient at the patient's home to provide diagnostic or therapeutic advice through telephone or video conference [31]. Tis scoping review addresses the research question: "what service process factors of teleconsultation are perceived to have the most impact on patients' and clinicians' teleconsultation experiences in outpatient neurology clinics following the rapid shift to teleconsultation during the early stages of COVID-19 outbreak?"

2.3 Methods

The scoping review framework by Arksey & O'Malley served as the framework to structure this review [32]. We applied the five-stage analytic method, which is: (1) identifying the research question, (2) identifying relevant studies, (3) selecting relevant studies, (4) charting the data, and lastly, and (5) collecting, summarizing, and reporting the results [32]. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews guided the reporting of this study [33]. An additional PRISMA checklist shows this in more detail (see Appendix A Additional file 1).

2.3.1 Search Strategy (Identifying Relevant Studies)

The search strategy for this study was developed by both GM and TT (a research librarian). The search statement comprised both indexed and free-text terms to capture the three main concepts: (1) Virtual consultation, (2) Neurological services, and (3) Service quality assessment. Each of these concepts was captured using the appropriate subject headings (i.e., MeSH and Emtree) along with corresponding natural language keywords that were modified with truncation and phrase search techniques. The final literature search was conducted on April 17, 2021, in four major health sciences databases, including the Cumulative Index to Nursing and Allied Health Literature (CINAHL), APA PsycINFO, PubMed and Scopus.

Since each database has distinctive search functionality and parameters, individually tailored search statements were developed with appropriate search filters. Final search statements were devised through an interactive process to ensure that relevant articles were included while irrelevant ones were excluded. For instance, the initial search contained a large set of articles on "rehabilitation" in neurological services, which is out of scope for this study. As this skewed the search precision, the search statement was revised to exclude this concept. The search was further limited to the English language, peer-reviewed studies that were published from January 2020 to April 2021. The date specification narrowed the search results to articles published since the onset of the COVID-19 pandemic. Final search statements, along with a list of search results, were downloaded from each database for the title and abstract screening.

Some examples of keywords and indexed terms used for this literature search include: (1) virtual consultation: telemedicine, e-consult, remote consultation, videoconferencing; (2) neurological Services: stroke, neurology, neurosurgical procedures, neurologic examination, neurologists; and (3) service quality assessment: quality assessment, patient satisfaction, quality of health care, and surveys and questionnaires. A detailed major search terms and search strategy, shows this in more detail (see Appendix A additional file 2).

2.3.2 Study Selection

The inclusion criteria specified that studies must: (1) be undertaken during the COVID-19 outbreak with a focus on a response to service change due to the pandemic; (2) report on virtual synchronous neurology consultations between a physician or an advanced practice provider and a patient over the age of 18 from a home setting; (3) report on patient and/or physicians'/advanced practice providers'

experience of teleconsultation; and (4) be qualitative, quantitative, or mixed-method peer-reviewed original research. Studies were excluded if the results did not apply to the adult population or the results were not reported (email, APP, text message, or messaging via web-portal) telemedicine.

After the title-abstract screening for relevancy by one reviewer (GM), the second reviewer (TT) randomly reviewed 8% of the title-abstract articles. A google document was created during the screening process. The results were compared, and discrepancies were resolved by making an inclusion or exclusion decision through team discussion. GM and TT reviewed the full-text against inclusion and exclusion criteria. The articles that were chosen for full-text screening were shared with the research team. The level of agreement among the two reviewers was high (98%). The detailed steps of the systematic literature search can be found in the flow chart (Fig. 2-1). A total of 1141 articles were screened for eligibility. Forty-eight were included for the full-text examination, of which 29 were excluded as they did not meet the eligibility criteria. As a result, 19 articles qualified for this scoping review.

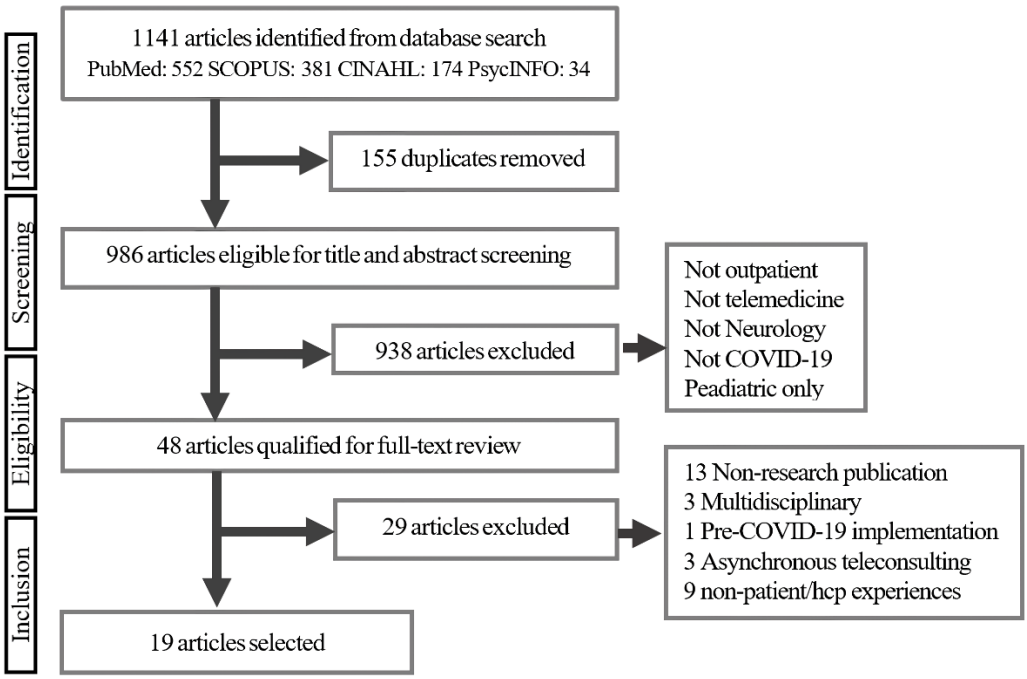

Figure 2-1 Scoping review flow diagram of article selection process

2.3.3 Charting the Data

Thematic analysis was used in this scoping review to identify, analyze, and report patterns (themes) within the data. Braun and Clarke have outlined six steps in undertaking a thematic analysis [34]. A deductive thematic analysis of the results section of selected articles was used to identify service dimensions and their respective service process factors which have the most impact on patients' and/or clinicians' teleconsultation service experiences.

2.3.4 Codebook Development

The initial codebook was developed by referencing the telehealth service SERVQUAL questionnaire [29]. An additional table shows this in more detail (see Appendix A additional file 3). Some codes were added to reflect the teleconsultation characteristic (e.g., comfort level using technology, human touch), while other codes were combined to avoid redundancy (e.g., voice and image quality were categorized under technological issues). Additional codes (e.g., triage, clinical activities) were identified inductively and added to the codebook during the coding process. There were 21 parent codes for clinicians and 18 for patients in the codebook (see Appendix A additional file 4). The codebook modifications were discussed in the biweekly team meetings during the coding process.

2.3.5 Collecting, Summarizing and Reporting the Results

We followed Ose's nine steps to organize all extracted data using Microsoft Excel and Word [35]. For deductive thematic analysis, the results sections of the chosen studies were entered into Microsoft Excel. The paragraphs were broken into sentences, with each sentence representing one code. All relevant data were coded inclusively. The child codes and the quoted texts/sentences were sorted under each parent code in Excel [35]. GM coded the entire dataset. TT independently coded five articles that had 129 codes. The results were compared and reached an initial 83.6% agreement. The discrepancies were discussed, and conflicts were resolved through discussion. Definitions of codes were further clarified where needed.

The frequency of occurrence of each key service process factor was calculated by tallying the total occurrence of each code to identify dimensions and attributes that were most prevalent in the selected studies. Identifying the most frequently mentioned service process factors helped us establish the key determinants or gaps in service quality. We sorted the quotes into sub-themes under each key process factor. We grouped all identified process factors and their themes from both patients' and clinicians'

experiences. All data generated or analysed during this study are included in this published article (Appendix A additional file 4).

2.4 Results

A summary of characteristics from the 19 studies is listed in Table 2-1. The selected publication for this review comprised 13 quantitative cross-sectional survey studies, three cohort studies, two mixed-methods studies, and one qualitative thematic analysis. Study settings included seven general neurology clinics, five epilepsy clinics, two neurosurgery clinics, and five other settings, such as movement disorder, MS or NMOSD, Alzheimer's, or neurology spine specialties. The majority of studies were primarily conducted in developed countries including the United States (n=8), Germany (n=2), Spain (n =2), United Kingdom (n=1), Ireland (n=1), Norway (n=1), France (n=1), and Italy (n=1). In addition, there were two international survey studies. Single academic institutional authorship was most prevalent (13/19). With regards to the population studied, seven of the articles focused on the clinicians' perspective, five on the patients' perspective, and another seven that included both patients' and clinicians' perspectives. The participants' age varied with each study. Nine studies reported the patients' mean age ranged from 37 to 73.5 years; three reported patients' mean age above 55 years, only two studies indicated the mean age of clinicians at 41.23 and 42.1. Seventeen studies were carried out from March 17 to July 2020 in the early phase of the COVID-19 global pandemic. Two studies did not specify the study time frame but indicated they were conducted during the COVID-19 pandemic. Regarding the mode of teleconsultation, 12 of the studies looked at both video and telephone, while 4 were telephone only and 3 were video only.

Table 2-1 Descriptive characteristics of the studies (N=19)

#	Authors	Location	Methods	Sample size	Clinician	PT[1]	Mode	Age in years	Setting	Study period
1	Alonso et al. (2021)	South American (4 out of 14 countries)	Cross-sectional study	N=129	Neurologists		Telemedicine with video of 52.3%	mean 41.23	South American MS and NMOSD experts in an outpatient setting	July 3 to 10, 2020
2	Arighi et al. (2021)	Italy	Prospective cohort study	N=108		PT	Video or telephone	mean 73.5	The Alzheimer clinic of a tertiary care academic center	Mid-April to the end of July 2020
3	Casares et al. (2020)	USA	Cross-sectional study	N (PT) =35 N(C)=5	Physicians	PT	Telephone (12 %) Video (88%)	PT mean 37	Epileptic clinic in a tertiary academic center	COVID pandemic
4	Chesnel et al. (2021)	France	Cross-sectional study	N(PT)=358	Physician	PT	telephone	PT Mean 55.4	A tertiary hospital neuro-urology clinic	March 16 to June 1, 2020
5	Conde-Blanco et al. (2020)	Spain	Cross-sectional study	N=66	Neurologists		Telephone 88%, video 4.5%	35-45 (39.4%) 45-55 (31.8%) >55 (21.2%)	Spain neurologists in epilepsy clinics	April 14 to May 11, 2020
6	Courtney et al. (2021)	UK	Thematic analysis	N=22	Neurologists and GP with a specialist interest		Telephone or video	20-29 (1/22) 30-39 (6/22) 40-49 (6/22) 50-59 (6/22) 60-69 (3/22)	A tertiary hospital general neurological clinics	June to July 2020

7	Esper et al. (2021)	USA	Retrospective case-control	N(PT)=686	Clinicians	PT	Video 79.6% Telephone 18.4%	PT mean 64.9	A tertiary academic Movement disorder clinic	March 23 to April 28, 2020
8	Fonseca et al. 2020	Spain	Cross-sectional study	N=225		PT	telephone	Mean 48.2	A tertiary hospital epilepsy clinic.	March 16 to April 17, 2020
9	Harper et al. (2021)	USA	Cross-sectional study	N(PT)=1558	Clinicians	PT	video	NA	Tertiary academic neurology Ambulatory Clinics	March 18 to May 8, 2020
10	Kristoffersen et al. (2021)	Norway	Cross-sectional study	N=135	Neurologists		More telephone than video	Mean 42.1	Neurologists in Norway hospital-based outpatient clinics	April 2020
11	Kummer et al. (2021)	USA	Mixed methods	N(PT)=204 N(C)=117	Clinicians	PT	video	PT mean 48.8	Tertiary academic Outpatient neurology clinic	April 13 to May 15, 2020.
12	Lovecchio et al. (2021)	International	Cross-sectional study	N=485	Spine surgeons		Telephone 34.6% Video 57.5%	35-44 (68.7%) 45-54 (33.0%)	Members of AO Spine International	May 15 to 31, 20230
13	McKenna et al. (2020)	Ireland	Cross-sectional study	N=194		PT	Telephone	Mean 47.8	Tertiary hospital General neurology clinics	March 23 to May 25, 2020
14	Mohanty et al. (2020)	USA	Cross-sectional study	N(PT)=79 N (C)=40	Neurosurgeons	PT	Video or telephone	NA	Tertiary academic center outpatient neurosurgery clinics	March 1 to July 2, 2021

[15]	Ryu et al. (2021)	USA	Cross-sectional study	N=14	Neurosurgeons and APPs[3]		Teleconference/ video	NA	Tertiary academic center neurosurgery department	During COVID-19
[16]	Saliba-Gustafsson et al. (2020)	USA	Mixed methods	N=66	Physicians and APPs		Video visit	NA	Tertiary academic medical center's ambulatory neurology clinics	March 22 to May 16, 2020
[17]	Smith et al. (2021)	USA	Cross-sectional study	N=367		PT	Telemedicine Appointment[2]	Non-migraine median age 60 Migraine median age 45	Tertiary Neuroscience outpatient neuro clinics	April 22 to May 18, 2020
[18]	von Wrede et al. (2020)	Germany	Cross-sectional study	N=239		PT	Telephone (79%) Video (21%)	Mean 41.5	Tertiary Epilepsy center outpatient clinic	March 23 to May 8, 2020
[19]	Willems et al. (2020)	Germany	Prospective cohort study	N=272	Physicians	PT	Telephone	PT mean 38.7	Tertiary Epilepsy center outpatient clinics	March 17 to May 29, 2020

[1] PT: patients
[2] The study did not specify the method of telemedicine appointment
[3]APPS: advanced practice provider

Most clinicians and patients reported positive experiences in teleconsultation, the definition of satisfaction varied among studies. Between the two populations studied, clinicians had more codes (n =300) than patients (n =101), which is attributed to the fact that there were more qualitative studies examining clinicians' experiences than of patients. For instance, three (one qualitative and two mixed methods) studies qualitatively examined clinicians' experiences instead of just one mixed-method study on patients' experiences. Based on the deductive thematic analysis of the selected studies, we identified six service process factors in outpatient neurology teleconsultation experiences during COVID-19.

2.4.1 Key Service Process Factors in Clinicians' Teleconsultation Experiences

There are 300 codes for clinicians' perceptions of teleconsultation services. The prevalence of codes under each of the SERVQUAL dimensions (tangible, reliability, responsiveness, assurance, and empathy) is listed in Table 2-2. The most prevalent dimension, process factors, and themes are listed in Table 2-3. The top six highest-ranking process factors among total coding counts are clinical activities (23%), triage (18.3%), technical issues (14.7%), confidence in care (7.7%), administrative support (6.3%), and communication (5.7%).

Table 2-2 Frequency of each SERVQUAL dimension for clinicians

Dimension	Frequency	%	References from the studies
Tangible comments coded	61	20.3	[37, 39, 40, 41, 43, 47, 48, 50]
Reliability comments coded	96	32	[16, 18, 37, 39, 40, 41, 43, 46, 47, 48, 49, 50]
Responsiveness comments coded	23	7.7	[37, 40, 41, 43, 46, 47, 48, 49]
Assurance comments coded	113	37.7	[16, 18, 39, 40, 41, 43, 46, 47, 48, 49, 50, 51]
Empathy comments coded	7	2.3	[40, 41, 48]
Total SERVQUAL comment coded	300	100	[16, 18, 37, 39, 40, 41, 43, 46, 47, 48, 49, 50, 51]

Table 2-3 The most frequent SERVQUAL dimensions, process factors, sub-themes among clinicians (N = 300)

Dimension	Most frequent process factors	Sub-themes
Assurance (n=113, 37.7%) (The knowledge and courtesy of employees and their ability to inspire trust and confidence)	Clinical activities (n=69): Physical examination (n=32)	The positive role of video in PE Limitation of remote PE Lacking utilization of remote assessment tools Availability of family support

	Confidence in care (n=23)	Video adding confidence Experiences and training adding confidence Perceptions of decreased standard care Unusual conditions (delivery bad news or sensitive information) lowing the confidence
	Communication (n=17)	Perceived risk of misunderstanding Difficult recognizing emotion Difficult establishing trust relationship Superiority of video visits in communication (enhance PE and diagnosis)
Reliability (n=96) (the ability to perform the promised service dependably and accurately)	Appropriate triage (n=55)	Clinical factors: • Follow-up vs New • Screening or stratification • Disease characteristics (severity, stability, acuity, complexity)
		Patient factors: • Demographic • Physical or psychological limitation • Caregiver support; • Access to technology • Experience in using technology
	Administrative support (n=19)	Change workflow: Scheduling and registration; Previsit preparation technically and medically; Accurate patient information.
Tangible (n=61) (The equipment and personnel)	Technical issues (n=44)	System availability System reliability System connectivity System flexibility Functionality limitation
Responsiveness (n=23) (The willingness to help customers and provide prompt service)	Address patients' logistical needs (n= 13)	Convenience (save time, travel and decrease cost)
Empathy (n=7) (The provision of individual care and attention to customers)	Human touch (n=6)	Losing/missing relationship Lacking empathy: business-like

*Original table with selected quotes in Appendix A Additional file 5

2.4.2 Key Service Process Factors in Patients' Teleconsultation Experiences

There are 101 codes for patients' perceptions of teleconsultation services. The prevalence of codes under each of the SERVQUAL dimensions is listed in Table 2-4. The most prevalent dimensions, process factors, and themes are listed in Table 2-5. The top six highest-ranking process factors among total coding counts are technical issues (18.8%), logistical needs (16.8%), medical needs (13.9%), communication (11.9%), reliable tests/prescription (7.9%), and home environment (5.9%).

Table 2-4 Frequency of each SERVQUAL dimension for patients

Dimension	Frequency	%	References
Tangible Comments Coded	25	24.8	[36, 37, 38, 39, 45, 46, 47, 49]
Reliability Comments Coded	15	14.8	[37, 38, 42, 43, 46, 47, 49]
Responsiveness Comments Coded	33	32.7	[19, 37, 38, 42, 43, 44, 46, 47]
Assurance Comments Coded	23	22.8	[37, 38, 43, 46, 47, 49]
Empathy Comments Coded	5	5	[38, 47, 49]
Total SERVQUAL Comment Coded	101	100	[19, 36, 37, 38, 39, 42, 43, 44, 45, 46, 47, 49]

Table 2-5 The most frequent SERVQUAL dimensions, process factors, sub-themes among patients (N=101)

Dimension	Most frequent process factors	Sub-themes
Responsiveness (n=33) (The willingness to help customers and provide prompt service)	Address logistical needs (n=17)	Convenience (saving time, travel and cost)
	Address medical needs (n=14)	Address communicative needs (e.g., understanding care plan, or disease, change medication regiments.)
Tangible (n=25) (The equipment and personnel)	Technical issue (n=19)	Connectivity; Usability; Availability; Family support.
	Home environment (n=6)	Comfort
Assurance (n=23) (The knowledge and courtesy of employees and their ability to inspire trust and confidence)	Communication (n=12)	Situational effectiveness
	Diagnosis (n=5)	Delay and uncertain
Reliability (n=15)	Tests, prescriptions, Treatments	Delay

(the ability to perform the promised service dependably and accurately)	(n=8)	
Empathy (n=5) (The provision of individual care and attention to customers)	Personal attention (n=3)	Present Embarrassing

*Original table with selected quotes in Appendix A Additional file 6

2.4.3 Six Key Common Service Process Factors and Themes among Clinicians and Patients

The top six factors that influenced both patients' and clinicians' perceptions of teleconsultation experiences are: (1) technical issues, (2) triage, (3) logistical needs, (4) administrative support, (5) clinical activities, and (6) communication. Table 2-6 shows the six identified key service process factors and themes under each factor.

Table 2-6 The six identified key service process factors and themes among clinicians and patients

Key factors	Themes	Subthemes
Technical issues	System and organizational level	Availability Connectivity Functionality Flexibility Reliability Technical support
	Individual level	Technological capacity
Triage	Patients' preference	Patients' ability to use technology • Demographic • Physical and cognitive impairment • Family support

	Clinical appropriateness	Clinical factors • Disease types • Stability/acuity Need physical examination
Logistical needs	Convenience	Save time, travel, cost
Administrative support	Virtual workflow issues	Scheduling and registration Pre-visits preparation: technically and medically Accurate patient information
Clinical activity	Clinicians' lack of confidence, virtual care experiences and competency	Virtual care competency • Lack of utilization of existing electronic resources and remote assessment tools • Lack of training and experiences Superiority of video • Enable virtual assessment • Enhance confidence in diagnosis
Communication	Lack of non-verbal communication	• Misunderstanding • Difficult recognizing emotion • Difficult establishing trust relationship

The first key service process factor, technical issues, was raised mainly by clinicians who reported significant gaps in this area, especially regarding functionality limitations, reliability (connectivity issues), availability, accessibility, system flexibility (rigid schedule), lack of technical support and training [19,36,37,39,42,43,47,51]. For instance, clinicians indicated that patients' technological capacity was a barrier to successful teleconsultation [19, 47]. Although one study reported that none of their patients (mean age 37) expressed internet connectivity issues as barriers [37], according to another one, 31.5% of patients with cognitive impairment (mean age 75.7) failed video consultation

mainly due to difficulty in establishing a connection (76.4%) [36]. One study which compared the video to telephone consultation groups reported that only age revealed a statistically significant shift towards a preference to telephone consultation [40].

The second key service process factor, triage, has evolved from a clinical process to a complex process weighing the interest of both patients and clinical standpoints. The patient component includes demographic factors such as age, gender, racial/ethnic minority, socioeconomic status, psychological or psychological challenges, caregiver support, language barriers, access to technology, and experience with technology [40,47,49,51]. Whereas the clinical component includes disease stability, disease acuity, disease complexity, disease types, new versus follow-up visits, the role of physical examination in decision making, high-risk procedure, and the delivery of bad/sensitive news [18,19,37,39,42–44,46,47,50,51]. The clinicians identified that most appropriate patients for teleconsultation were: (1) follow-up patients with well-established diagnosis and requiring regular monitoring, (2) patients with chronic, stable, and uncomplicated conditions, (3) patients being stratified or screened to assess the need for in-person visits, (4) certain conditions or diseases such as headache or epilepsy, (5) older patients or vulnerable population who are unable to attend in-person visits [18, 19, 37, 39, 42–44, 46, 47, 50, 51]. Clinicians identified the most inappropriate patients for teleconsultation were: (1) new patients, (2) those with acute conditions or declined health or physical changes, (3) individuals with life-threatening diagnosis or high-risk treatments, (4) patients needing/ requiring hands-on physical examination, (5) individuals with certain types of diseases such as movement disorder or MS; (6) patients with hearing or visual or cognitive impairment; (7) those with language barriers; (8) patients lacking family support; (9) and individuals with low technical capability such as older or low-income patients [18,19,37,39,42–44,46,47,50,51]. In terms of the suitability of teleconsultation for the older and vulnerable populations, it was considered both appropriate and inappropriate.

The third key service process factor, meeting patients' logistical needs, plays a crucial role in contributing to a positive teleconsultation experience from both patients' and clinicians' perspectives [40,45,46,48,51]. According to the findings from one publication, 88% of patients agreed that teleconsultation was more convenient than an in-person visit [46]. Other research findings also indicate that the benefits of teleconsultation to patients included reduced unnecessary travel and increased access to healthcare, especially for vulnerable populations, including those with disabilities or lack access to transportation [19,37,47].

The fourth key service process factor, administrative support, is an essential component to ensuring the success of teleconsultation [19,37,43,51]. Clinicians identified that lack of administrative support negatively affected their perceptions of teleconsultation [51]. Administrative support is vital to a successful teleconsultation. Many of the studies indicated that clinicians emphasized the need for environmental (e.g., adequate space, optimal camera position, and lighting), technological (e.g., technology availability, access to a virtual platform, working camera and speaker, patients' technological knowledge and experience assessment, and opportunity for a trial run before teleconsultations), and clinical preparations (e.g., medication reconciliation, investigation results, and past medical history) with direct patient and family involvement [19,36,37,51]. For instance, having family support from the younger generation has significantly increased the success of video consultations among the elderly with cognitive impairment [36]. These studies reported that clinicians experienced difficulty connecting to patients, such as when patients were unavailable at the time of appointment or were engaged in other activities (working or driving), or the patients were simply not prepared for teleconsultation [19, 37]. Kummer et al. found that 8.3% of video consultations had to switch to different modality due to lack of technical preparation [43].

The fifth key service process factor, clinical activities, is a crucial factor identified in eleven of the studies. The concerns of clinical activities include clinicians' concerns with their inability to perform clinical activities, primarily physical examinations during a teleconsultation visit [16, 18, 19, 36, 38, 39, 43, 44, 46, 47, 51]. Some studies uncovered that part of the obstacles to clinical activities with teleconsultation is due to clinicians' lack of utilization of existing electronic resources and remote assessment tools [16, 39]. One study found that even though hospitals subscribe to electronic medical record (EMR), 30.3% of clinicians still reported being unable to access the EMR, and almost 20% of clinicians could not make electronic prescriptions [39]. Correspondingly, other studies have shown that increased experience and training with virtual care correlated with improvement in clinicians' ability to diagnose and develop treatment plans virtually and boost their acceptability and satisfaction with teleconsultation [43,44].

Lastly, the sixth key service process factor, communication, dealt primarily with the perceived quality of communication between audio-only and video modes of teleconsultation. For instance, clinicians disclosed that the difficulty with audio-only teleconsultation was a barrier to holistically obtaining information, which in turn also negatively affected the patient-physician relationship. The lack of visual cues interfered with the clinicians' ability to interact with their patients, as they could

not access non-verbal communication. This was especially problematic for physicians with patients with hearing or cognitive impairments and those with language barriers [19, 38, 51]. From the clinicians' perspective, teleconsultation using video platforms had added value by giving them access to non-verbal communication allowing them to visually and verbally assess their patients' responses and reactions. In turn, video, as opposed to audio-only, teleconsultations enabled physicians to diagnose with more confidence, resulting in physicians expressing a more successful experience [44,47,51]. However, with technical issues and a lack of administrative support, this is an unmet need for clinicians to use video to optimize their teleconsultation experiences.

2.5 Discussion

Without a doubt, the COVID-19 pandemic has been a catalyst for teleconsultations' rapid expansion in many health sectors. The impact of the pandemic, which forcibly halted in-person services in most sectors globally, sparked the rapid and massive adaptation of virtual communication due to social distancing restrictions [52]. According to one study, teleconsultation requests in outpatient neurology were significantly associated with the subjectively perceived threat by SARS-CoV-2 ($p = 0.004$) [50]. Since the start of the COVID-19 pandemic, teleconsultation has become an essential tool in outpatient service delivery [41]. The rapid expansion of teleconsultation in outpatient neurology service has allowed us to gain new insight into service quality as the scope of adaptation has never been seen before in healthcare history.

This scoping review identified six key service process factors that affected the teleconsultation experiences at outpatient neurology services from both patients' and clinicians' perspectives. While four of the identified service factors, technical issues, logistical needs (convenience), communication, and ability to perform clinical activities, were consistent with findings from the pre-COVID era, the remaining two factors, appropriate triage and administrative support are new findings from this review. Our review has highlighted that appropriate triage is essential for a successful teleconsultation, especially considering patients' technological capacity, preference (logistical needs), disease characteristics, and the ability of their clinician to perform a physical examination for diagnosis and formulating a treatment plan. In addition, this review also determined that appropriate administrative support is essential to a successful teleconsultation visit by equipping both patients (by assessing patients' technological capacity, assisting technical issues, and supporting patients/caregivers) and clinicians (by providing well prepared documents, accurate patient

information, vital signs, and medication reconciliation) with the necessary tools, support, and information. Therefore, the findings from this review will be essential to ensuring a high-quality teleconsultation visit in neurology outpatient.

2.5.1 Exacerbated Technical Issues during COVID-19 for Vulnerable Population

Before the COVID-19 outbreak, there were not as many technical issues reported in outpatient neurology teleconsultation when done at a satellite clinic [11,13,53–55]. According to one study, veterans with chronic neurological diseases who had follow-up teleconsultations at satellite clinics rarely encountered technical problems [53]. Additionally, according to another study, there were few same-day cancellations (2/64) in follow up teleconsultation for rare neurological diseases due to technical issues [11]. However, the amount and extent of the technical issue encountered became prominent in follow-up visits with teleconsultation from a home setting. Teleconsultations with patients at home were manifested with technical troubles and having to do with patients' discomfort with technology, which often necessitated assistance from younger caregivers [10,56].

From a technological perspective, although the COVID-19 pandemic has significantly increased the use of digital technologies in nearly every aspect of our lives, it has also deepened digital inequity [57]. Digital inequality exasperated by the rapid, large-scale adaptation in telecommunications has proven to be a significant barrier to the vulnerable patient population [36]. Due to social distancing, much of the teleconsultations since the COVID-19 outbreak were conducted from the patients' homes, rather than a satellite clinic. Without proper assistance and experience with telecommunication has gravely contributed to the technical difficulties encountered at the patients' end. Our review has confirmed that access to appropriate technology, patients' digital literacy, language, physical or cognitive capability, coupled with the medical needs of the elderly and vulnerable population, have significantly limited access to teleconsultation [19,36,37,47].

According to a cross-sectional population study based on data collected in 2018 of community-dwelling adults over the age of 65, 38% of all older adults in the United States were not ready for video visits, mainly because of inexperience with technology. In addition, telephone visits would be problematic for 20% of this population due to having hearing impairments, difficulty communicating or suffering from dementia [58]. A literature-based framework explored the four key age-related barriers influencing mobile health usability, enabling further evaluation of teleconsultation in the geriatric population [59]. Digital health literacy has become a new social determinant of health [56].

As such, healthcare policymakers must consider technology-enabled services to counter the effects of this determinant [56]. Both political and community interventions must be enacted to ensure that appropriate supports are in place and to mitigate the adverse effects of the pandemic and the social health inequalities [57].

2.5.2 Clinical Activities: Clinicians' Moral Distress and the Role of Physical Examination

The limitation of the remote physical examination has been a significant concern in outpatient neurology teleconsultation before the COVID-19 pandemic. This was likely the primary reason that the majority of teleconsultations were done only for follow-up patients after the initial in-person assessment. In fact, prior to the outbreak, teleconsultation was positioned as an optimal solution for remote longitudinal care as a physical examination is not as vital for follow-up patients [60]. Studies examining new but non-urgent neurology patients assessed via teleconsultation conducted in satellite clinics with the aid of a professional telepresenter, demonstrated the noninferiority of virtual consultations for diagnosis, especially given the high level of patient acceptance [12,13]. In fact, the assistance of a professional telepresenter could highly enhance the accuracy of remote physical examinations by ensuring that any vital signs and symptoms that are relevant to diagnosis are not overlooked [60]. A 2019 review of telemedicine in neurology by the American Academy of Neurology established that diagnosis in traumatic brain injury, dementia, Parkinson's disease (PD), and MS, via teleconsultation, can be as effective as in person [5]. However, this study had several limitations. For instance, the analysis did not distinguish between studies that evaluated inpatient versus outpatient groups [5]. Moreover, some of the studies included were performed in artificial settings, involved the aid of a telepresenter, had a small sample size, or only comprised of the stable, unchanged non-acute patient population [5].

Since the COVID-19 outbreak, teleconsultation has been widely utilized with new and follow-up patients in a home setting without the luxury of a professional telepresenter to assist with the technology or the examination. The rapid adoption of teleconsultation in neurology has compelled many clinicians to provide care without appropriate training or credentialing to use this unique service delivery model effectively. Performing remote physical examinations without providing patients appropriate assistance and clinicians the needed training could gravely affect diagnosis and treatment plan. Our review confirms that the constraints of conducting a physical examination

virtually has often been translated into a sense of diminished confidence in service quality for the clinician [10]. The impact of the COVID-19 outbreak on health care has immensely altered the standard practice model, compelling clinicians to compromise on the widely accepted care standards to reduce the impact of the highly infectious and virulent disease. The lack of standard best practice guidelines for teleconsultation among neurology sub-specialties has pressured the ethical and moral responsibility of providing good quality of care directly in the hands of individual clinicians. According to Courtney et al., clinicians' heightened awareness of the risks associated with diagnostic uncertainty led to much of the reluctance with virtual examination resulting in 'unknown unknowns' [51]. Therefore, we recommend further research investigating clinicians' moral distress in teleconsultation during COVID-19.

Despite the explosion of teleconsultation in neurology, some neurology specialties still have yet to adopt physical examination into a digital landscape [36,44,47]. For example, Casares et al. found that providers preferred in-person appointments for complex cases in a follow-up epilepsy clinic during the COVID-19 pandemic, even when the visits rely mainly on the interview rather than the physical examination [37]. The limitations with adopting traditional neurological examinations into a teleconsultation model could be addressed with innovations in digital health and the use of remote monitoring devices [43,47]. With a vulnerable patient population, having family members assist clinicians with remote physical examinations has proven vital in ensuring patients' safety [19]. Therefore, it would be beneficial to conduct further research on the reliability and safety of family-supported remote physical examinations in undiagnosed patients. Lastly, further research identifying the components of the in-person examination that are essential for the clinical decision-making process needs to be deciphered to meet documentation requirements [43,46]. Communication: more negative perceived by clinicians Before the COVID-19 pandemic, patients' satisfaction with the quality of communication during teleconsultation was high but mostly among follow-up patients or in outpatient neurology satellite clinics with the assistance of a telepresenter [13,53–55,61]. Contrarily, some follow-up patients at home-setting expressed discomfort with telecommunication and indicated a preference for in-person interaction as they experienced greater ease communicating and found the physical interaction more reassuring and personal [10,56]. Unfortunately, clinicians' satisfaction with teleconsultation communication quality was less examined in outpatient neurology settings.

Since the COVID-19 outbreak, teleconsultation visits have been mainly conducted with patients from a home setting. Many of these teleconsultations have been with new patients who have had no

established relationship with the clinician, which may have contributed negatively to their perceived quality of communication. Interestingly, teleconsultation studies show that patients had more positive perceptions than clinicians. Four studies that used telephone and video modalities indicated that most patients felt communication was effective and sufficient with teleconsultations [37,46,49,50]. Contrarily, clinicians expressed more negative experiences towards communication in five of the studies that used both telephone and video modalities, especially regarding concerns about decreased personal connections and risk of misunderstanding [19,39,47,51]. Further research is needed to explore patient-clinician relationships in a virtual setting in terms of the role of verbal and nonverbal communication from both clinicians' and patients' perspectives. Non-verbal communication enables the clinician to observe patients' physical appearance, eye contact, or emotions and assess the home environment, providing more information in formulating diagnosis and treatment plans [19, 62]. The added value of non-verbal communication on patient-clinician relationships and the ability to perform clinical activities may differ among specialties and diverse patient populations, requiring further exploration.

2.5.3 Meeting Logistical Needs (Convenience): a Contributing Factor

A systematic review of telehealth services pre-COVID-19 concluded that convenience (travel-saving, time-saving, and cost-saving) is one of the most significant factors influencing patients' satisfaction [63]. The outpatient neurology teleconsultation is no exception. Convenience by meeting patients' logistical needs (travel, transportation, missing work and finical constrain) is one factor that influences patients' positive perceptions of the personal benefits of teleconsultation [5, 8–10, 54, 61, 64]. Interestingly, the distance was not statistically associated with patient satisfaction in outpatient neurology teleconsultation [11,61]. Another study that examined outpatient neurological teleconsultation follow-up visits found that 30% of local patients chose teleconsultation, which indicated that patients might benefit for a variety of reasons other than distance [9].

With COVID-19 restrictions, teleconsultation is undoubtedly preferable to the alternative, not receiving any care [42]. Our review confirmed that both patients and clinicians appreciated the convenience of teleconsultation as a factor swaying their positive perceptions of the teleconsultation service quality. However, convenience does not equate to quality of care. Therefore, although convenience is an important factor, understandably, preference for it could easily influence patients' evaluation of teleconsultation service regarding the quality of care [10].

2.5.4 An Improved Triage Process: Finding the Middle Ground

A new insight revealed in this review is that teleconsultation triage has become a complex collaborative process involving both patients and clinicians. Patient selection for teleconsultation requires careful consideration to optimize care and respect preferences from both patients' and clinicians' points of view [19]. The triage process needs to be established by considering patients' technological competency, their preference, disease characteristics, and the role of physical examination in the diagnosis and formulation of a treatment plan [18,19,37,39,42–44,46,47,50,51].

Prior to the outbreak, teleconsultation in outpatient neurology was mainly limited to follow-up patients with a confirmed diagnosis. With this mentality, many clinicians tend to regard teleconsultation as unsuitable for new referrals or follow-up patients with worsening symptoms [19,37,42,51]. Interestingly, in contrast, one of the studies observed that the utilization of teleconsultation was high for both new and returning patients. However, it could have been due to underlying fears of contracting COVID-19 confounding this observation [19]. Clinicians believe that medical conditions that depend on medical history-guided diagnostic decision-making are more appropriate than those that are neurological examination-guided [18,45,46]. Certain conditions (e.g., headache and epilepsy) were perceived as more suitable for teleconsultation than others (e.g., MS, movement disorders, or myelopathy) [18,44,48]. As a result, a disease specific triage algorithm is necessary to guide patient selection.

Some clinicians expressed that teleconsultation might empower their patients with management options, leading to an excessive number of consultations in an already overused and high-demand specialty [47]. Clinicians also expressed concerns that patients may find teleconsultation too convenient and opt-out of recommended in person visits [19]. Thus, they were apprehensive about patients preferring the convenience of teleconsultation against their clinical recommendation for an in-person visit. This finding has not been reported in studies before the COVID-19 pandemic. The possible reasons could be that the COVID-19 restrictions compelled many new patient intakes via teleconsultation prior to developing clear patient selection criteria or virtual care guidelines.

2.5.5 Administrative Support: a New Virtual Care Workflow

Another new insight uncovered from this review is that lack of proper administrative support negatively affected clinicians' perceptions of teleconsultation [19,37,43,51]. The lack of protocols prior to the teleconsultation, specifically with regards to technology set up, check-in processes,

procedures with vital sign assessment, and medication reconciliation, reflect a need to establish a new administrative virtual care workflow [19,37,43,51]. Unfortunately, teleconsultation, compared to an in-person visit, seems to have generated more work for clinicians and administrative staff. This, in turn, is affecting workflow efficiency and widening the gap between the needs of a successful teleconsultation and the actual administrative support available [19,43,51]. The rapid adaptation of teleconsultation since the onset of the COVID-19 pandemic, without the appropriate organizational planning and support, in addition to the strains of staffing deployment due to COVID-related care as well as keeping pace with transitioning workflow between telephone, video, and in-person visits, may have contributed to the maladaptation [43]. The onus of establishing new administrative protocols to manage virtual workflow rests at the organizational level rather than with the individual clinicians. Keeping in mind that technology is a "tool", not the "solution.", it necessitates building a sustainable administrative virtual workflow model to support the frontline clinicians [65].

2.5.6 Future Teleconsultation Service Model in Outpatient Neurology

Our review has highlighted six key service process factors that must be addressed to improve teleconsultation service quality. Two models of care could address some of the issues highlighted in the six key service process factors identified. On the one hand, a hybrid model or a multimodal system that is comprised of both virtual and in-person visits would help mitigate some of the barriers faced by vulnerable patient populations, such as those who have disabilities or issues accessing transportation [47]. The added value of teleconsultation affords new opportunities to collaborate, incorporate family support, and ensure continuity of care [18,19,38]. On the other hand, a disease-specific model would address the diverse needs of the various neurology subspecialty groups. For instance, while some subspecialties, such as oncology neurosurgery, could accommodate follow-up patient intake with teleconsultation, others, such as functional neurosurgery, may be stringent with follow-up visits to be done in-person [46]. As such, further research is needed to identify the types of disease and the needs of varying patient populations to ensure that appropriate care is delivered using best practices to accommodate both clinicians' and patients' provisions.

2.5.7 Strengths and Limitations

There are two strengths of this review. First, we strictly applied the systematic scoping review framework. Second, we applied the SERVQUAL model as a theoretical framework to classify the factors that impact the perceptions of teleconsultation. This review focuses on experiences of

teleconsultation during the COVID-19 outbreak based on qualitative, quantitative, or mixed-method peer-reviewed original research published from January 2020 to April 2021. Due to the restrictions imposed during the COVID-19 pandemic, many of the well-established protocols and standards of practices relating to privacy, security, reimbursement, and appropriate credentialing in the pre-COVID era were relaxed [3,18]. The teleconsultations conducted with the onset of the COVID-19 pandemic have vastly broadened the width and depth of teleconsultation adoption in both urban and remote areas, with new and follow-up patients accessing care from a home setting, who have or have yet to be diagnosed. Our review has contributed to gaining a better understanding of outpatient teleconsultation service quality at-home settings.

Our scoping review has many limitations. First, due to the nature of a scoping review, it is challenging to interpret patients' or clinicians' experiences when the little context was provided during the coding process. Second, the selected studies were conducted in broad geographic areas, across many neurology specialties, with varying methodologies. The heterogeneous nature of the selected studies made it challenging to identify specific factors in a particular group of the patient population. However, in line with the advantages of a scoping review methodology, is that it offers a broader lens as it allows for analysis of a variety of study designs and patient populations in mapping the unfamiliar phenomenon [32].

2.6 Conclusion

Our scoping review identified six key service process factors of teleconsultation that had the most impact on patients' and clinicians' teleconsultation experiences during the COVID-19 outbreak. Compared to the pre-COVID outpatient neurology teleconsultation literature, we identified two new findings: the need to develop and implement a new triage system model and define gaps in an administrative workflow to incorporate virtual care. These findings will help inform a best practice model by guiding researchers, clinicians, and policymakers to design theory-informed teleconsultation services tailored to the needs of neurology patients and clinicians. Thus, these findings lay the groundwork to improve teleconsultation implementation in outpatient neurology services.

2.7 References

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Chapter 3 Factors that Influence Patient Satisfaction with the Service Quality of Home-Based Teleconsultation during the COVID-19 Pandemic: Cross-Sectional Survey Study

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The previous chapter detailed the results of a comprehensive scoping review, which identified six key service process factors that impacted both patients' and clinicians' experiences with teleconsultation in outpatient neurology services: technical issues, triage, administrative support, clinical activities, and communication. Among these, technical challenges, such as connectivity and patients' technological proficiency, were noted as significant obstacles affecting the reliability of teleconsultation. The review also emphasized the critical importance of an effective triage system, particularly in secondary stroke prevention clinics, to ensure patients are appropriately selected for teleconsultation. Additionally, administrative support, including patient preparation and streamlined virtual workflows, were essential for the smooth delivery of teleconsultation services. Clinicians highlighted concerns regarding the limitations in performing clinical activities remotely and the communication barriers inherent in teleconsultation, such as the lack of non-verbal cues.

These findings underscore the need to enhance the triage process and standardize virtual care pathways to improve the teleconsultation experience, especially compared to pre-pandemic practices. While the scoping review identified critical factors for improving teleconsultation services, it also revealed a gap: none of the reviewed studies specifically addressed patient satisfaction with home-based teleconsultation in secondary stroke prevention services. Given the widespread adoption of teleconsultation during and post the COVID-19 pandemic, understanding its impact on service quality and patient satisfaction is essential.

To fill this gap, we conducted a cross-sectional survey to explore the factors influencing patient satisfaction with home-based teleconsultation. The survey utilized the service performance model (SERVPERF), derived from the service quality model (SERVQUAL) used in the scoping review, to

ensure methodological consistency and continuity between the two studies. By employing the same theoretical framework, we aim to build a cumulative understanding of teleconsultation service quality, facilitating direct comparisons between findings. This second study thus builds upon the insights gained from the scoping review, focusing specifically on patient satisfaction in stroke prevention clinics and delving into the perspectives of patients who directly experienced this shift. It assesses how key service quality dimensions, such as responsiveness, empathy, and reliability, shape patients' experiences with home-based teleconsultation. Additionally, the survey incorporates demographic and clinical characteristics to gain a comprehensive view of the factors influencing patient satisfaction. Ultimately, this study aims to inform the development of quality indicators for teleconsultation in stroke prevention, ensuring high standards of care are maintained in this setting.

In summary, this chapter begins by addressing the critical gap identified in the scoping review: the lack of patient satisfaction data in home-based teleconsultation for stroke prevention. We build upon the theoretical models used in the previous study, applying them to our survey design to ensure consistency in our approach. By the end of this chapter, we will have a clearer understanding of the factors that most influence patient satisfaction in this unique healthcare setting. This chapter begins with the study's abstract, followed by the full-text manuscript.

3.1 Abstract

Background: Ontario stroke prevention clinics primarily held in-person visits before the COVID-19 pandemic and then had to shift to a home-based teleconsultation delivery model using telephone or video to provide services during the pandemic. This change may have affected service quality and patient experiences.

Objective: This study seeks to understand patient satisfaction with Ontario stroke prevention clinics' rapid shift to a home-based teleconsultation delivery model used during the COVID-19 pandemic. The research question explores explanatory factors affecting patient satisfaction.

Methods: Using a cross-sectional service performance model, we surveyed patients who received telephone or video consultations at 2 Ontario stroke prevention clinics in 2021. This survey included closed- and open-ended questions. We used logistic regression and qualitative content analysis to understand factors affecting patient satisfaction with the quality of home-based teleconsultation services.

Results: The overall response rate to the survey was 37.2% (128/344). The quantitative analysis was based on 110 responses, whereas the qualitative analysis included 97 responses. Logistic regression results revealed that responsiveness (adjusted odds ratio [AOR] 0.034, 95% CI 0.006-0.188; P<.001) and empathy (AOR 0.116, 95% CI 0.017-0.800; P=.03) were significant factors negatively associated with low satisfaction (scores of 1, 2, or 3 out of 5). The only characteristic positively associated with low satisfaction was when survey consent was provided by the substitute decision maker (AOR 6.592, 95% CI 1.452-29.927; P=.02). In the qualitative content analysis, patients with both low and high global satisfaction scores shared the same factors of service dissatisfaction (assurance, reliability, and empathy). The main subcategories associated with dissatisfaction were missing clinical activities, inadequate communication, administrative process issues, and absence of personal connection. Conversely, the high-satisfaction group offered more positive feedback on assurance, reliability, and empathy, as well as on having a competent clinician, appropriate patient selection, and excellent communication and empathy skills.

Conclusions: The insights gained from this study can be considered when designing home-based teleconsultation services to enhance patient experiences in stroke prevention care.

3.2 Introduction

3.2.1 Secondary Stroke Prevention and Ontario Stroke Prevention Clinics

As of 2019, stroke was the second leading cause of disability worldwide for people aged >50 years, and it was the fourth leading cause of death in Canada from 2017 to 2019 [1,2]. The 36% decline in stroke mortality from 1990 to 2016 can be attributed to better prevention and management of stroke risks [3]. The INTERSTROKE study found that 90% of strokes are preventable owing to modifiable risk factors, including disease-related and behavioral lifestyle factors [4]. Secondary stroke prevention is crucial, as there is up to a 10% risk of recurrent stroke within 90 days of a transient ischemic attack (TIA) or minor stroke [5].

Approximately 80% of patients with minor stroke discharged from the emergency department in Ontario are referred to stroke prevention services [6]. Stroke prevention clinics provide rapid assessments, diagnostic tests, treatments, prevention, and education to reduce the risk of recurrent stroke [7]. Ontario's 41 stroke prevention clinics are integral to publicly funded health systems [7]. Stroke prevention clinic services are associated with a 25% reduction in mortality [8]. Before the

COVID-19 pandemic, stroke prevention care in Ontario was predominantly delivered through in-person consultations. A small percentage of rural and northern Ontario stroke prevention clinics used teleconsultation at local satellite clinics to address access challenges [9]. One stroke prevention clinic conducted a pilot project offering follow-up home video visits from August 2018 to September 2019 [10]. The video consultation produced higher patient satisfaction, was considered safe by physicians, and was shown to be cost-effective in reducing health care costs and patient expenses [10].

In this study, home-based teleconsultation was defined as a synchronous consultation between a clinical service provider and a patient in their home to provide diagnostic or therapeutic advice through telephone or videoconference [11]. Despite a handful of cases in which home-based teleconsultation was used for follow-up care, before the COVID-19 pandemic [10], Ontario stroke prevention clinics had never used home-based teleconsultation to conduct synchronous, interactive, in-home patient visits for new referrals. A survey of >3000 Canadians with stroke, heart disease, or vascular impairment conducted in the spring of 2021 showed that 80% of respondents had had a teleconsultation during the pandemic [12]. The effect of the rapid change from in-person visits to home-based teleconsultation during the COVID-19 pandemic on patients' experiences was unknown. Patients with stroke are often older adults with multiple chronic conditions [13]. Older adults have lower telehealth service use overall [14]. The impact of service mode change on the older population of stroke prevention clinics needs further exploration.

3.2.2 Service Quality and Patient Satisfaction

Although the rapid transition to home-based teleconsultation may be a temporary response to the COVID-19 pandemic, it offers a significant opportunity to examine the service quality of home-based teleconsultation in stroke prevention clinics. Delivering safe, high-quality health services is the primary goal of health systems [15]. The literature's definition of health care service quality is commonly described as including 2 aspects. One views health care service quality as characteristics and features that meet clinicians' predetermined specifications and standards (such as professional or ethical standards); the other views it as characteristics and features that meet or exceed patients' needs and expectations [16]. Patients often cannot accurately assess the internal service quality as they lack the medical knowledge to judge [17]; however, patient satisfaction with a medical service is the primary determinant of service quality [18]. Patient satisfaction is essential for and meaningful to delivering high-quality care [19].

Patient satisfaction is generally regarded as patients' perception of care delivery as well as how their health needs have been addressed [20,21]. Patient satisfaction can be examined using direct and indirect indicators [21]. First, service quality can be measured by directly asking patients to rate their satisfaction with service quality via, for example, a single item with response options ranging from very dissatisfied to very satisfied [21]. However, the shortfall of single-item measurement is that we can not evaluate or identify a specific aspect of service quality [21]. The alternative approach is to ask patients to rate their experience of different aspects of care, but this indirect measure has the weakness of preemptive assumptions about the determinants of service quality [21]. To obtain an accurate measurement of patient satisfaction, we applied direct and indirect measurements. We asked one question on global satisfaction and applied a theory-guided questionnaire to assess patient satisfaction.

3.2.3 Service Performance Model

As health care quality is multidimensional, we chose an appropriate service quality model (SERVQUAL) to assess patient satisfaction. Examples of existing health care SERVQUALs include the SERVQUAL [22] and its derivative service performance model (SERVPERF) [23], Total Quality Management [24], Health Quality Model [25], service quality for a public hospital [26], and hospital quality model [27]. The Health Quality Model, service quality for a public hospital, and hospital quality model are derivatives of the SERVQUAL model and assess the care quality of hospital inpatient services. The SERVQUAL and SERVPERF models include 5 dimensions: tangibles, reliability, responsiveness, assurance, and empathy [22]. SERVQUAL tends to measure the difference between one's expectations and the actual performance of the service [22]. SERVPERF only focuses on the actual performance, and studies have shown that service quality is appropriately modeled using SERVPERF as an antecedent of satisfaction [23,28]. There are 22 service attributes listed within the 5 service dimensions of the SERVPERF model [29]. Table 3-1 presents each dimension and item in detail.

Table 3-1 Dimensions and items of the service performance model (adapted from Zeithaml et al [29]).

Dimension description	Item description
Tangible: facilities, equipment, and the presence of personnel	1. Up-to-date equipment 2. Visually appealing physical facilities 3. Neat-appearing employees

	4. Visually appealing materials associated with the service
Reliability: ability to perform the promised service responsibly and accurately	5. The company keeps its promises to do something by a certain time 6. The company shows a sincere interest in solving the customer's problem 7. The company performs the service right the first time 8. The company provides its services at the time it promises to do so 9. The company insists on error-free records
Responsiveness: willingness to provide help and a prompt service to customers	10. Employees of the company tell customers exactly when services will be performed 11. Employees of the company give prompt service to customers 12. Employees of the company are always willing to help customers 13. Employees of the company are never too busy to respond to customer
Assurance: the knowledge and courtesy of employees and their ability to inspire trust and confidence	14. The behaviour of employees of the company instills confidence in customers 15. Customers of the company feel safe in their transactions 16. Employees of the company are consistently courteous with customers 17. Employees of the company have the knowledge to answer customer's questions
Empathy caring and understanding, which a company provides and/or offers its customers in terms of its individualized and personalized attention	18. The company gives customers individual attention 19. The company has operating hours convenient to all its customers 20. Employees of the company give customers personal attention 21. The company has the customer's best interests at heart 22. The employees of the company understand the specific needs of their

3.2.4 Study Aims and Research Question

Any new service model implementation should usually be well planned to improve user satisfaction; however, home-based teleconsultation at stroke prevention clinics was implemented without the usual planning. The rapid implementation could affect patients' experiences. As a result, it is vital to evaluate patient satisfaction with the quality of the teleconsultation service they received during the COVID-19 pandemic by assessing satisfaction with various service dimensions to identify aspects of service quality that patients are and are not satisfied with. This study aimed to explore the factors affecting patient satisfaction. The research question was as follows: "what are the patient-identified factors influencing patients' satisfaction with service quality in stroke prevention clinics' home-based teleconsultation service?"

3.3 Methods

3.3.1 Participants and Procedure

We conducted a web-based or telephone survey of patients who had at least one home-based teleconsultation, either the initial or follow-up visit, at the stroke prevention clinics. The study sites were 2 stroke prevention clinics at 2 tertiary hospitals in Ontario, Canada. The study sample consisted of individuals who received at least one home-based teleconsultation at a stroke prevention clinic between January 1, 2021, and November 30, 2021. A convenience sampling technique was used as we invited patients who lived in their homes and self-participated in the stroke prevention clinic home-based teleconsultation service during the COVID-19 pandemic. Our exclusion criteria included (1) patients who lived in a long-term care home or group home and (2) patients with dementia who could not participate in home-based teleconsultations.

To minimize volunteer bias and increase the response rate, we applied various data collection techniques to capture participants with and without internet access. A web survey was used for patients with email addresses, whereas a telephone survey was used for patients without email addresses. The questionnaire was administered between May 17, 2021, and December 10, 2021.

We developed a telephone script for recruitment to explain the research project in lay terms. In total, 2 modified-duty nurses from one site and neurologists from another site who were not part of the research team obtained permission from patients to be contacted by the research team. The list of email addresses or telephone numbers of patients who gave permission was shared with the research team. Participants who chose a web-based survey received an email with a brief cover letter explaining the study's purpose and their rights as study participants. Informed consent was via the web before accessing the questionnaire, and they were asked to click a box indicating that they agreed to complete the survey (Appendix B Multimedia Appendix 1). Participants who chose a telephone survey received a mail-in cover letter, a consent form, and a copy of the survey (Appendix Multimedia Appendix 2).

3.3.2 Ethical Considerations

This study was reviewed by the research ethics boards of Southlake Regional Health Center and Mackenzie Health and was considered a continuous quality improvement project; thus, a full research

ethics review was not required. This study was also reviewed by the University of Waterloo Office of Research Ethics (ORE 42686) and received ethical clearance.

3.3.3 Measures

Our study used SERVPERF to design a Likert-scale survey to assess patient satisfaction with home-based teleconsultation service quality in stroke prevention clinics. We acknowledge that patient satisfaction is subjective, with many determinants that may not be related to the SERVPERF model. The literature has indicated that patient satisfaction can be influenced by patient knowledge and expectations; therefore, other factors such as demographics (e.g., age, gender, and education), clinical factors (e.g., comorbidities, diagnosis, and number of visits), and experiences with teleconsultation can influence patient expectations [20,21]. We also included these factors in our survey. By considering other factors and applying direct and indirect measurements, we attempted to explore patient satisfaction using a holistic approach. The 18-item questionnaire used in our study was developed by referencing the telehealth service quality questionnaire developed by Yin et al [30] (see Appendix B Multimedia Appendix 3 for a description).

The survey consisted of three components: (1) demographic, clinical, and telemedicine questions; (2) an 18-item Likert scale–based questionnaire measured on a 5-point scale, with 1 for strongly disagree and 5 for strongly agree; and (3) 6 open-ended follow-up questions (Appendix B Multimedia Appendix 4). The demographic, clinical, and telemedicine independent variables were selected based on previous evidence from a literature review and clinical significance from a practice point of view [31]. We conducted a pilot study in March 2021 with 10 participants who had home-based teleconsultation from October 2020 to December 2020 and asked 6 additional questions about the survey content (Appendix B Multimedia Appendix 5). Overall, patients were satisfied with the language and content of the survey, indicated in their feedback.

3.3.4 Data Collection

The web survey was conducted through a secured, password-protected REDCap (Research Electronic Data Capture; Vanderbilt University) website hosted at the University of Waterloo that supports research data collection [32]. Skype for Business (Skype Technologies) from the University of Waterloo, with recording and transcription functions, was set up for the research assistant to conduct the telephone survey.

3.3.5 Statistical Analysis

We applied quantitative and qualitative analysis to understand patient satisfaction. A binary outcome variable was defined as (1) a low-satisfaction group if the participants chose very unsatisfied, dissatisfied, and neither satisfied nor satisfied with the overall home-based teleconsultation service quality; and (2) a high-satisfaction group if the participants chose satisfied and very satisfied. We used SPSS for Windows (version 28.0.1; IBM Corp) for statistical analysis [33]. The Likert-scale questions were converted to numerical values. Using the item means, we generated each SERVPERF dimension score and an overall questionnaire score for each respondent's survey. There were 10 demographic, 7 clinical, and 6 technical-related independent variables (see Appendix Multimedia Appendix 6 for the definitions). Chi-square tests were used to identify the statistical significance between the categorical independent and binary outcome variables. The point biserial correlation was calculated to identify the correlation between a continuous independent variable and the binary outcome variable. To test the internal reliability of our instrument, we calculated the Cronbach α. As we had a large number of independent variables under consideration, a forward selection model was most suitable [34]. We used statistically significant variables correlating to the binary outcome variable in the stepwise binary logistic regression model, with $P<.05$ considered significant.

We used NVivo (QSR International), a software developed to organize and support the analysis of qualitative data. GM coded the entire data set, and ST independently coded 10 random samples. The results were compared and reached an initial 87.1% agreement. Discrepancies were discussed, and conflicts were resolved after further clarification of the definition of the codes. We applied direct content analysis to understand the service quality of the teleconsultation under study [35]. We used the 5 service dimensions and their operational definitions as the initial coding categories [36]. Next, we read each transcript and identified and categorized all the text that appeared to represent the operational definition of the code [35]. Text not categorized using the initial coding scheme would be considered for a new code. We summarized the categories of the entire data set and then divided them into low- and high-satisfaction groups to explore positive and negative patient perceptions. We compared the differences between the 2 groups that could explain the quantitative analysis results [37].

3.4 Results

3.4.1 Participant Characteristics

The response rate was 35.9% (104/290) for the web-based survey and 44% (24/54) for the telephone survey. A total of 110 (n=86, 78.2% web and n=24, 21.8% telephone) surveys were included for quantitative analysis, and 97 (n=74, 76% web and n=23, 24% telephone) surveys were included for direct content analysis. Figures 3-1 and 3-2 show a flowchart summarizing the subsequent exclusion of cases from the original number participants to arrive at the final analysis. A total of 97.3% (107/110) of the participants used telephone consultations. The percentages of missing values (1% to 8%) for each Likert-scale question were insignificant (<20%); therefore, the mean of each item was used to replace the missing data [38].

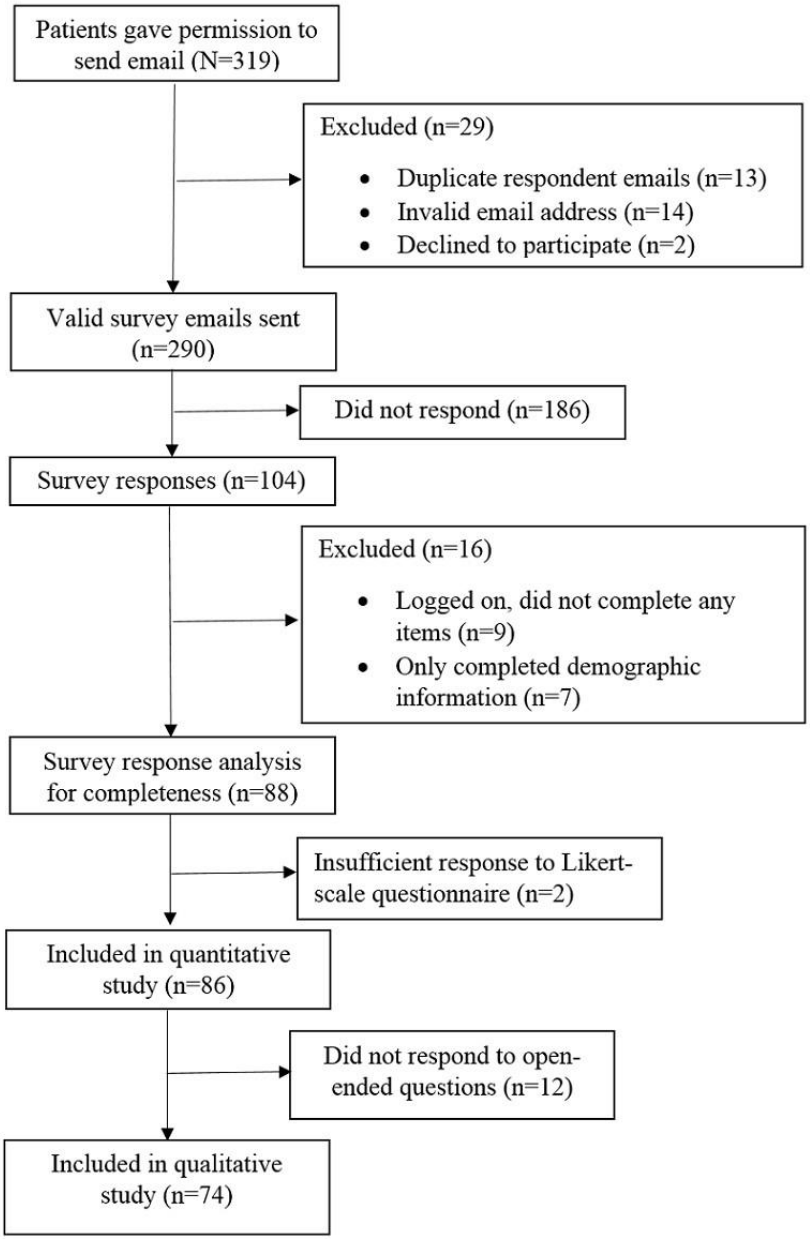

Figure 3-1. Sample flowchart for the web-based survey.

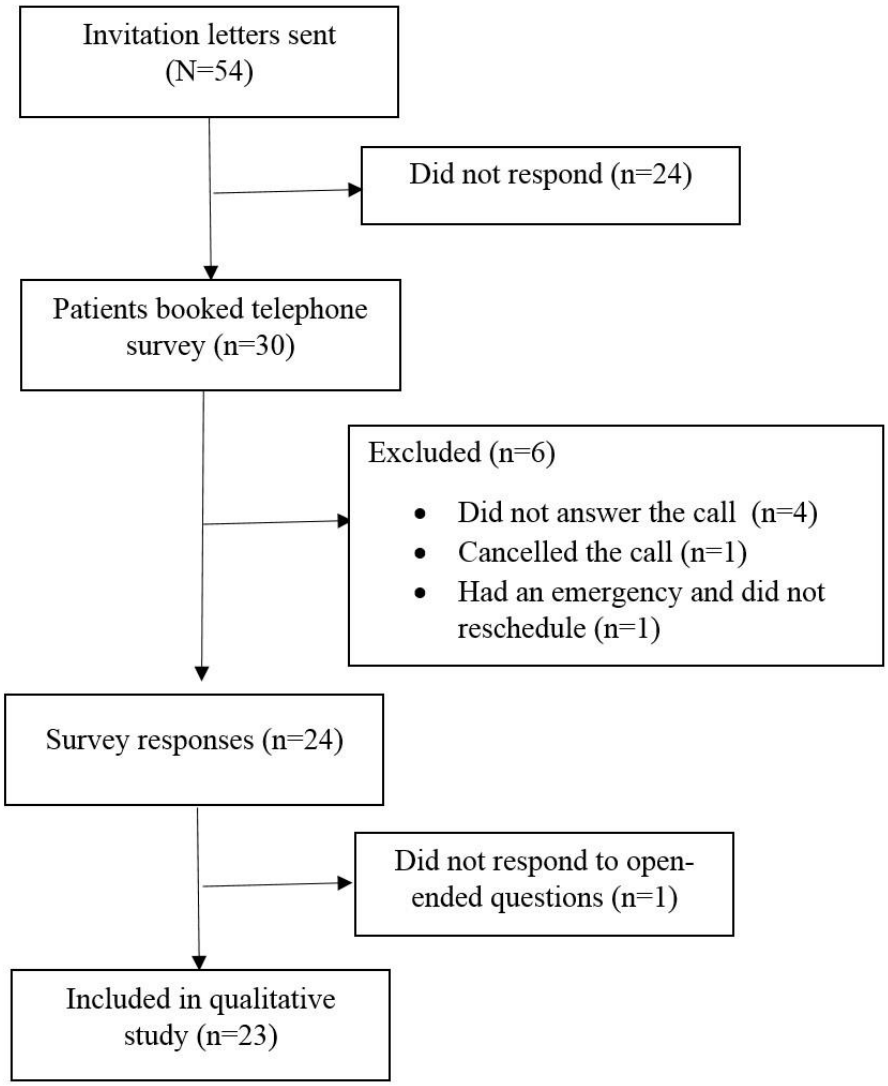

Figure 3-2. Sample flowchart for the telephone survey

The descriptive statistics of the demographic, clinical, and telemedicine variables are presented in Tables 1-3. Briefly, most of the participants (99/110, 90%) were aged ≥55 years, were retired (80/109, 73.4%) and married (76/110, 69.1%), lived with others (85/109, 78%), and lived within 20 km of where the stroke prevention clinic was located (77/110, 70%). Only a few participants (7/109, 6.4%) had an educational level lower than high school, and most (67/109, 61.5%) had a postsecondary education (Table 3-2). Regarding clinical factors, most participants had a stroke diagnosis (71/110, 64.5%) and self-identified as having only one stroke risk factor (74/110, 67.3%). Most patients were new (101/110, 91.8%) to the stroke prevention clinics (Table 3-3). Many

participants had relatively less experience with health technology. Although most of them owned digital equipment for teleconsultation (79/109, 72.5%), many of them had never used patient portals (94/108, 87%) and telemedicine (92/108, 85.2%) before the COVID-19 pandemic (Table 3-4).

Table 3-2. Demographic characteristics of the patients included in the study (N=110)

Variables	Total[a]	Low satisfaction (n=26)	High satisfaction (n=84)	*P* value
Age group (y), n (%)				.04[b]
<55	11 (10)	2 (7.7)	9 (10.7)	
55-64	18 (16.4)	3 (11.5)	15 (17.8)	
65-74	25 (25.5)	4 (15.4)	24 (28.6)	
75-84	40 (36.4)	16 (61.5)	24 (28.6)	
≥85	13 (11.8)	1(3.8)	12 (14.3)	
Sex, n (%)				.52
Female	49 (44.5)	13 (50)	36 (42.9)	
Male	61 (55.5)	13 (50)	48 (57.1)	
Distance (km), mean (SD)	17.73 (16.52)	13.53 (11.65)	19.03	.31
1-20, n (%)	77 (70)	21 (80.8)	(17.61)	
21-40, n (%)	21 (19.1)	4 (15.4)	56 (66.7)	
>40, n (%)	12 (10.9)	1 (3.8)	17 (20.2)	
			10 (13.1)	
Education, n (%)				.52
Grade 8 or lower	7 (6.4)	0	7 (8.3)	
High School	35 (32.1)	10 (40)	25 (29.8)	
College	32 (29.4)	6 (24)	26 (31)	
University	24 (21.8)	6 (24)	18 (21.4)	
Graduate school	11 (10)	3 (12)	8 (9.5)	
Employment, n (%)				.68
Retired	80 (73.4)	20 (76.9)	60 (72.3)	
Working	17 (15.6)	2 (7.7)	15 (18.1)	
Unemployed	4 (3.7)	1 (3.8)	3 (3.6)	
Self-employed	3 (2.8)	1 (3.8)	2(2.4)	
On disability	5 (4.6)	2 (7.7)	3 (3.6)	
Marital status, n (%)				.42
Married	76 (69.1)	18 (69.2)	58 (69.1)	
Divorced	11 (10)	4 (15.4)	7 (8.3)	
Widowed	17 (15.5)	4 (15.4)	13 (15.5)	
Single	6 (5.5)	0	6 (7.1)	
Living arrangement, n (%)				.69
With others	78 (78)	21 (80.8)	64 (77.1)	
Alone	24 (22)	5 (19.2)	19 (22.9)	
Transportation, n (%)				.24
Drives	67 (65)	12 (54.5)	55 (67.9)	
Relies on others	36 (35)	10 (45.5)	26 (32.1)	

Using of a cane or walker (yes), n (%)	30 (27.5)	8 (30.8)	22 (26.2)	.57
Language barrier (yes), n (%)	10 (9.1)	6 (23.1)	4 (4.8)	.005[c]
Hearing impaired (yes), n (%) Affecting phone conversations (yes), n (%)	28 (25.5) 14 (50)	9 (34.6) 6 (66.7)	19 (22.6) 8 (42.1)	.22 .22
Vision impaired (yes), n (%) Affecting the use screen (yes), n (%)	33 (30) 16 (50)	8 (30.8) 5 (62.5)	25 (29.8) 11 (45.8)	.92 .41
The survey consented to by SDM[d] (yes), n (%)	53 (49.1)	18 (69.2)	35 (41.7)	.01[b]
Web survey (yes), n (%)	86 (78.2)	24 (92.3)	62 (73.8)	.046[b]

[a]Note that the percentages are based on denominators that vary from the overall sample size of 110 because of missing data.

[b]*P*<.05.

[c]*P*<.01.

[d]SDM: substitute decision maker. Indicates that the survey was consented to and answered with the help of an SDM.

Table 3-3. Clinical characteristics of the patients included in the study (N=110)

Variables	Total, n (%)	Low satisfaction (n=26), n (%)	High satisfaction (n=84), n (%)	*P* Value
Had stroke diagnosis Had stroke residual deficits	71 (64.5) 27 (38)[a]	17 (65.4) 9 (52.9)[b]	54 (64.3) 18 (33.3)[c]	.92 .15
New referral	101 (91.8)	25 (96.2)	76 (90.5)	.36
Number of stroke risk factors 0 1 2-4 5-6	 14 (12.7) 74 (67.3) 19 (17.3) 3 (2.7)	 3 (11.5) 21 (80.8) 1 (3.8) 1 (3.8)	 11 (13.1) 53 (63.1) 18 (21.4) 2 (2.4)	.40

[a]N=71.

[b]N=17.

[c]N=54.

Table 3-4. Telemedicine-related characteristics of the patients included in the study (N=110)

Variables	Total, n (%)[a]	Low satisfaction (n=26), n (%)	High satisfaction (n=84), n (%)	*P* Value
Using telephone	107 (98.2)	26 (100)	81 (97.6)	.42
# of stroke prevention clinic home-based teleconsultation Once only 2-4 times ≥5 times	 52 (47.3) 50 (45.5) 8 (7.3)	 13 (50) 12 (46.2) 1 (3.8)	 39 (46.4) 38 (45.2) 7 (8.3)	.74
Patient portal use before COVID-19 Never 1-2 times 3-5 times >5 times	 94 (85.5) 10 (9.1) 3 (2.7) 1(0.9)	 23 (92) 2 (8) 0 0	 71 (85.5) 8 (9.6) 3 (3.6) 1 (1.2)	.71

Telemedicine use before COVID-19				.35
Never	92 (83.6)	21 (80.8)	71 (86.6)	
1-2 times	7 (6.4)	2 (7.7)	5 (6.1)	
3-5 times	6 (5.5)	1 (3.8)	5 (6.1)	
>5 times	3 (2.7)	2 (7.7)	1 (1.2)	
Pre-visit contact by the stroke prevention clinic (no)	94 (85.5)	24 (92.3)	70 (85.4)	.36
Owned digital equipment at home (yes)	79 (71.8)	19 (73.1)	60 (72.3)	.94

[a]Note that the percentages are based on denominators that vary from the overall sample size of 110 owing to missing data.

3.4.2 Findings from the Quantitative Analysis

Overall, the instrument was reliable as the Cronbach α reliability analysis of the SERVPERF questionnaire was .894 (Appendix B Multimedia Appendix 7), which indicated an excellent level of reliability of the instrument [39]. The adjusted R2 value was 0.76, indicating that the 5 SERVPERF dimensions could explain 76% of the variation in the global satisfaction score. The mean global satisfaction score was 2.5 (SD 0.65) for the low-satisfaction group and 4.40 (SD 0.49) for the high-satisfaction group. To examine the explanatory variables that were significantly associated with the binary outcome variable, consent from the substitute decision maker (SDM), language barrier, age group, survey method, and 5 service dimensions were entered into the final forward stepwise logistic regression model. The adjusted R2 indicated that 69% of the variance could be explained in the final model. Table 4 illustrates that consent from the SDM (adjusted odds ratio [AOR] 6.59, 95% CI 1.45-29.93; P=.01) was positively associated (β=1.89) and the responsiveness (AOR 0.03, 95% CI 0.006-0.188; P<.001) and empathy (AOR 0.12, 95% CI 0.02-0.80; P=.03) dimensions were negatively associated (β=−3.37 for responsiveness; β=−2.15 for empathy) with dissatisfaction with the home-based teleconsultation service quality (Table 3-5). The odds of dissatisfaction for participants who consented to the survey through their SDM were 6.59 (95% CI 1.45-29.93) compared with those who consented themselves. Every one-unit increase in the responsiveness dimension score decreased the odds of dissatisfaction by 0.03 (95% CI 0.006-0.19) when other variables were held constant. Every one-unit increase in the empathy dimension score decreased the odds of dissatisfaction by 0.12 (95% CI 0.02-0.8) when other variables were held constant.

Table 3-5. The forward stepwise binary logistic regression model

Variables	*β*	SE	*P* Value	AOR (95% CI)

Consent by substitute decision-maker [a]	1.89	0.772	.01[b]	6.59 (1.45-29.93)
Responsiveness[c]	-3.37	0.867	<.001[d]	0.03 (0.006-0.19)
Empathy	-2.15	0.986	.03[b]	0.12 (.02-0.80)

Abbreviations: SE, standard error; AOR, adjusted odds ratio; CI, confidence interval; SDM, substitute decision-maker.

[a]Consent by substitute decision-maker indicated that the SDM was consented that she or he is willing to help the participant to answer questions in this survey.

[b] $P < .05$

[c]Responsiveness is a SERVPERF dimension in the willingness to help customers and provide prompt service

[d]$P< .001$

[e]Empathy is a SERVPERF dimension in providing individual care and attention to customers.

The significant characteristics of the participants who had their SDM sign the consent form and help them answer the survey are listed in Table 3-6. The participants whose SDM provided consent to help them answer the survey were more likely to answer a web-based survey (χ^2_2=15.6; P<.001) and have a language barrier (χ^2_2=15.6; P<.001), hearing impairment (χ^2_2=3.9; P=.048), or hearing that affected telephone conversations (χ^2_2=5.6; P<.02) and were less likely to drive (χ^2_2=7.0; *P*=.04). Tangibles was the only statistically significant SERVPERF dimension (*P*<.001). The participants who consented through their SDM had a shorter travel distance, were older, and were more likely to have residual stroke symptoms.

Table 3-6 Comparison of variables between survey consented by the substitute decision-maker[a] and patient self (difference of % > 15%)

Characteristics	Consent by substitute decision-maker n=53	Consent by patient n=57	*P* Value
Web-based survey	94.3% (50/53)	63.2% (36/57)	< .001[c]
Age (years)	73.75(SD 13.085)	70.60 (SD10.61)	.17
Male	64.2% (34/53)	47.4% (27/57)	.08
Distance	15.897 (SD16.525)	19.435 (SD 16.48)	.26
Driving	55.1% (27/49)	74.1% (40/54)	.04[b]
Language barrier	18.9% (10/53)	0	<.001[c]
Hearing impaired Affect phone conversation	34% (18/53) 66.7% (12/18)	17.5% (10/57) 20% (2/10)	.048 .02[b]
Residual stroke symptoms	48.6% (17/35)	27.8% (10/36)	.07

Tangible	3.21 (SD 0.83)	3.67 (SD 0.61)	< .001[c]
Reliability	3.87 (SD 0.82)	3.94 (SD 0.56)	.68
Responsiveness	3.76 (SD 0.94)	3.76 (SD 0.59)	.98
Assurance	3.99 (SD 0.78)	4.04 (SD 0.53)	.68
Empathy	3.75 (SD 0.71)	3.96 (SD 0.56)	.34

[a]Consent by substitute decision-maker indicated that the survey was answered with the help of a substitute decision-maker

[b] $P < .05$

[c] $P < .001$

3.4.3 Findings from the Content Analysis

3.4.3.1 Overview

A total of 88.2% (97/110) of patients completed the open-ended questions in the survey, with 25% (24/97) in the low-satisfaction group and 75% (73/97) in the high-satisfaction group. Apendix B Multimedia Appendices 8 and 9 list the dimensions and subcategories of positive and negative comments among patients with low and high satisfaction scores, respectively. Interestingly, the low- and high-satisfaction groups shared the same dissatisfied service dimensions (assurance, reliability, and empathy) and subcategories. Overall, missing clinical components, inadequate communication, administrative issues, and absence of personal connection were the significant concerns that affected patients' perceived home-based teleconsultation quality at the stroke prevention clinics.

In contrast, the most satisfying service dimensions were assurance, empathy, and responsiveness among the high-satisfaction group. Overall, a competent clinician with effective communication skills and great empathy for patients is crucial for patient-perceived high-quality care in home-based teleconsultation. In addition, convenience, appropriateness to the patient's situation, and timely consultation were important for high satisfaction with home-based teleconsultation.

3.4.3.2 Future use of home-based teleconsultation

Assessment of patient preference for future use of home-based teleconsultation under normal circumstances (after the COVID-19 pandemic) showed that 35% (33/95) of participants preferred not to use home-based teleconsultation. Most participants (18/23, 78%) in the low-satisfaction group preferred not to use home-based teleconsultation. In contrast, 56% (40/72) of participants in the high-

satisfaction group were willing to use it, and 24% (17/72) indicated that they might use home-based teleconsultation for specific reasons. However, a minority of participants in the high-satisfaction group (15/72, 21%) still refused to use it in normal circumstances, with primary concerns of communication issues, lack of personal connection, and the belief in the superiority of in-person consultations.

3.5 Discussion

3.5.1 Principal Findings

Home-based teleconsultation as a form of telemedicine rapidly expanded in many health sectors in Canada during the COVID-19 pandemic owing to lockdowns and social distancing restrictions [31]. Since the COVID-19 pandemic, home-based teleconsultation has become essential in outpatient service delivery [40]. By April 2020, 77% of Ontario ambulatory visits were conducted using teleconsultation, a total of 77% of ambulatory visits were conducted using a virtual modality [41]. Nearly all (32/33, 97%) Ontario stroke prevention clinics that responded to a province-wide survey from June 2021 to July 2021 (response rate of 33/41, 80%) reported that they had adopted home-based teleconsultation as a service delivery mode in addition to in-person visits since the COVID-19 pandemic [42]. Patient satisfaction should be the priority in future virtual care development and adoption [43]. To our knowledge, this is the first study to use a service quality theoretical lens to assess patient satisfaction with home-based teleconsultation in outpatient stroke care during the pandemic. Many studies of patient surveys during the COVID-19 pandemic have found that most patients and clinicians reported positive experiences with teleconsultation at outpatient neurology services during the COVID-19 pandemic [31]. However, no study has investigated outpatient stroke prevention services or examined the service quality of home-based teleconsultation during the COVID-19 pandemic. The patient population of stroke prevention clinics and the disease characteristics differ from those of other chronic neurological diseases. For instance, patients at stroke prevention clinics have a unique mix of acuity (such as early identification of large vessel occlusion and cardiac source of embolism) and chronic disease management (eg, hypertension, dyslipidemia, diabetes, and lifestyle management), and most are older adults. Owing to health resource disparity, timely access to outpatient magnetic resonance imaging is not always feasible for minor strokes. When referred to stroke prevention clinics, patients with TIA have transient neurological symptoms, unremarkable brain images, and normal physical examinations. History taking is essential in patients

with TIA. The unique patient population and characteristics may pose different challenges in home-based teleconsultation, especially for newly referred patients. Our study found that the participants who were older (mean age 72.12, SD 11.92 years) and mostly newly referred (101/110, 91.8%) and used the telephone modality (107/109, 98.2%) were satisfied with the home-based teleconsultation provided by the stroke prevention clinics during the COVID-19 pandemic. We identified patient-reported factors that affected their satisfaction with the service quality of home-based teleconsultation. Our study filled these research gaps.

Responsiveness was the most statically significant dimension in our quantitative results and is an influential factor for a positive experience. Convenience was the main subtheme of the responsiveness dimension in the high-satisfaction group. The patients in the low-satisfaction group tended to live closer to the stroke prevention clinics, with an average distance of 13.53 (SD 11.57) km, than those in the high-satisfaction group (mean 19.03, SD 17.61 km). Even though they were less likely to drive and had some communication barriers (more likely to have language barriers or hearing impairments), convenience was not a positive factor influencing their satisfaction. Our content analysis supported that convenience, by saving time, travel, and energy, influenced patients' positive perceptions of the personal benefits of home-based teleconsultation during the pandemic [31]. Our findings were consistent with those of studies conducted before the COVID-19 pandemic [44]. A systematic review of digital experience also found that convenience is one of the motivating factors contributing to a positive digital patient experience [45]. The convenience of home-based teleconsultation is an influential factor in swaying patients' satisfaction with service quality to the positive side and their preference for teleconsultation [31]. However, convenience is not equivalent to good quality of care. We need to consider the effect of convenience when assessing patients' preferences and evaluating patient satisfaction with the service quality of home-based teleconsultation.

Second, the empathy dimension was a significant factor in both the quantitative and qualitative analyses. Dissatisfaction feedback in the empathy dimension was found in both the low and high-satisfaction groups. Our study participants used mostly the telephone modality, where the lack of nonverbal cues may be associated with a profound concern about the lack of personal connection, which is the primary subcategory of the empathy dimension. As indicated by existing studies, the replacement of interpersonal connection and a lack of physical human contact are negatively associated with digital patient experiences [45]. The literature shows that empathy can have powerful

effects on positive patient outcomes and satisfaction [46,47]. There is a concern that the digitalization of health care services could primarily lead to a decrease in the expression of empathy [46]. A study on patient satisfaction with tele-obstetric care found that a desire for personal connection via face-to-face interaction with a clinician was a critical motivation for selecting in-person versus teleconsultation care modalities [48]. Our findings are in line with those of the previous literature. The lack of personal connection in our content analysis could explain the negative relationship between the empathy dimension and dissatisfaction. An interesting finding from our content analysis was that even 98% (81/83) of the participants in the high-satisfaction group used the telephone modality; they expressed overwhelmingly more positive than negative comments (34 vs 12) on the empathy dimension. The clinician's empathy skills may significantly enhance patient experiences even with a low-technology modality. Empathy skill training for clinicians, primarily through computer-mediated communications, is a key area to study in the future [46].

Third, although the assurance dimension was not found to be statistically significant between the low- and high-satisfaction groups, this was likely due to no real difference between the 2 groups. Our content analysis indicated that the assurance dimension was one of the most important SERVPERF dimensions in both the low- and high-satisfaction groups. The subcategories raised from the content analysis revealed that the patients' concerns in the assurance dimension were the missing clinical components—especially physical examination—and inadequate communication. The view of the inferior quality of a remote examination among clinicians was dominant in outpatient neurology teleconsultation before the COVID-19 pandemic [49]. This is likely why most teleconsultations were performed for follow-up patients with chronic neurological diseases before the COVID-19 pandemic [50]. Compared with before the COVID-19 pandemic, home-based teleconsultation has been widely used in both new and follow-up patients at home without the luxury of having a health care professional assisting a teleconsultation since the COVID-19 pandemic [31]. The lack of a physical examination and inadequate communication could impede the clinician's ability to diagnose and formulate a treatment plan, especially for new patients [31]. In addition, the use of video is more challenging than the use of a telephone because of the rapid adaptation and lack of preparation. According to the Ontario stroke prevention clinic web survey, nearly half of the clinics use only the telephone [42]. Video consultations enable a certain degree of remote examination and may facilitate better communication, whereas telephone-only visits limit clinical assessment and communication. Telephone consultations lack body language and physical prompts, which could negatively affect the

communication between the clinician and patient. However, most of the participants in our study used telephone consultations (107/110, 97.3%), and their overall satisfaction was high (3.9/5). Future studies could consider patient satisfaction when using a telephone-only modality for new referrals in this patient population under normal circumstances.

The appropriateness of patient selection is a critical factor in high-quality home-based teleconsultation from patients' perspectives. Our statistical findings indicated that patients who required help from their SDM to consent and answer the survey were positively associated with dissatisfaction. The SDM may have chosen a web survey, as the participants had difficulty answering a telephone survey because of language barriers, hearing impairments, or communication difficulties from residual stroke symptoms (such as aphasia, apraxia, or mild cognitive impairment; Table 5). Moreover, the patients who needed their SDM to consent and help them answer the survey scored significantly lower in the tangibles dimension, which may indicate that the participants had low comfort levels with technology and technical difficulties even with the telephone modality. The consent from an SDM has many unknown characteristics and requires further exploration in future research.

Similarly, the analysis showed that there were no statistically significant differences in the reliability dimension between the low- and high-satisfaction groups. However, it is important to note that issues primarily related to administration, which fall under the reliability dimension, had a negative impact on both the low- and high-satisfaction groups. This possibility aligns with findings from a scoping review that the lack of proper administrative support has harmed clinicians' teleconsultation satisfaction [31]. Our findings indicate that it also negatively affects patient satisfaction. Some of the low satisfaction may be due to the abrupt change to teleconsultation because of the COVID-19 pandemic and the lack of clinical and patient preparation. We know that some administrative problems are not unique to home-based teleconsultation, as they occur during in-person visits. Home-based teleconsultation may have increased the workload by keeping pace with the transitioning workflow among telephone, video, and in-person visits, contributing to the maladaptation of home-based teleconsultation [51]. Establishing a new care pathway for home-based teleconsultation may streamline the administrative workflow.

The assurance, empathy, and reliability dimensions all had the most negative comments in both the low- and high-satisfaction groups, and the high-satisfaction group had the most positive remarks in

the assurance and empathy dimensions in the content analysis, which showed a double-edged effect. This finding might indicate that different key subcategories have buffer effects on improving patient satisfaction with the service quality of home-based teleconsultation. This may reflect the advantage of using both quantitative and qualitative data to provide diverse types of information [37]. By comparing them side by side, the qualitative analysis may provide insights to explain the quantitative findings.

3.5.2 The Future of Stroke Prevention Clinics' Service Delivery Mode

A combination of teleconsultation and in-person visits for outpatient stroke prevention care is the future. Our study showed that 45% (43/95) of participants were willing to use it and 18% (17/95) would consider using home-based teleconsultation in future nonpandemic conditions. A study examining patient preference for telehealth for nonemergent health issues after the COVID-19 pandemic concluded that patients were generally willing to use video but preferred in-person visits [52]. A patient-centered service should be delivered by offering the patient a choice [20]. Virtual care provides an opportunity to design a health system that is actually patient-centered [43]. A combination of in-person visits and home-based teleconsultation—a hybrid care model—could best meet patient needs by improving efficiency and capacity without added risk [53,54].

Hybrid care should be sustainable in practice settings to ensure patient care quality, equity, and justice [53]. To avoid increasing the digital divide, a telephone may be favorable instead of video calls for older patients and those with a lower education or income and from racial and ethnic minority groups [55]. However, we should refrain from creating a 2-tiered health care system in which high-income individuals receive video consultations and low-income individuals receive phone consultations. Patients should receive the right care in the right setting, at the right time, and with the right mode; the cost of the service should be reduced; and the best clinical practice guidelines should be followed [56]. Hybrid care could be a balanced approach to achieving a high-performance health care system. Patients can choose the best model by considering flexible options, and clinicians can offer individualized recommendations for optimal care modalities [54].

3.5.3 Limitations

Our study has several limitations. First, the cross-sectional survey only provides a snapshot of a phenomenon and cannot determine the temporal relationship between the dependent and independent

variables. Second, the participants in this study may not be generalizable to patients of other stroke prevention clinics in Ontario, notably in areas with different health resources such as urban versus very remote rural centers. In addition, the open-ended responses to the web survey were very brief, limiting our ability to gain a deeper understanding of their experiences. Next, as we surveyed patients who had had a home-based teleconsultation within 6 months, recall bias is possible [57]. Only patients who had a home-based teleconsultation in January 2021 and February 2021 received the survey 4 to 5 months later; the following patients received their survey 2 and a half months after the home-based teleconsultation on average (range 1-3 months). In addition, there is potential nonresponse bias, as web surveys usually have a low response rate [57]. A meta-analysis comparing web survey response rates concluded that the average response rate for web surveys was approximately 11% [58]. Our web survey had a 35.9% (104/290) response rate, and the telephone survey yielded a 44% (24/54) response rate.

Overall, although our study may only reflect part of the concept of satisfaction with service quality because of its complexity, it provided substantial insights into areas for quality improvements from patients' point of view. The literature suggests that patient satisfaction is a multidimensional concept that still needs to be fully defined. The patient satisfaction scores may reflect the demographic mix and clinical and psychological picture of the patients served by a medical service [59]. Our study attempted to use a theory-guided quantitative and qualitative analysis to reveal the relationship and explanation of such a complex phenomenon. Despite the problems of using patient satisfaction to assess service quality, its measurement provides unique information regarding the care process as seen through the patients' eyes [59]. Patients still provide the best source of accurate information on the care they receive [60]. In the absence of choice in public-funded health care, our survey gave patients a voice to indicate their preferences [21].

3.6 Conclusions

Our findings highlighted 2 crucial service quality dimensions (responsiveness and empathy) that were negatively statistically significantly associated with patient dissatisfaction. Moreover, we identified that a survey consented to by an SDM was positively associated with dissatisfaction. In addition, there were 4 subcategories related to patient dissatisfaction (missing clinical activities, inadequate communication, administrative process issues, and absence of personal connection). We anticipate that appropriate patient selection, consideration of patient preferences, a streamlined home-

based teleconsultation administrative workflow, and a competent clinician with communication and empathy skills are essential for achieving high satisfaction with home-based teleconsultation. These factors could be considered when designing home-based teleconsultation services to enhance patient experiences of stroke prevention care.

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Chapter 4 Developing Indicators for Home-based Teleconsultation in Secondary Stroke Prevention: A Modified Delphi Study

Status: submitted to Stroke for review.

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The scoping review in this thesis served as the foundational analysis, identifying critical service process factors that shape both patient and clinician experiences in home-based teleconsultation within outpatient neurology services. These findings highlighted the need for improvements in triage processes and the standardization of virtual care pathways to optimize home-based teleconsultation, particularly in a post-COVID healthcare environment. However, while the scoping review laid the groundwork, it also revealed a significant gap in research: the lack of understanding around patient satisfaction with home-based teleconsultation in specific contexts, such as stroke prevention services.

In response to this gap, we conducted a patient satisfaction survey that focused on home-based teleconsultation in secondary stroke prevention clinics. Building on these insights, the patient satisfaction survey further highlighted that dimensions such as responsiveness and empathy were vital determinants of patient satisfaction, while dissatisfaction often stemmed from technical problems, incomplete clinical assessments, and a lack of personal connection. These findings underscored the importance of adopting a more patient-centered approach in home-based teleconsultation services for secondary stroke prevention. These findings provided a clearer understanding of patient expectations and experiences, reinforcing the need for actionable changes in service delivery.

Despite identifying these important service dimensions, no established quality indicators existed for measuring the performance of home-based teleconsultation in Ontario's secondary stroke prevention clinics. Building on the findings from both studies, the development of quality indicators is now the essential next step in our research journey. The third study employed a modified Delphi method to develop and rate quality indicators (QIs) that address both clinical relevance and patient orientation. This approach allowed for the development of QIs that measure aspects such as technical reliability, triage accuracy, and the effectiveness of communication and responsiveness during home-based teleconsultations. Moreover, the introduction of the six domains of healthcare quality—including safety, effectiveness, and equity—in Study 3 provided a more holistic and outcome-focused

framework that extends beyond the service quality dimensions explored in the first two studies. This framework strengthens the development of well-rounded indicators, ensuring that home-based teleconsultation not only meets patient expectations but also achieves critical clinical outcomes such as prevention of recurrent strokes and risk factors management. Ultimately, these indicators will enhance the quality and consistency of home-based teleconsultation services in secondary stroke prevention clinics.

To summarize, the scoping review highlighted the service process factors that influence the quality of teleconsultation, while the patient satisfaction survey provided valuable insights into patient perspectives. Both studies underscore the urgent need for improvements in home-based teleconsultation, particularly in stroke prevention clinics. The development of quality indicators will allow us to transform these research findings into actionable, measurable standards that can guide the future of home-based teleconsultation services and ensure consistent, patient-centered care. This chapter focuses on the process of developing these indicators, marking a crucial step in refining home-based teleconsultation practices. This chapter begins with the study's abstract, followed by the full-text manuscript.

4.1 Abstract

Background: Since the onset of COVID-19, many Ontario Stroke Prevention Clinics (SPCs) have integrated home-based teleconsultation to various degrees. Currently, there are no quality indicators to measure the quality of home-based teleconsultation. Therefore, this study aims to identify a set of quality indicators for home-based teleconsultation using a Delphi approach with SPCs staff.

Method: The study employed a three-phase modified Delphi method to identify potential quality indicators for home-based teleconsultation for Stroke Prevention Clinics (SPC). Initially, we conducted a literature review and held a focus group meeting with clinicians from Ontario SPCs experienced in home-based teleconsultation. Utilizing a six-domain healthcare quality framework, we performed qualitative content analysis on the literature review and focus group discussions to generate an initial list of quality indicators. These indicators were then assessed by panelists across two survey rounds, focusing on their clinical relevance and patient orientation. We established group consensus by applying the Average Percent of Majority Opinion (APMO) cut-off rate to statistically validate the results.

Results: The synthesis of the literature review and focus group discussion initially identified 15 potential quality indicators. Four clinicians representing three different SPCs participated in the focus group. In the first survey round, we received responses from 13 participants across 13 SPCs, accounting for 32% (13/41) of Ontario SPCs. Following two rounds of the survey, nine quality indicators were confirmed through group consensus by the end of the process. The top five QIs identified as most clinically relevant and patient-orientated are: 1) patients' feedback in understanding after teleconsultation, 2) clinics use a virtual triage algorithm for new referrals, 3) patients received their preferred model of consultation, 4) patients revisited ED or admitted to hospital for recurrent stroke within 30 and 90 days after using home-based teleconsultation, and 5) patient was given the choice of modality.

Conclusions: The study establishes a set of patient-orientated and clinically relevant quality indicators, developed through expert consensus, that are designed to enhance decision-making, support home-based teleconsultation, highlight variations across different models of care, and improve patient safety and overall quality of care.

4.2 Introduction

4.2.1 Teleconsultation in Secondary Stroke Prevention Care

Stroke is the second leading cause of death and disability globally, with 90% of strokes attributable to ten major modifiable risk factors [1]. The 2010 Canadian Community Health Survey indicated a rising trend in vascular risk factors: over 7% of Ontarians reported having diabetes, 52.6% were classified as overweight or obese, and 17.6% reported hypertension [2]. More recent projections from the 2020 US Census anticipate a continued increase in these risk factors [3]. By 2060, the incidence of stroke is expected to rise by 33.8% compared to 2025, potentially affecting 15 million individuals [3]. Therefore, reducing exposure to vascular risk factors is crucial for both primary and secondary stroke prevention, leading the World Stroke Organization to prioritize stroke prevention as its main advocacy focus [1].

Ontario Government funds 11 Regional Stroke Networks with 41 secondary stroke prevention clinics (SPCs) as vital parts of its health systems [4]. These SPCs offer rapid assessments, diagnostic tests, treatments, prevention, and education to reduce the risk of recurrent stroke [5]. Prior to the COVID-19 pandemic, stroke prevention services in Ontario SPCs were primarily delivered through

in-person consultations. Teleconsultation was limited to specific rural and northern regions, enabling community-based stroke rehabilitation or secondary prevention services for patients attending local satellite clinics [6]. Home-based teleconsultation, involving synchronous telephone or video consultation between healthcare providers and patients at their home, offer diagnostic or therapeutic advice to support secondary prevention assessment, management and ongoing follow-up for individuals who have experienced a stroke, or transient ischemic attack [7,8].

The earliest documented instance of SPC home-based teleconsultation was a pilot study conducted by a regional stroke centre for southeastern Ontario, which implemented follow-up home-based video visits from August 2018 to September 2019 [9]. However, the COVID-19 pandemic necessitated a rapid adoption of telemedicine for outpatient medical care, resulting in 97% of the SPCs integrating some form of home-based teleconsultation in 2020-2021[10]. Some SPCs have continued to this practice routinely post-pandemic. Despite its prevalence, the quality of these teleconsultation services within SPCs has yet to be thoroughly evaluated.

4.2.2 Quality Indicators in Stroke and Secondary Prevention Care

Quality indicators (QIs) are essential tools for evaluating healthcare system performance and quality, highlighting both positive changes and unintended consequences of improvement efforts [11]. The National Health Service describes QIs are 'items that patients, caregivers and professionals believed were important in achieving the benchmarks of best practice' [12]. In stroke care, QIs are primarily developed for and implemented within acute in-patient settings. However, a comparative analysis across six European countries has revealed significant variability in acute stroke services, underscoring the need to develop QIs that cater to specific population subgroups to optimize care delivery [13]. This variation makes it crucial to create QIs specifically for outpatient stroke prevention care.

Nationally, the Canadian Stroke Best Practice Recommendation (CSBPR) were updated in 2021 to include 60 rigorously developed stroke related QIs via a Delphi process [14]. While most of these indicators target inpatient care, only seven are dedicated to secondary stroke prevention, and none addressed teleconsultation. In Ontario, provincial stroke prevention indicators were established in 2018 by the Stroke Prevention Provincial Integrated Working Group (SPPIWG), which developed 45 QIs, yet only one pertains to access to clinic-based telemedicine [15]. With no indicators specifically for home-based teleconsultation in stroke prevention care.

Furthermore, reporting on these indicators has been suboptimal. CorHealth Ontario's most recent report for the fascial year 2019 to 2020 documented 30 indicators across four categories: prevention and public awareness, hyperacute care access and outcomes for ischemic stroke, acute care access and outcome for stroke and transient ischemic attack, and post-acute stroke rehabilitation access and timelines [5]. The only indicator for secondary stroke prevention service was the referral rate for stroke and TIA patients discharged from the emergency department [5]. The report illustrates the lack of comprehensive data from SPCs, which hinders a comprehensive evaluation of the access and effectiveness of SPC services. [5].

4.2.3 Study Aims and Research Question

This study seeks input from Ontario SPCs clinicians to develop and evaluate a set of QIs specifically designed to measure the quality of home-based teleconsultation. Our research question is: "What are the quality indicators for home-based teleconsultation in Ontario stroke prevention clinics?"

4.3 Methods

4.3.1 Study Design

Our study utilized a three-phase modified Delphi method to develop quality indicators for home-based teleconsultation in SPCs [16]. In Phase One, we reviewed evidence to guide a structured focus group discussion with SPC clinicians. Phase Two engaged SPC clinicians in identifying quality considerations and key indicators, culminating in the formulation of a preliminary list of QIs. Phase Three implemented a two-round Delphi survey, enabling us to refine these indicators and achieve a consensus among the group on the finalized set of QIs.

4.3.2 Conceptual Framework Used in Healthcare Quality and Quality Measures

In our study, we adopted a modified healthcare quality framework that combines the Donabedian model with six domains of Healthcare Quality Framework (Figure 4-1) [17]. Donabedian's structure, process, and outcome framework is widely utilized in developing QIs and is endorsed by Health Quality Ontario [18]. Structural indicators assess the characteristics and resources that influence and facilitate delivery of care [18]. The process indicators assess the activities involved in providing care [18]. Outcome indicators measure the end results of the care provided [18]. The six domains of healthcare quality are: safe (avoiding harm to patients from the care intended to help them), effective

(providing services based on scientific knowledge to all who could benefit); efficient (avoiding waste of equipment, supplies, ideas, and energy), patient-centered (providing care that is respectful of and responsive to individual patient preferences, needs, and values), equitable (providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status), and timely (reducing waits and sometimes harmful delays) [19].

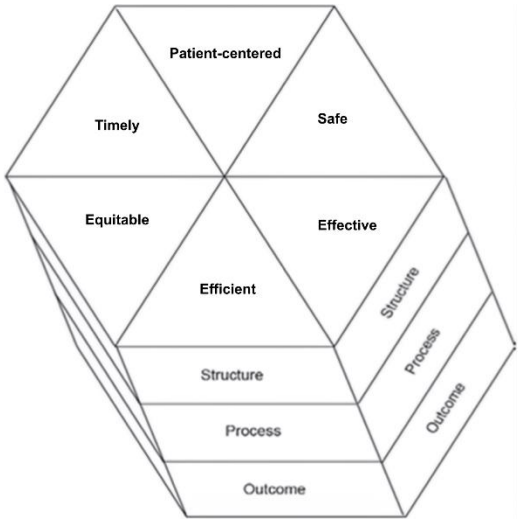

Figure 4-1. A modified healthcare quality framework in developing quality indicators [17]

4.3.3 Panel Selection

The expert panel was selected based on their expertise in secondary stroke prevention and experience with home-based teleconsultation. The study was introduced during a meeting of the Stroke Prevention Provincial Integrated Working Group (SPPIWG). Following this, invitation emails were distributed to potential panelists by the chairs, who forwarded these to their respective regional stroke coordinators (Appendix C File S1). The anonymity of the panelists was maintained throughout the Delphi surveys. Informed consent was obtained upon acceptance of the invitation to participate in the study (Appendix C File S2).

4.3.4 Ethics

The study received ethics clearance from the University of Waterloo Research Ethics Board (REB#43018, #45727).

4.3.5 Modified Delphi Methods

4.3.5.1 Defining the scope

Before commencing the study, we set an objective to reach a group consensus on at least 50% of the proposed QIs. Achieving this threshold would eliminate the need for further re-rating of the same QIs. Consensus plays a crucial role and the most challenging task in Delphi methods [20,21]. Reported consensus levels in previous studies vary widely, ranging from 51% and 100% [22]. For this study, we adopted the Average Percent of Majority Opinion (APMO) cut-off rate.

4.3.5.2 Data sources

4.3.5.2.1 Phase one: preparation

Phase One aimed to map current evidence on the quality characteristics of home-based teleconsultation, thereby establishing a comprehensive knowledge base for the focus group meeting. We examined national-level Canadian and Ontario SPC virtual care documents, including a scoping review and the SPC patient satisfaction survey of home-based teleconsultation [23,24]. To incorporate clinicians' perspectives, we conducted a secondary analysis of the SPCs clinicians' virtual care survey, which was administrated by the SPPIWG in June-July 2021.

4.3.5.2.2 Phase two: focus group

Phase One data synthesis led to the creation of two patient personas, along with a round table agenda, pre-reading documents and guiding questions (Appendix C Figure S1, S2, and File S3). After obtaining informed consent from the participants (Appendix C File S4), we conducted a 60-minute Zoom meeting.

4.3.5.2.3 Delphi survey development

The first round of survey was developed using the QIs identified in Phase One and Two (Appendix C File S5). We evaluated the QIs against three criteria: 1) clinically relevant: indicators should directly impact patient care and be valued by clinicians; 2) patient-orientated: indicators should reflect patient experiences, outcomes and satisfaction, enhancing patient care; and 3) feasible: indicator should be measurable without significantly increasing clinicians' workload. Data were collected using a 5-point Likert scale, from 1 (least important) to 5 (most important). REDCap (Research Electronic Data Capture), hosted at the University of Waterloo, was used for secure data management [25]. Upon

analyzing the data from the first survey, the second round of survey was crafted (Appendix C File S6). Data of this study are requested from the corresponding author.

4.3.5.3 Delphi sample size

The panel was composed entirely of clinicians experienced in home-based teleconsultation within the past year (November 2022-2023 post pandemic). They were all from Ontario SPCs, as a homogenous group. Literature suggests that the appropriate sample size for such a group range from 8-15 [26,27]. As a result, our study targeted recruiting between 8-15 participants.

4.3.5.4 Qualitative data analysis

We utilized Excel ® 2018 (Microsoft) and NVivo ® (QSR International) to organize and support the qualitative data analysis. Direct content analysis was used to understand the quality considerations of home-based teleconsultation. We used six domains of healthcare quality and their operational definitions as the initial coding categories [29]. GM coded the entire dataset, and S-FT independently coded a portion of the dataset, including 20% document analysis, 10% SPC clinician survey narrative comments, and 46% of the focus group transcriptions. Initial agreement rates were high: 91.4% for document review, 95.2% for the clinician survey, and 92.3% for focus group transcripts. The coding discrepancies were resolved by refining the code definitions. Key quality considerations identified in Phase One were developed into subcategories. In Phase Two, we compared and combined data across sources for triangulation [30], seeking convergence and corroboration through different data sources and methods [31].

After synthesizing data from Phase One and Two, we employed Brunswik's Lens Model to develop QIs. The Lens Model is instrumental in ensuring content validity [32]. Within this framework, the construct of interest is the quality of care regarding home-based teleconsultation at the SPCs. We organized the content into six domains of healthcare quality and the corresponding subcategories derived from the data. This set of QI encompasses relevant subdomains and content domains (Appendix C Figure S3), ensuring alignment with the defined construct of interest.

4.3.5.5 Statistical analysis

The data was analyzed using IBM SPSS version 27. First, a descriptive analysis was conducted to calculate percentages of the demographic information of each panel member. In the Delphi method,

the results are analyzed independently in each round. The percentages of responses were calculated in accordance with the consensus analysis method of APMO [33].

$$\text{APMO}= \frac{\#\ of\ majority\ agreement\ responses + \#\ of\ majority\ disagreement\ responses}{Total\ participants\ responses} \times 100\%$$

Agreement was defined as responses between 3 and 5 on the Likert scale, while disagreement was defined as responses of 1 and 2. For the purposes of computation, a statement was considered as agreed if the majority (>50%) of panel members responded with a score between 3 and 5. Conversely, a statement was considered to have achieved disagreement if the majority (>50%) of panel members responded with a score of 1 or 2.

4.4 Results

The focus group included four female clinicians from three Ontario SPCs. The first round of survey received responses from 13 SPCs, representing 31.7% of Ontario SPCs, as shown in Table 1. The respondents were nurses (53.8%, 7/13), neurologists (23.1% 3/13) and administrative staff (23.1%, 3/13). The second round of survey achieved a response rate of 92.3% (12/13). The detailing Delphi process is presented in Figure 4-2.

Table 4-1. Demographic of the participants of the round one survey

Demographics	**N =13 (%)**
Position	
Nursing	7 (53.8%)
Registered Nurse	5 (38.5%)
Clinical nurse specialist	1 (7.7%)
Nurse practitioner	1 (7.7%)
Neurologist	3 (23.1%)
Administrative (Manager /Clerk)	3 (23.1%)
Age Group	
<30	0
30-39	3 (23.1%)
40-49	6 (46.2%)
50-59	2 (15.4%)
>60	2 (15.4%)
Gender	
Male	3 (23.1%)
Female	10 (76.9%)
Education	
College	5 (38.5%)
Bachelor	3 (23.1%)

Master	2 (15.4%)
MD	3 (23.1%)
Years of experience in stroke speciality	
<1	1 (7.7%)
1-5	6 (46.2%)
6-10	2 (15.4%)
>10	4 (30.8%)

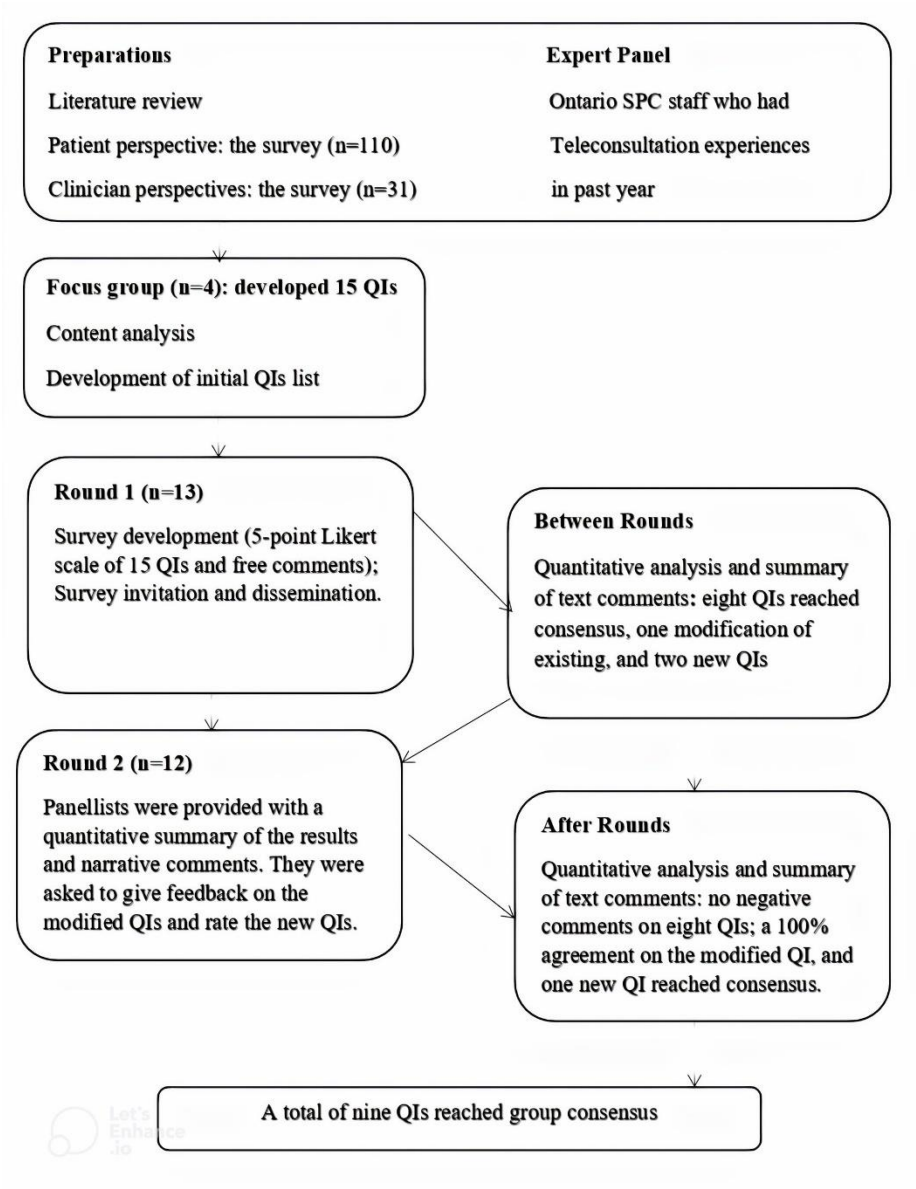

Figure 4-2. Delphi process flowchart

4.4.1 Phase One Results

In Phase One, we reviewed 10 Canadian national virtual care documents (Appendix C Table S1, S2), the current CSBPR and virtual care tool kits, three Ontario SPC provincial documents, along with our previous scoping review, the SPC patient satisfaction survey (N=110), and the SPC clinician virtual care survey (N=31). The content analysis of the preparation phase yielded 13 subcategories of quality considerations for home-based teleconsultation across six domains of healthcare quality framework (Table 4-2).

Table 4-2 Data Synthesis of Current Evidence

Quality domains	Quality Considerations
Safe Avoiding harm to patients from the care that is intended to help them	Appropriate model of care • Clinical appropriateness • Appropriate patient selection
	Clinicians' teleconsultation competency
Effective Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit	Clinical effectiveness: • Stroke risk factor management • Diagnostic accuracy • Etiology identification
	Communication effectiveness
	Technical effectiveness
Efficient Avoiding waste, including waste of equipment, supplies, ideas, and energy	Workflow integration: • Administrative support • Patient preparation
	Financial and logistic impact on patients and family
Patient-centred Providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions	Patient preference
	Patient clinician relationship
	Patient satisfaction
Equitable Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status	Social determinants of health[1]
	Digital determinants of health[2]
Timely Reducing waits and sometimes harmful delays for both those who receive and those who give care	Access within the target time

[1]Social determinants of health are defined by the Centers for Disease Control and Prevention as "conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks [34].

[2]Digital determinants of health are conditions in the digital environment that affect a wide range of health, functioning, and quality of life outcomes and risks [35].

4.4.2 Phase Two Results

Eleven subcategories were identified from the content analysis of the focus group meetings that supported the findings from Phase One. However, two subcategories - clinician teleconsultation competency and financial and logistic impact on patients and families – were considered less crucial by the clinicians. The perspective likely stems from the absence of physicians and patients in the focus group. In our effort to develop a balanced set of quality indicators, we decided to retain the subcategories of clinician teleconsultation competency in the early stage of QI development to ensure a comprehensive evaluation of quality.

We further explored the quality indicators raised in the discussion. The group emphasized the significance of indicators that capture the patient-centeredness of care by understanding patients' preferred care mode. The participants proposed linking patient satisfaction with patient preference indicators to assess whether teleconsultation improves patient experiences. They also recommended correlating them with clinical outcome indicators to determine whether patient preference enhances patient outcomes. Additionally, the group noted the importance of offering patients choices in care mode, highlighting discrepancies between centres in their approach post-COVID-19. One participant from a resource-rich centre remarked, "we never give patients a choice," as their centre has reverted to in-person consultation for all new patients after COVID-19, discouraging teleconsultation. Conversely, two participants from a rural centre primarily offered video consultations with limited in-person visits. Such indicators, participants noted, could inform evidence-based decision-making in health resource allocation by identifying gaps in resource distribution.

This discussion extended to evaluating technology and clinical effectiveness, such as the frequency of switching from video to telephone consultations and the necessity for technical support. The significance of pre-visit preparation was also emphasized as crucial for effective teleconsultation.

After integrating these insights with Phase One findings and employing the Lens Model, we developed 15 QIs aimed at enhancing the quality of home-based teleconsultation in SPCs, detailed in Appendix C Figure S3 and Table 4-3.

Table 4-3 Proposed 15-QIs for Improving Home-Based Teleconsultation Quality in SPCs

Content domains	**Subdomains**	**Related QIs**	**Calculation**
Safe Avoiding harm to patients from the care that is intended to help them	Clinically appropriateness	(Y/N) The SPC uses a virtual triage algorithm for new referrals.	Yes/No
	Training certification	(Y/N) The staff had teleconsultation training or certification.	Yes/No
Effective Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit (avoiding underuse and misuse, respectively)	Clinical effectiveness	(Y/N) Teleconsultation clinical outcomes are compared to in-person visit.	Yes/No
	Communication effectiveness	(Y/N) Collecting patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsultation.	Yes/No
	Technical effectiveness	Proportions of video converted to telephone monthly.	Numerator: number of video visit converted to telephone monthly. Denominator: Total numbers of patients had video visit monthly.
		Proportions of video consult requires technical support monthly	Numerator: number of video visits requested IT support monthly. Denominator: Total numbers of video visits monthly.
Efficient Avoiding waste, including waste of equipment, supplies, ideas, and energy.	Financial & logistic efficiency	Not included in this study.	NA
	Workflow	(Y/N) The SPC uses a patient intake checklist for teleconsultation.	Yes/No
		(Y/N) The SPC uses a patient pre-visit checklist for teleconsultation .	Yes/No
Patient-centred Providing care that is respectful of and responsive to individual	Patient preference	Proportions of patients who have been given the choice of teleconsultation monthly	Numerator: number of patients was given a choice of teleconsultation monthly. Denominator: Total numbers of patient visits monthly.

patient preferences, needs, and values and ensuring that patient values guide all clinical decisions.		Proportions of patients who received their preferred model of consultation monthly	Numerator: number of patients expressed their preference for model and actually received their preferred mode of care monthly. Denominator: Total numbers of patient visit monthly.
	Therapeutic relationship	(Y/N) Collecting patient perception of therapeutic relationship after teleconsultation	Yes/No
Equitable Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status.	Social determinants of health	Proportions of patients were unable to receive video consults due to language barrier, physical or cognitive impairment.	Numerator: Number of patients who did not receive teleconsultation after was deemed clinically suitable by reason categories: 1. Language barrier 2. Physical impairment 3. Cognitive impairment Denominator: Numbers of patients that are clinically appropriate for teleconsultation monthly.
	Digital determinants of health	Proportion of patients unable to receive video consults due to barriers to access or use technology.	Numerator: Number of patients who did not receive video consult after was deemed clinically suitable by reason categories: 1. No equipment or internet connection 2. Not have technical knowledge or confident Denominator: Numbers of patients that are clinically appropriate for teleconsultation monthly.
Timely Reducing waits and sometimes harmful delays for both those who receive and those who give care	Meeting target timeline to access SPCs	Proportions of patients were seen within target time as per Canadian Stroke Best Practice Recommendations using teleconsultation.	Numerator: Number of patients were seen via teleconsultation from referral received until seen at the SPC within the recommended target time monthly. Denominator: Total number of patients were seen within the recommended target time visit monthly.
		Proportions of patients had initial consults within the target time using video.	Numerator: Number of patients were seen via video from referral received until seen at the SPC

			within the recommended target time monthly. Denominator: Total number of patients were seen via teleconsultation as initial visit within the recommended target time monthly.

4.4.3 Phase Three Results

4.4.3.1 Round one results

Eight QIs achieved group consensus, with the APMO of 83.2% (312/375 x 100% = 83.2%) (Appendix C Table S3), surpassing the APMO threshold of 50%. The group expressed difficulty in rating the feasibility of data collection, underscoring the need for a provincial database and the integration of QIs into electronic health records. As a result, the feasibility rating criterion was removed in the subsequent round. The group provided insightful feedback on modifying a QI within the timely domain, including rationales for these changes. Based on the group's narrative feedback, two new QIs were introduced in the next survey round.

4.4.3.2 Round two results

All participants (12/12) unanimously agreed on the proposed modification to the QI in the timely domain. The feedback on achieving round one consensus and the removal of the feasibility criterion was favourable. The participants described the consensus-reaching QIs as “useful,” “sensible” and “relevant” from both clinical and administrative perspectives. Additionally, one of the two newly introduced QIs in the effective domain also reached group consensus. In total, nine QIs achieved group consensus (see Table 4). The patient-centred domain contained the most QIs, covering aspects such as patient preference, the perceived therapeutic relationship, and offering patients choices.

Table 4-4 The grouping of nine identified teleconsultation-specific QIs in the six domains of healthcare quality and healthcare quality measures

Six domains of healthcare quality	**QIs**	**Types of healthcare quality measures**	**Clinically relevant % of agreement**	**Patient-orientate % of agreement**
Safe	(Y/N) The SPC uses a virtual triage algorithm for new referrals.	Structure	84.6	100

Avoiding harm to patients from the care that is intended to help them.				
Effective Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit (avoiding underuse and misuse, respectively).	Proportion of patients with TIA/stroke were revisited ED or admitted to hospital due to recurrent stroke within 30 and 90 days after using teleconsult modalities[1].	Outcome	88.9	90.9
	(Y/N) Patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsultation.	Outcome	92.3	100
Patient-centred Providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions.	Proportions of patients who received their preferred model of consultation monthly.	Process	92.3	92.3
	(Y/N) Collecting patients' perception of therapeutic relationship after teleconsult.	Outcome	84.6	84.6
	Proportions of patients who have been given the choice of teleconsult monthly.	Process	83.3	92.3
Efficient Avoiding waste, including waste of equipment, supplies, ideas, and energy.	(Y/N) The SPC uses a patient pre-visit checklist for teleconsult.	Structure	83.3	91.7
Equitable Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status.	Proportion of patients were unable to receive video consults due to barriers to access or use technology.	Process	83.3	91.7
Timely Reducing waits and sometimes harmful delays for both those who receive and those who give care.	Proportion patients were seen within targeted time as per Triage Algorithm for Stroke Prevention Clinic Referrals[2] when using teleconsult[3].	Process	83.3	91.7

[1]The new quality indicator that reached the group consent.

[2]CorHealth, 2022. Triage Algorithm for Stroke Prevention Clinic Referrals [36]

[3]The modified quality indicator that reached the group consent.

4.5 Discussion

Utilizing a modified Delphi technique, a panel of SPC experts achieved consensus on nine QIs for the quality measurement of home-based teleconsultation in secondary stroke prevention care. Secondary stroke prevention has been identified as a high priority for Ontario stroke care [37]. Currently, quality measures for home-based teleconsultation at the SPCs have yet to be implemented. Our study aimed to initiate this process by proposing a list of QIs for home-based teleconsultation derived from current research, clinical evidence, and clinician's perspective. To ensure the inclusion of multiple viewpoints, we incorporated patient and clinician surveys during phase one. A focus group meeting was conducted to validate the findings and provide feedback, potentially revealing the relationship and importance among the QIs. Due to the time constraint faced by frontline clinicians and concerns regarding the content validity of the QIs, we did not ask the panel to propose all QIs. Instead, we applied theoretical instruments to develop these QIs, thereby enhancing content validity [38]. We have detailed the literature and survey research results and discussed these findings with the focus group. Additionally, we identified potentially significant QIs for home-based teleconsultation in the focus group discussions. Lastly, the use of the Delphi technique strengthened the face validity of the QIs as it is generally defined within the sphere of subjective professional consensus [39].

The highest rated QI in our study is "Patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsultation." It is the healthcare provider's responsibility to deliver instructions that equip patients with the knowledge required for effective treatment compliance [40]. Treatment-related information significantly influences treatment compliance, disease control, hospitalization frequency, and healthy behaviours [41]. Measuring communication effectiveness is crucial to ensure desired health outcomes. The Agency for Healthcare Research and Quality reported that 40-80% of the medical information patients are told during office visits is forgotten immediately, and nearly half of the retained information is incorrect [42]. In the literature, the average teleconsultation consultation time is comparable or shorter than in-person visits [9,43]. A study examining the relationship between the self-perceived consultation time and the knowledge of the proposed treatment found that low self-perceived consultation time were associated with a poorer understanding of the prescribed treatment, whereas medium and high consultation times were linked to a better understanding [41]. The duration of teleconsultation, particularly telephone-only visits, may impact the patients' comprehension of the communication. This group consensus underscored the

clinician's concerns about communication effectiveness and highlighted the importance of measuring this QI to ensure the quality of home-based teleconsultation.

Not surprisingly, the patient-centeredness domain had the most QIs archived group consensus, including respecting preference, giving a choice and therapeutic relationship. Healthcare has transformed from a predominantly paternalistic model towards a pluralistic model, which aims to democratize decision-making, share understanding, and empower patients and their families [44]. Our results reflected the essence of patient-centred healthcare: that the healthcare system should be designed around patients, respecting personal preferences, values, and needs, and formulating system, organizational, and clinical-level tools to achieve this [45]. Studies showed that patient preference can significantly moderate the relationship between patient participation and trust [46]. Interestingly, our expert panel members agreed that the patient's perception of therapeutic relationships after teleconsultation is another important QI. The therapeutic relationship, often referred to as the therapeutic alliance, is foundational for effective healthcare outcomes [77]. It is built on trust, rapport, communication, and mutual respect [47]. Research has shown that a strong therapeutic relationship improves patient adherence to treatment plans, promotes open communication, and encourages patients to share vital health information, which leads to better outcomes [48]. The current literature on therapeutic alliance identifies several key constructs—collaboration, affective bond, agreement on goals, trust, and empathy—that are crucial in fostering a successful patient-practitioner relationship [49]. Future studies could explore the measurement of these constructs and their role in therapeutic relationships in home-based teleconsultation.

Patient preferences are a complex phenomenon. Our focus group discussion highlighted that while patients may not have their preferences granted, they can still be quite satisfied with the model of care provided. The participants felt that patient satisfaction indicators could link to patient preference indicators to determine whether the patient is genuinely satisfied with the service model they chose. Notably, patient preference does not necessarily lead to better health outcomes. Our goal is to offer patients the best quality of care and great experience. Patient preferences can be influenced by various social demographic factors, such as age, marital status and level of education [50]. Despite having preference, patients may face constraints such as longer wait time, transportation issues or caregiver availability, which may force them to choose against their initial preference. Additionally, health human resource constraints are a significant factor that limits patient choice, particularly in suburban areas.

Patient preference, a process indicator, is a critical component of the care process whose true values is realized when it is clearly linked to positive clinical outcomes [51]. By integrating patient preference indicator with clinical outcome indicators, healthcare systems can enhance evidence-based decision-making. This alignment helps identify areas where additional resources are necessary, ultimately optimizing health resource allocation to improve care delivery and patient satisfaction. Many focus group participants felt that home-based teleconsultation was a step down from in-person visits. The literature also reflects clinicians' concerns about clinical outcomes of teleconsultation, and that patients may find teleconsultation too convenient and opt out of recommended in-person visits [52]. By linking patient preference and clinical outcome indicators, our QIs may provide data to demonstrate that teleconsultation might be an effective alternative for delivering care with comparable or better outcomes in certain conditions.

The third highly rated QI pertains to the safety domain which is foundational in healthcare quality. Safety is a major concern for clinicians adopting teleconsultation during the COVID-19 pandemic [23]. The literature emphasizes ethical consideration surrounding teleconsultation during the pandemic [53]. Clinicians should assess the appropriateness of the home-based teleconsultation modality for each patient by evaluating the benefit and risks before deciding on the modality of care [53]. It is crucial to conduct a medical risk assessment and consider patients' individual circumstances to inform a personalized care plan and ensure the quality of care [54].

The quality of home-based teleconsultation is complex and cannot be interpreted by examining a single quality indicator in isolation. Each quality indicator must be considered within the broader context to provide an accurate assessment. When measuring safety, effectiveness, and timely access, we also must ensure that equity and patient-centeredness measures are in place. Our focus group participants emphasized that patient safety and communication effectiveness underscore the importance of language interpretation services when communicating with patients or family members whose primary language is not English. Healthcare organizations are committed to providing culturally responsive, equitable, and high-quality patient care. Effective communication is fundamental to achieving this goal. In a diverse and inclusive society, we must have the capacity to serve patients from various cultural and linguistic backgrounds. It is the responsibility of healthcare organizations and providers to ensure that language barriers do not hinder effective communication, compromise patient safety, or impede the delivery of high- quality care. Access to video interpretive service should be used in clinical settings and embedded within video consultation platforms. There

are pressing issues concerning patient safety, preference, equity, and clinical outcome within the current digital divide population; therefore, the quality of home-based teleconsultation should be measured immediately. It may become less critical as virtual care is increasingly accepted and becomes a common practice.

From the perspective of types of healthcare quality measures, this study's structure indicators focused on the system's readiness to effectively support patient care [18]. Key elements, such as the availability of a home-based teleconsultation triage algorithm and a patient pre-visit checklist, emerged as essential components for ensuring the efficient delivery of teleconsultation services. Furthermore, developing best practice guidelines for clinicians on home-based teleconsultation in secondary stroke prevention is crucial for ensuring its successful implementation in the future.

Process indicators, including patient preferences and access to technology, were identified as crucial in maintaining patient-centered and equitable care across diverse populations. Moreover, technology-related process indicators—particularly in the domains of equity and timeliness—may require age stratification to address digital inequities and the digital divide. This adjustment is vital to capturing the unique challenges older patients face in accessing and navigating home-based teleconsultation services. Similarly, equity process indicators should also account for ethnicity and racial background to ensure comprehensive representation. These considerations are critical for improving the accuracy of outcome measures and ensuring that teleconsultation services are both equitable and effective. Our findings underscore the importance of linking process indicators—such as patient preferences or access to technology—to outcome measures, particularly their perceived therapeutic relationship. This connection enhances treatment adherence and, in turn, improves clinical outcomes. Establishing this link is essential to validate which process indicators genuinely contribute to better clinical outcomes, especially in managing stroke prevention [51].

Finally, the study emphasized the importance of tracking outcome indicators related to home-based teleconsultation, such as patient-reported satisfaction, communication efficiency, and 90-day stroke recurrence rates. However, outcome indicators are influenced by various factors, including the patient’s medical condition, age, comorbidities, and the quality of care provided [51]. For example, a patient with undiagnosed high-grade carotid stenosis faces a significantly higher risk of stroke recurrence within 90 days, whereas a patient with a lacunar stroke due to hypertension typically has a

much lower risk. Future studies may need to consider specific stratifications to capture these differences more accurately. Overall, the alignment of structure, process, and outcome indicators is crucial for optimizing home-based teleconsultation services for stroke prevention. By ensuring that infrastructure supports efficient processes, and that these processes are connected to meaningful clinical outcomes, healthcare systems can enhance both the quality and effectiveness of home-based teleconsultation services. Overall, this set of home-based, teleconsultation-specific QIs is crucial for decision-making. Significant barriers to a large-scale adaptation of teleconsultation in outpatient neurology, as identified in the literature, include the need for more evidence of its efficacy and a clear understanding of its role in traditional practice [55]. During the COVID-19 pandemic, there was a perception among clinicians that home-based teleconsultation may decrease the standard of care in outpatient neurology clinics during COVID-19 [23]. The lack of standard best practice guidelines for teleconsultation among neurology sub-specialties has hindered the implementation of home-based teleconsultation, as clinicians felt an ethical and moral responsibility to provide high-quality care [23]. This perception is likely true in non-pandemic situations as well. The reluctance to adopt home-based teleconsultation in SPCs post-pandemic was evident. In our focus group meeting, a resource-rich regional stroke centre has ceased offering home-based teleconsultation for new referrals. There is a great need to measure the outcome of teleconsultation to aid decision-making regarding its implementation in stroke prevention care. The existing QIs for secondary stroke care should be applied to home-based teleconsultation with outcome measures remaining consistent regardless of service delivery modality. Our goal is to develop a set of home-based, teleconsultation-specific QIs to fill the existing gap, rather than reinvent the wheel.

To effectively measure the quality of home-based teleconsultation, a robust data collection system is essential. Currently, Ontario lacks a standardized system for collecting and reporting SPC QIs [15], and Electronic Medical Record systems do not capture data elements for secondary stroke prevention in Ontario. The diversity of EMR systems across Ontario hospitals – comprising 11 certified EMR vendors and 12 EMR products [56] - poses a significant challenge for data collection [57]. Achieving consensus on these QIs and establishing specific data collection points within the EMR system will enable local, regional, and provincial initiatives to bridge existing data gaps and utilize available components in current administrative datasets [15].

4.5.1 Limitation

Our study has several limitations. Firstly, the small sample size - four focus group and 13 survey participants – may limit the generalizability of the findings. The difficulty of recruiting frontline staff due to their time constraints posed a significant challenge. Additionally, relying on regional stroke coordinators to distribute the survey invitation added another layer of complexity in reaching potential participants. Secondly, the study also lacked broad stakeholder involvement, particularly direct input from patients and caregivers in developing these QIs. Future research should directly involve patients and caregivers in validating these QIs. Economically focused QIs were excluded from this study as the cost benefits of teleconsultation are well-documented [58,59]. Finally, the proposed QIs have yet to reach a consensus representing areas that could guide future clinical and fundamental scientific research.

4.6 Conclusion

The study used a modified Delphi method to develop and rate a list of home-based teleconsultation QIs for secondary stroke prevention care, with nine achieved group consensus. The nine QIs identified as most clinically relevant and patient-orientated are: (1) the SPC uses a virtual triage algorithm for new referrals; (2) proportion of patients with TIA/stroke were revisited ED or admitted to hospital due to recurrent stroke within 30 and 90 days after using teleconsultation modalities; (3) Patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsultation; (4) proportions of patients who received their preferred model of consultation monthly; (5) collecting patients' perception of therapeutic relationship after teleconsultation; (6) proportions of patients who have been given the choice of teleconsultation monthly; (7) the SPC uses a patient pre-visit checklist for teleconsultation; (8) proportion of patients were unable to receive video consults due to barriers to access or use technology; (9) Proportion patients were seen within targeted time as per Triage Algorithm for Stroke Prevention Clinic Referrals[2] when using teleconsultation. These IQs are specific to home-based teleconsultation and aim to guide practice and continuous quality improvement in secondary stroke prevention.

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Chapter 5 Conclusion

5.1 Summary of Key Findings

The key findings from the three papers on service quality of home-based teleconsultation are as follows: Firstly, the scoping review in Chapter 2 is the first study reviewing existing research to identify service process factors within home-based teleconsultation for outpatient neurology service during COVID-19. Our initial plan was to focus on the outpatient stroke population; however, despite the increased research on teleconsultation in outpatient neurology during COVID-19, we were unable to find studies specific to this group. This limitation led us to expand our research to include outpatient neurology services. This scoping review provided an extensive overview, identifying six key process factors affecting patients' and clinicians' experiences of home-based teleconsultation practices in outpatient neurology services: (1) technical issues, (2) triage, (3) logistical needs, (4) administrative support, (5) clinical activities, and (6) communication. Compared to the pre-COVID outpatient neurology teleconsultation literature, we identified two new findings: developing and implementing a new triage system model and defining gaps in an administrative workflow to incorporate home-based teleconsultation. The findings would set the groundwork for studies 2 and 3 in outpatient secondary stroke prevention services. The second study (Chapter 3) evaluates patient satisfaction with home-based teleconsultation services implemented during COVID-19 for secondary stroke prevention. The overall patient global satisfaction score of teleconsultations at SPCs was 3.9/5. Responsiveness, defined as the willingness to help patients and provide prompt service, and empathy, which involves individual care and attention, were significant predictors of higher patient satisfaction. Patients raised concerns about missing clinical activities, administrative issues, inadequate communication, and a lack of personal connection, which negatively impacted their satisfaction. Positive feedback was closely tied to assurance (clinicians' knowledge and competency), reliability (appropriate patient selection and triage), and empathy (clinicians' empathy skills). These results echoed findings from the scoping review, except for the empathy dimension. Our patient satisfaction survey revealed a statistically significant negative relationship between empathy and dissatisfaction, whereas the empathy dimension had the lowest coding frequency in the scoping review. Our survey participants had their teleconsultations from January to November 2021, compared to March to July 2020 in the scoping review. The timing difference may have influenced patients' perceptions of personal connection, as the fear of the virus decreased, and social distancing policies relaxed over

time. One unexpected and statistically significant finding was that surveys that were consented to and answered with the help of substitute decision-makers (SDMs), have many unknown characteristics that require further exploration. The patients who had their SDMs assist them with completing the survey tended to be older, lived closer to the clinic, were less likely to drive, and often faced language barriers, hearing impairments, or residual symptoms from stroke. These factors suggest the need for further investigation into the unique needs and characteristics of this patient subgroup.

The objective of the third study (Chapter 4) is to develop quality indicators for home-based teleconsultation in stroke prevention clinics using a modified Delphi method. Consensus was reached on nine quality indicators, emphasizing clinical relevance and patient orientation. These indicators cover various domains such as safety, effectiveness, patient-centeredness, and timeliness, reflecting comprehensive healthcare quality. Notably, there are more quality indicators (3 out of 9) focused on patient-centeredness. These include giving patients a choice, respecting their preferences, and measuring patient-clinician relationships, all of which achieved group consensus. The quality indicator with the highest consensus rating is communication effectiveness, which is essential in medical consultation. Effective communication ensures that patients receive accurate information about their treatment and adhere to it, ultimately achieving desired health outcomes. We also found that the quality of home-based teleconsultation cannot be assessed in isolation. When measuring safety, effectiveness, and timeliness, we must also ensure equity and patient-centredness.

Overall, the studies collectively underscore the critical need for well-defined quality measures and standards in home-based teleconsultation to enhance patient satisfaction and healthcare outcomes in secondary stroke prevention care. Both the scoping review and patient survey highlight the importance of effective patient selection and triage, efficient administrative workflows, meeting patients' logistical needs, clear communication, and addressing the impact of the lack of personal contact on the patient-clinician relationship in teleconsultation settings. These factors are crucial for improving service quality, patient experience and satisfaction levels. The selected quality indicators incorporate these service quality factors and, with the involvement of SPC staff, ensure that home-based teleconsultation services are safe, effective, efficient, accessible, equitable, and patient-centred for the stroke prevention patient population.

5.2 Study Strengths and Limitations

5.2.1 Study Strengths

Similarly, the strengths of each study have been discussed in the previous chapter. The overall strengths of this dissertation are detailed as follows. First, the dissertation strictly adhered to standardized methodologies, theoretical models, and frameworks in the research design, which offers several strengths that enhance the overall quality, reliability, and validity of the dissertation. Using standardized methodologies ensures that the studies can be replicated by other researchers, leading to consistent results. This consistency is critical for building a reliable body of knowledge [20]. Adherence to standardized methods facilitates the reproduction of the studies and the verification of findings by other researchers, thereby enhancing the credibility of the research [21]. Standardized methodologies also contribute to external validity by making the findings more generalizable to other settings and populations [22]. Theoretical models and frameworks help in establishing clear and testable hypotheses, improving the internal validity of the study by ensuring that it measures what it intends to measure [16]. The use of theoretical models and frameworks provides a structured approach to research, guiding the study design, data collection, and analysis processes, which helps systematically address the research questions [23]. Additionally, theoretical models assist in interpreting the findings within a broader context, making the results more meaningful and relevant to existing literature [24].

Second, the dissertation employed multiple methods, including both qualitative and quantitative approaches, to comprehensively understand the phenomenon. This multiple methods approach provides a more comprehensive understanding of the research phenomenon by triangulating data, thereby increasing the robustness of the findings [25]. The combination of various methods allows researchers to explore different dimensions of the phenomenon, offering both depth (through qualitative methods) and breadth (through quantitative methods) of insight [26].

Third, the dissertation established fundamental knowledge with real-world applicability and relevance. The studies are highly pertinent to the stroke prevention population and address significant knowledge gaps in current practice. Research with real-world relevance bridges the gap between theoretical frameworks and practical applications, ensuring that theoretical insights are translated into practical tools and strategies [27]. This approach fosters a comprehensive understanding of issues by

integrating theoretical perspectives with practical realities, leading to more effective and sustainable solutions [28]. By filling knowledge gaps, this research ensures that practices are grounded in the best available evidence, thereby enhancing the effectiveness and efficiency of interventions and policies [29].

5.2.2 Study Limitation

The limitations of each individual study have been outlined in the previous chapters. There are a few exceptions. First, a limitation of the patient satisfaction survey conducted during COVID-19 is the lack of direct comparison to patient satisfaction with virtual care before the pandemic. Although the survey provides valuable insights into patient experiences during the pandemic, it does not incorporate pre-pandemic baseline data from previous studies, which would have allowed for a more comprehensive evaluation of how patient satisfaction may have shifted over time. There was a lack of comparable pre-COVID-19 studies in assessing patient satisfaction of home-based neurology out-patient virtual care. Among patient satisfaction with virtual care studies conducted in Ontario prior COVID-19, some studies were provider (a primary care provider) to provider (a specialist) without patient direct interaction with the specialist which primary care providers to consult specialists electronically without needing in person consultation [30,31]. A recent email inquiry regarding patient satisfaction with Ontario's eConsult service revealed that they currently do not conduct patient satisfaction surveys for eConsult cases, and unfortunately, no report on this subject is available for their service. Other studies only evaluated the end user satisfaction with eReferral of providers or patients who were receiving email notifications about appointments and status updates, not for evaluation of patient satisfaction of the consultation [32-35]. Without integrating such pre-pandemic data, it is challenging to determine whether the pandemic-specific conditions, such as the necessity of home-based teleconsultation and increased familiarity with the technology, significantly influenced the higher satisfaction rates observed during COVID-19. This gap limits the ability to assess whether the current satisfaction levels represent an improvement over the past or are circumstantial due to pandemic-driven factors.

Based on the demographic data from the patient satisfaction survey, a key limitation is the absence of detailed information on the ethnicity and income levels of the participants, which may affect the generalizability of the findings. Without this information, the applicability of the results to more ethnically diverse populations—who may have different preferences or experiences with home-based

teleconsultation—remains uncertain. Additionally, the lack of income data could skew the findings regarding access to technology and comfort with virtual healthcare services, as individuals from lower socioeconomic backgrounds may face unique barriers. The study participants were primarily located in the northern part of the York Region in Ontario, Canada, with the vast majority (96-99%) speaking either English or French, and 49-60% of households reporting incomes over $100,000 [36-38]. Furthermore, the region experienced a population increase of 63,455 people between 2016 and 2021, with recent immigrants making up 84.4% of this growth, predominantly from China, Iran, and India [39]. The absence of comprehensive demographic data suggests that future research should include a broader and more representative sample to better capture the full spectrum of patient experiences with home-based teleconsultation.

When considering the dissertation as a whole, several overarching limitations emerge. The sample sizes for the patient survey and the modified Delphi study were relatively small. Low response rates, a common challenge in clinical studies, can significantly impact the validity and generalizability of research findings. It is often difficult for frontline clinicians and patients to commit the time necessary to complete extensive questionnaires [40]. Potential participants may not be adequately informed about the study or its importance [41]. Complex medical jargon and research procedures can also be confusing, leading to lower participation rates from patients [42]. Additionally, patients with severe medical conditions, family responsibilities, and work commitments may find it difficult to participate [43]. Low response rates can introduce selection bias, where the characteristics of participants differ from those who do not participate, potentially skewing the results [44]. A reduced sample size limits the statistical power of the studies to detect significant differences or associations [45]. Consequently, the internal and external validity of the studies could be compromised, reducing the reliability and generalizability of the findings [46].

Moreover, using data collected during the COVID-19 pandemic for home-based teleconsultation presents limitations when applying findings to post-pandemic settings. The studies in this thesis, focused on pandemic-era home-based teleconsultation, reflect a unique context driven by necessity rather than patient preference. Due to restricted in-person visits, teleconsultation became the primary option, which may have inflated satisfaction levels as safety was prioritized over other care elements [47,48]. Rapid adaptation to virtual platforms also created urgency, potentially influencing process and outcome indicators. In a post-pandemic environment, where teleconsultation is one option among

many, patient preferences and engagement could shift, particularly with the return of in-person care. Additionally, pandemic data may not fully address long-term challenges like digital equity, particularly for older patients or those with limited tech access. As such, future studies should re-evaluate patient preferences and outcomes in a more stable healthcare environment to ensure teleconsultation remains patient-centered and effective. Thus, while the pandemic-era insights are valuable, they must be interpreted with caution when making implications for post-pandemic care.

Additionally, as the researcher is a clinician actively working in one of the secondary stroke prevention clinics, there is a potential for insider bias in the research. This dual role presents both advantages and disadvantages, which can influence the objectivity and outcomes of the studies [49]. On the one hand, insider status offers advantages such as deeper contextual understanding, enhanced rapport with participants, and access to internal resources [49,50]. However, it also introduces risks. Subjectivity and confirmation bias may affect the interpretation of data, and pre-existing relationships could skew participant feedback due to perceived power dynamics [49,50]. To mitigate these issues, the studies employed methods like triangulation and the use of multiple data sources and methodologies to ensure research integrity and objective data analysis [50]. Additionally, the researcher deliberately avoided direct involvement in conducting patient telephone surveys in Study 2, reducing the influence of perceived power dynamics during data collection. This step further helped to safeguard the objectivity of the findings.

5.3 Contribution and Implications for Healthcare Practice and Policies

Overall, the dissertation has extensive implications for public health practice and policies. Scoping Review has provided a basis for policymaking by identifying evidence-based practices and knowledge gaps in service process factors that affect the patients' and clinicians' experiences in home-based teleconsultation during COVID-19. It suggested areas where policy needs to evolve to support expanding teleconsultation initiatives in outpatient neurology services. Healthcare policymakers must consider technology-enabled services to address the effects of digital and social determinants of health. Both political and community interventions are essential to ensure that appropriate support is in place and to mitigate the adverse effects of health emergencies and social health inequalities.

The findings of the patient satisfaction with home-based teleconsultation study highlighted the importance of responsiveness and empathy in teleconsultation services, suggesting areas for

developing virtual care workflow and training and development in teleconsultation competencies. Policy implications could include developing best practice guidelines for teleconsultation in secondary stroke prevention care to ensure these factors are integrated into best practice standards to improve patient outcomes and satisfaction. Best practice guidelines tailored to home-based teleconsultation will ensure that patients receive the right care in the right setting, at the right time, and in the right mode, while also aligning with the best clinical practice standards.

The modified Delphi study identified key quality indicators that can be instrumental in developing standards and protocols for teleconsultation services in secondary stroke prevention care. These indicators have the potential to influence telehealth policy decisions significantly. By focusing on patient safety, effectiveness, efficiency, patient-centredness, equity, and timely access, the study's findings could guide policy adjustments to integrate teleconsultation more effectively into routine in-person care. These insights offer robust measures for enhancing teleconsultation services, with significant implications for public health practice and policy formulation.

To measure the quality of home-based teleconsultation, an electronic data collection system is essential. Enhancing the feasibility of data collection should be prioritized with the development of the provincial eHealth system. If there is consensus that these quality indicators effectively measure the quality of home-based teleconsultation, it is crucial to establish data collection points within the EMR system. Implementing these measures will enable local, regional, and provincial projects to address existing gaps and leverage available data components in current administrative datasets [13]. Involving informaticists early in the QI project can significantly enhance system impact. Establishing health information systems for the ongoing maintenance and monitoring of quality indicators (QIs) is crucial to ensure the sustained impact of improvements.

5.4 Direction for Future Research and Practices

There are broad directions for future research in the field of service quality of adding home-based teleconsultation in routine in-person care models, service quality and patient satisfaction among aging population in digital care, especially digital health determinants and digital divide, and many values outside of stroke care. This dissertation will help inform a best practice model by guiding researchers, clinicians, and policymakers to design theory-informed teleconsultation services tailored to the needs of stroke prevention patients and clinicians. A combination of teleconsultation and in-person visits for outpatient stroke prevention care is the future. Virtual care provides an opportunity to design

a health system that is actually patient-centred. A combination of in-person visits and home-based teleconsultation—a hybrid care model—could best meet patient needs by improving efficiency and capacity without added risk [51,52]. Future research should investigate the sustainability of hybrid care in stroke prevention practice settings regarding service quality, equity, and justice [51].

Another important future research direction is examining the digital divide and service quality between telephone and video teleconsultation modalities. Telephone consultations may be more favorable for older patients, those with lower education or income, and those from racial and ethnic minority groups. Our scoping review revealed that older and vulnerable populations were simultaneously considered the most in need of teleconsultation, due to factors like disability or lack of access to transportation, and the least suitable for it, due to hearing, visual, or cognitive impairments. Our patient satisfaction survey indicated that patients whose SDMs consented and helped to answer their survey, were more likely older, to have a language barrier, hearing impairment, or residual deficits from their stroke. These patients were generally more dissatisfied with home-based teleconsultation. The consent from an SDM has many unknown characteristics and requires further exploration in future research. In addition, future research should include a broader and more representative sample to better capture the relationship between social determinant of health (such as age, culture, ethnicity and incomes), digital literacy and service quality with home-based teleconsultation. Moreover, future research should focus on mitigating the unfavorable factors and ensuring equity in digital care by addressing digital equity and digital literacy education for older adults and developing user-friendly system designs tailored to their needs.

Clinically, it is important to research and identify the essential components of in-person examinations that are crucial for the clinical decision-making process. Additionally, evaluating the effectiveness of remote physical examinations and family-assessed physical examinations is vital for improving teleconsultation practices. Next, a disease-specific virtual care triage algorithm is needed to assess patients' clinical appropriateness for home-based teleconsultation, addressing the diverse needs of various stroke subspecialty groups. Integrating teleconsultation seamlessly into the care pathway is essential for a streamlined and successful process. Our patient survey identified that clinicians' empathy skills significantly contribute to high patient satisfaction. Therefore, future studies should focus on empathy skill training for clinicians, particularly in the context of computer-mediated communications. This training could enhance the quality of teleconsultation services and improve patient experiences. Comprehensive, longitudinal studies are also needed to track the long-term

effectiveness and patient satisfaction with home-based teleconsultation in the secondary stroke prevention population.

The dissertation underscores the necessity for standardized measures to assess and enhance the quality of teleconsultation services. Future efforts should focus on integrating these QIs into practice, refining teleconsultation models based on patient feedback, and ensuring that home-based teleconsultations are accessible, equitable, and effective for all patient demographics. Additionally, future studies should validate and expand the selected QIs across various teleconsultation models in different patient populations. Future studies could explore the relationships between different QIs to identify moderators or mediators, such as patient preferences, therapeutic relationships, and clinical outcome indicators, in home-based teleconsultation. Additionally, the quality indicator of patient preferences is a complex phenomenon influenced by various social and demographic factors, making it worthy of further exploration. The above research could lead to evidence-based decision-making for the utilization of teleconsultation in secondary stroke prevention care.

Overall, the studies in this dissertation have identified service process factors and patient-identified factors that influence home-based teleconsultation experiences. Additionally, a preliminary set of quality indicators, specifically designed to measure the quality of home-based teleconsultation for secondary stroke prevention care, has been developed. The dissertation has successfully met its research objectives and answered the research questions. Moreover, it has significantly contributed to the existing body of knowledge, with the potential to transform current stroke prevention practices and improve the quality of secondary stroke prevention care for all patients.

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Appendix A

Chapter 2 Additional Files

Additional File 1

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1-2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	3-5
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	6
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address);	na

		and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	7
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	7-8
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	8
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	8-9
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	9
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	9-10
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	na
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	9-10

RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	10-13
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	11-13
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	na
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	13-16
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	16-20
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	20-30
Limitations	20	Discuss the limitations of the scoping review process.	30
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	31
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the	na

		scoping review. Describe the role of the funders of the scoping review.	

Additional file 2

Major search terms statements April 17, 2021

Virtual Consultation

Indexed Terms:

- Ambulatory Care (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Ambulatory Care Facilities (MH PsycINFO, MeSH)
- Distance Counseling (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Home Care Services (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Outpatients (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Remote Consultation (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Telehealth (CINAHL MW, Scopus INDEXTERMS)
- Telemedicine (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Teleneurology (CINAHL MW, Scopus INDEXTERMS)
- Telenursing (CINAHL MW, Scopus INDEXTERMS)
- Telestroke (Scopus INDEXTERMS, CINAHL MW)
- Videoconferencing (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)

Free-text Terms:

- Digital health
- eConsult
- eHealth
- electronic visit
- eVisit
- outpatient
- Remote care
- Remote consult
- Remote health
- Teleconsult
- Telehealth
- Telemedicine
- Teleneurology
- Telestroke
- Televisit
- Video Visit

- Virtual care
- Virtual health

Patient/Clinician Perspective

Indexed Terms:

- Attitude of Health Personnel (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Attitude to Health (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Job Satisfaction (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Nurse Patient Relations (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Outcome Assessment Health Care (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Outpatients (MH PsycINFO)
- Patient Preference (CINAHL MW, Scopus INDEXTERMS)
- Patient satisfaction (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Patient-Centered Care (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Personal satisfaction (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Physician Patient Relations (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Practice Patterns Nurses (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Practice Patterns Physicians (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Professional patient Relations (MH PsycINFO, MeSH)
- Professional-Client Relations (Scopus INDEXTERMS, CINAHL MW)
- Professional-Patient Relations (CINAHL MW, Scopus INDEXTERMS)
- Quality of Health Care (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Surveys and Questionnaires (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)

Free-Text Terms:

- Patient-centered
- User-centered
- Combination of: (Patient, Health Personnel, Provider, Physician, Nurse, Neurologist, Clinician, User, Outpatient, Ambulatory) AND (satisfaction, experience, perspective, Evaluation, Survey, Lessons, Practices, Observation, Attitude OR View)

Neurology

Indexed Terms:

- Cerebrovascular Disorders (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Neurologic Examination (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)

- Neurologists (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Neurology (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Neurosurgical Procedures (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Stroke (MH PsycINFO, CINAHL MW, Scopus INDEXTERMS, MeSH)
- Stroke Units (CINAHL MW, Stroke Units (Scopus INDEXTERMS)

Free-Text Terms:

- Stroke
- Neurology
- Neurologist

Full Search Statements for all 4 Databases

Pubmed 552 (April 17, 2021)

(("2019/11/01"[Date - Publication] : "3000"[Date - Publication])) AND (((((telemedicine[MeSH] OR videoconferencing[MeSH] OR remote consultation[MeSH] OR Ambulatory Care Facilities[MeSH] OR Outpatients[MeSH] OR Ambulatory Care[MeSH] OR Distance Counseling[MeSH] OR Home Care Services[MeSH] OR Tele?medicine[TiAb] OR Tele?health*[TiAb] OR Tele?neurolog* [TiAb] OR tele?stroke[TiAb] OR Tele?consult*[TiAb] OR Digital?health*[TiAb] OR Tele?visit*[tiab] OR e?Health[Ti] OR e?consult*[Tiab] OR ((Virtual*[Tiab] OR Remote*[tiab]) AND (health[tiab] OR care[tiab])) OR e?visit*[Tiab] OR "electronic visit*"[Tiab] OR outpatient*[Tiab] OR "Video Visit*"[tiab] OR "remote consult*"[tiab]) AND (Outcome Assessment, Health Care[MeSH] OR Quality of Health Care[MeSH] OR Surveys and Questionnaires[MeSH] OR Practice Patterns, Physicians'[MeSH] OR Practice Patterns, Nurses[MeSH] OR Professional patient relations[MeSH] OR Physician Patient Relations[MeSH] OR Nurse Patient Relations[MeSH] OR Job Satisfaction[MeSH] OR Patient satisfaction[MeSH] OR Personal satisfaction[MeSH] OR Patient-Centered Care[MeSH] OR Patient-center*[Tiab] OR User-center*[Tiab] OR (Patients[MeSH] OR Patient*[Tiab] OR Health Personnel[MeSH] OR Provider*[Tiab] OR Physician*[Tiab] OR Nurse*[MeSH] OR Nurse*[Tiab] OR Neurologist*[TiAB] OR "Neurologists"[MeSH] OR Clinician*[tiab] OR User*[tiab] OR Outpatients[MeSH] OR Outpatient*[Tiab] OR Ambulatory) AND (satisfaction*[Tiab] OR experience*[Tiab] OR perspective*[Tiab] OR Evaluation*[Tiab] OR Survey*[Tiab] OR Lesson*[Tiab] OR Practice* [Tiab] OR Observation*[Tiab] OR Attitude*[Tiab] OR View*[Tiab] OR Attitude of Health Personnel[MeSH] OR Attitude to Health[MeSH]))) AND (Stroke[MeSH] OR Stroke*[Tiab] OR Neurology[MeSH] OR Neurolog*[Tiab] OR "Cerebrovascular Disorders"[MeSH] OR Neurosurgical Procedures[MeSH] OR Neurologic Examination[MeSH] OR Neurologists[MeSH])) NOT (Rehabilitation[MeSH] OR Telerehabilitation[MeSH] OR Rehabilitation[TiAb] OR Telerehabilitation[TiAb] OR Editorial[Publication Type] OR Letter[Publication Type] OR Comment[Publication Type] OR News*[Publication Type] OR Review*[Publication Type] OR Letter[Tiab] OR Comment*[Tiab] OR Systematic Review[Ti] OR Scoping Review[Ti])) AND (journalarticle[Filter] AND 2020/3/1:3000/12/12[pdat] AND English[Filter]))

CINAHL 174 (April 17, 2021) Filter: Nov 2019 to present (Limiters - Published Date: 20191101-)

(MW ("Remote Consultation" OR "Telemedicine" OR "Videoconferencing" OR "Telenursing" OR "Telehealth" OR “Ambulatory Care” OR “Outpatients” OR “Distance Counseling” OR “Home Care Services” OR telestroke OR teleneurology) OR TI (Tele?medicine OR Tele?health* OR Tele?neurolog* OR tele?stroke OR Tele?consult* OR Digital?health* OR Tele?visit* OR e?Health OR e?consult* OR “Virtual health” OR “Remote care” OR e?visit* OR "electronic visit*" OR outpatient* OR "Video Visit*" OR "remote consult*") OR AB (Tele?medicine OR Tele?health* OR Tele?neurolog* OR tele?stroke OR Tele?consult* OR Digital?health* OR Tele?visit* OR e?Health OR e?consult* OR “Virtual health” OR “Remote care” OR e?visit* OR "electronic visit*" OR outpatient* OR "Video Visit*" OR "remote consult*")) AND (MW ("Stroke+" OR "Stroke Units" OR "Stroke Patients" OR neurology OR "Cerebrovascular Disorders" OR “Neurologists” OR “Neurosurgical Procedures” OR “Neurologic Examination”) OR TI ("Stroke" OR "Neurolog*") OR AB ("Stroke" OR "Neurolog*")) AND (MW ("Quality of Health Care" OR "Patient Preference" OR "Patient Satisfaction+" OR "Personal Satisfaction" OR "Professional-Client Relations+" OR "Professional-Patient Relations" OR "Physician-Patient Relations" OR "Nurse-Patient Relations" OR “Outcome Assessment, Health Care” OR “Surveys and Questionnaires” OR “Practice Patterns, Physicians‟ OR “ Practice Patterns, Nurses“ OR “Job Satisfaction“ OR “Patient-Centered Care” OR “Attitude of Health Personnel” OR “Attitude to Health”) OR TI (“Patient-center*” OR “User-center*” OR ((“Patient*” OR “Health Personnel” OR “Provider*” OR “Physician*” OR “Nurse*” OR “Neurologist*” OR “Clinician*” OR “User*”) AND (“satisfaction*” OR “experience*” OR “perspective*” OR “Evaluation*” OR “Survey*” OR “Lesson*” OR “Practice*” OR “Observation*” OR “Attitude*” OR “View*”))) OR AB (“Patient-center*” OR “User-center*” OR ((“Patient*” OR “Health Personnel” OR “Provider*” OR “Physician*” OR “Nurse*” OR “Neurologist*” OR “Clinician*” OR “User*”) AND (“satisfaction*” OR “experience*” OR “perspective*” OR “Evaluation*” OR “Survey*” OR “Lesson*” OR “Practice*” OR “Observation*” OR “Attitude*” OR “View*”)))) NOT (MW (“Telerehabilitation” OR “Rehabilitation”) OR TI (“Rehabilitat*” OR Telerehabilitat*” OR “Systematic Review” OR “Scoping Review” OR “Rapid Review” OR “Opinion*”) OR AB (“Rehabilitat*” OR Telerehabilitat*” OR “Systematic Review” OR “Scoping Review” OR “Rapid Review” OR “Opinion*”) OR PT (“Editorial” OR “Letter” OR “Comment*” OR “News*” OR “Review*” OR “Opinion*”))

Scopus 381 (April 17, 2021)

((INDEXTERMS ("Stroke" OR "Stroke Units" OR "Stroke Patients" OR neurology OR "Cerebrovascular Disorders" OR "Neurologists" OR "Neurosurgical Procedures" OR "Neurologic Examination") OR TITLE-ABS-KEY ("Stroke" OR "Neurolog*")) AND (INDEXTERMS ("Remote Consultation" OR "Telemedicine" OR "Videoconferencing" OR "Telenursing" OR "Telehealth" OR "Ambulatory Care" OR "Outpatients" OR "Distance Counseling" OR "Home Care Services" OR telestroke OR teleneurology) OR TITLE-ABS-KEY (telehealth OR telemedicine OR e?health OR e?consultation OR "remote consult*" OR "telephone consult*" OR "" teleconsult* "" OR "" virtual* AND visit* "" OR e?visit* OR "electronic visit*")) AND (INDEXTERMS ("Quality of Health Care" OR "Patient Preference" OR "Patient Satisfaction" OR "Personal Satisfaction" OR "Professional-Client Relations" OR "Professional-Patient Relations" OR "Physician-Patient Relations" OR "Nurse-Patient Relations" OR "Outcome Assessment, Health Care" OR "Surveys and Questionnaires" OR "Practice Patterns, Physicians'"

OR " Practice Patterns, Nurses" OR "Job Satisfaction" OR "Patient-Centered Care" OR "Attitude of Health Personnel" OR "Attitude to Health") OR TITLE-ABS-KEY ("Patient-center*" OR "User-center*" OR ("Patient*" OR "Health Personnel" OR "Provider*" OR "Physician*" OR "Nurse*" OR "Neurologist*" OR "Clinician*" OR "User*") AND ("satisfaction*" OR "experience*" OR "perspective*" OR "Evaluation*" OR "Survey*" OR "Lesson*" OR "Practice*" OR "Observation*" OR "Attitude*" OR "View*")))) AND NOT (INDEXTERMS ("Telerehabilitation" OR "Rehabilitation") OR TITLE-ABS-KEY ("Rehabilitat*" OR "Telerehabilitat*" OR "Systematic Review" OR "Scoping Review" OR "Rapid Review" OR "Opinion*")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020)) AND (LIMIT-TO (LANGUAGE , "English"))

PsycInfo 34 (April 17, 2021) limit 5 to (peer reviewed journal and english language and yr="2019")

1 (telemedicine or videoconferencing or remote consultation or Ambulatory Care Facilities or Outpatients or Ambulatory Care or Distance Counseling or Home Care Services).mh. or (Tele?medicine or Tele?health* or Tele?neurolog* or tele?stroke or Tele?consult* or Digital?health* or Tele?visit* or e?Health or e?consult* or e?visit* or "electronic visit*" or outpatient* or "Video Visit*" or "remote consult*" or ((Virtual* or Remote*) and (health or care))).ti. or (Tele?medicine or Tele?health* or Tele?neurolog* or tele?stroke or Tele?consult* or Digital?health* or Tele?visit* or e?Health or e?consult* or e?visit* or "electronic visit* " or outpatient* or "Video Visit* " or "remote consult* " or ((Virtual* or Remote*) and (health or care))).ab.

2 (Outcome Assessment Health Care or Quality of Health Care or "Surveys and Questionnaires" or Practice Patterns Physicians or Practice Patterns Nurses or Professional patient relations or Physician Patient Relations or Nurse Patient Relations or Job Satisfaction or Patient satisfaction or Personal satisfaction or Patient-Centered Care or Outpatients or Ambulatory or Attitude of Health Personnel or Attitude to Health).mh. or (Patient-center* or User-center* or ((Patient* or Health Personnel or Provider* or Physician* or Nurse* or Neurologist* or Clinician*OR User*) and (satisfaction* or experience* or perspective* or Evaluation* or Survey* or Lesson* or Practice* or Observation* or Attitude* or View*))).ti. or (Patient-center* or User-center* or ((Patient* or Health Personnel or Provider* or Physician* or Nurse* or Neurologist* or Clinician*OR User*) and (satisfaction* or experience* or perspective* or Evaluation* or Survey* or Lesson* or Practice* or Observation* or Attitude* or View*))).ab.

3 (Stroke or Neurology or Cerebrovascular Disorders or Neurosurgical Procedures or Neurologic Examination or Neurologists).mh. or (Stroke* or Neurolog*).ti. or (Stroke* or Neurolog*).ab.

4 (Rehabilitation or Telerehabilitation).mh. or (Rehabilitat* or Telerehabilitat* or Letter or Comment* or Systematic Review or Scoping Review).ti. or (Rehabilitat* or Telerehabilitat*).ab. or (Editorial or Letter or Comment or News* or Review*).pt.

5 (1 and 2 and 3) not 4

6 limit 5 to (peer reviewed journal and english language and yr="2021")

Additional File 3

The SERVQUAL questionnaire of a telehealth program in the case hospital conducted by Yin et al. (2016)

Dimension	Questions
Tangible	1. The hospital has easy to operate equipment 2. The hospital provides teaching lessons for equipment operations 3. Physiological measurement equipment provided by the hospital is functioning normally
Reliability	4. Hospital staff has completed the promised duties in time 5. Hospital staff is concerned my problem and resolves my problem 6. Equipment services provided by the hospital are trustworthy and reliable 7. Hospital staff can reply my needs and recommendations in time 8. The hospital can keep my measurement data each time and provide my historical data for query
Responsiveness	9. Hospital staff contacts me directly to make an arrangement for further examination when abnormal physiological measurement data are found 10. My questions have been quickly responded 11. Hospital staff is willing to understand and solve my problems 12. Hospital staff provides the timely services for me
Assurance	13. I feel warm and ease when hospital staff provides services 14. I feel comfortable and trust during the interaction with hospital staff 15. Hospital staff provides services friendly and courteously 16. Services provided by hospital staff are complete and meet my needs
Empathy	17. The hospital can provide customized needs for individuals 18. Hospital staff has sufficient medical knowledge and technology 19. Hospital staff respects opinions and cares needs for individuals

	20. The hospital places a high priority for my interests 21. The operation hours provided by the hospital meet my needs

Additional File 4

SERVQUAL model codebook

Codes	Descriptions	Clinician	Patient
1	**Tangibles**	X	X
1.1	Comfort level using virtual equipment (subjective)	X	X
1.2	Technical issues: equipment and capacity /functionality/connectivity/organizational (objective)	X	X
1.3	Technical support	X	X
1.4	Environment (setting of the teleconsulting)	X	X
1.5	Provide training/teaching	X	X
2	**Reliability**	X	X
2.1	Administration/scheduling support	X	X
2.2	Punctual (start on time or duration)	X	X
2.3	Timing of appointment/referral/DI testing/Rx/lab requisition		X
2.4	Appropriate triage	X	
2.5	Chart pre-/documentation readiness	X	
3	**Responsiveness**	X	X
3.1	Address logistical needs (transportation, physical, work, driving, financial etc.)	X	X
3.2	Response from the clinic (easy to contact)		X
3.3	Address medical needs		X
4	**Assurance**	X	X
4.1	Virtual verbal communication (sending or receiving information)	X	X
4.2	Virtual non-verbal verbal communication (emotion, attitude, personality, supplement to verbal communication)	X	X

4.3	Trust during interaction	X	X
4.4	Confidence	X	X
4.5	Clinical component	X	
4.5.1	Diagnosis	X	X
4.5.2	History taking	X	
4.5.3	Neurology physical examination/assessment	X	
4.5.4	Treatment plan	X	
4.5.5	Advanced decision making	X	
4.5.6	Image/tests review	X	
4.5.7	Documentation	X	
4.6	Completeness	X	X
5	**Empathy**	X	X
5.1	Personal attention	X	X
5.2	Human touch	X	X

Additional File 5

The most frequent SERVQUAL dimensions, process factors, sub-themes with selected quotes among clinicians (N=300)

Dimension	Most frequent process factors	Sub-themes	Selected quotes
Assurance (n=113) (The knowledge and courtesy of employees and their ability to inspire trust and confidence)	Clinical activities (n=69): PE (n=32)	The positive role of video in PE Limitation of remote PE; Lacking utilization of remote assessment tools; Availability of family support	Better interaction between clinicians and patients, and the use of video to enable a degree of examination led to an improved experience (6_PR[b]_59). 52% of providers disagreed that they were able to do the relevant neurological

			examination virtually (14_PR_310). A significant implementation barrier was the limited nature of the remote neurologic examination (11_PR_371). A majority of the responders (83.3%) reported not having administered any questionnaires (quality of life, adverse effects, depression, etc.) over the phone or by videoconference. (5_PR_271) Occasionally required assistance from a caregiver to position the phone to properly observe the patient, perform certain physician-directed exams (16_PR_164)
	Confidence in care (n=23)	Video adding confidence; Experiences and training adding confidence; Perceptions of decreased standard care. Unusual conditions (delivery bad news or	Compared with telephone (audio only), the use of videoconferencing technology was associated with increased confidence in the ability of telemedicine to formulate and communicate a treatment plan when

		sensitive information) lowing the confidence.	compared to in-person visits (12_PR_296). Those with neurosurgery training described increased confidence in telemedicine for imaging review and explanation (12_PR_301). …the corresponding proportion that reported an overall reduced standard of care during the pandemic were, respectively, 9% and 30% in epilepsy, 3% and 42% in headache, 24% and 71% in multiple sclerosis, and 57% and 74% in movement disorders. (10_PR_253).
	Communication (n=17)	Perceived risk of misunderstanding. Difficult recognizing emotion; Difficult establishing trust relationship Superiority of video visits in communication (enhance PE and diagnosis).	…only 62.5% felt the patient had understood the information correctly. (5_PR_270) The difficulties recognizing when patients are upset(1_PR_3) Clinicians reported that video visits were superior to a phone call, allowing them to gather more information than just a medical history. (16_PR_158).

Reliability (n=96) (the ability to perform the promised service dependably and accurately)	Appropriate triage (n=55)	Clinical factors: Follow-up vs New Screening or stratification Disease characteristics (severity, stability, acuity, complexity) Patient factors: Demographic; Physical or psychological limitation; Caregiver support; Access to technology; Experience in using technology.	When asked what type of visit telehealth was most suited for, 62% of providers chose follow-up visits (14_PR_317). Would want to conduct a traditional appointment if the patient had new or worsening symptoms. (3_PR_91). Numerous clinicians mentioned that some patients, particularly older adults and lower-income patient populations (e.g., unhoused individuals or rural farm workers), lacked technological capability to support a video call. (16_PR_154) In the absence of a supportive family member/caregiver, video visits with patients with cognitive, hearing, or visual impairment were also considered nonideal. (16_PR_155)
	Administrative support (n=19)	Change work flow: Scheduling and registration;	…administrative challenges in registration and scheduling (11_PR_346).

		Previsit preparation technically and medically; Accurate patient information.	Patients were often unprepared (6_PR_37) Lack of previsit charting and medication reconciliation (16_PR_134).
Tangible (n=61) (The equipment and personnel)	Technical issues (n=44)	System availability; System reliability; System connectivity; System flexibility; Functionality limitation.	Barriers noted included access to technology, (16_PR_138) …challenges in adapting platforms to meet the needs of patients and clinicians (11_PR_345)
Responsiveness (n=23) (The willingness to help customers and provide prompt service)	Address patients' logistical needs (n= 13)	Convenience (save time, travel and decrease cost)	Providers felt that televisits would reduce burden on patients related to transportation, behavior, and physical limitations. (3_PR_92) … increased convenience for patients, less cost for patients…(15_PR_229)
Empathy (n=7) (The provision of individual care and attention to customers)	Human touch (n=6)	Losing/missing relationship Lacking empathy: business-like	38% of clinician Missing/losing (the in-person connection/) relationship with patients (16_PR_115). …sense of empathy that is challenging to achieve remotely (15_PR_219). The perception that telephone consultations

			were of a different style, more ‘business-like’. (6_PR_22)

Additional File 6

The most frequent SERVQUAL dimensions, process factors, sub-themes and selected quotes among patients (N=101)

Dimension	Most frequent process factors	Sub-themes	Selected quotes
Responsiveness (n=33) (The willingness to help customers and provide prompt service)	Address logistical needs (n=17)	Convenience (saving time, travel and cost)	Participants considered no transport...no travel expense as advantage of TM appointment. (18_PT_36). I didn’t have to drive there, find parking, and all the way to the office, wasting an hour plus if time. (9_PT_113). Eighty-eight percent of patients agreed that their telehealth visit was more convenient for them than an in-person visit.(14_PT_127)
	Address medical needs (n=14)	Address communicative needs (e.g., understanding care plan, or disease, change medication regiments.)	Regarding to the ease of ….understanding the plan-of-care, the most frequent response was “very satisfied" (average rating 5.5/6). (3_PT_33) (About 88%) Majority of the participants stated that the TM appointment helped them as well as previous appointments onsite for the understanding of the illness, (18_PT_63)
Tangible (n=25)	Technical issue (n=19)	Connectivity; Usability; Availability;	A lag in audio (or visual) (3_PT_17) We found that patients experienced MyChart logistical challenges with synchronous TN, which resulted in

(The equipment and personnel)		Family support.	switching to non-MyChart platforms. (11_PT_178) ... the lack of PC, tablet, or phone with Internet connection in 8 cases (23.5%) (2_PT_173) Televisits performed in the presence of subjects of younger generation had a successful rate higher than the group without younger generation caregiver (2_PT_176)
	Home environment (n=6)	Comfort	Participants considered...more comfort as advantage of TM appointment. (18_PT_37) ‘‘Comfort of being in your own home. (9_PT_101)
Assurance (n=23) (The knowledge and courtesy of employees and their ability to inspire trust and confidence)	Communication (n=12)	Situational effectiveness	Language barrier without gesture compensated communication (0.9%) (19_PT_79) Sixty-four percent of patients agreed that they were able to adequately show their clinical signs to their provider, (14_PT_124)
	Diagnosis (n=5)	Delay and uncertain	Other disadvantages were the postponements of diagnostics or therapies (5.5%) (19_PT_77) Patients who found virtual clinic to be “not as good” were more likely to have an underlying neurological disorder that would benefit from clinical examination, namely, a neuromuscular condition (66.7%) (2_PT_14)
Reliability (n=15) (the ability to perform the promised service dependably and accurately)	Tests, prescriptions, Treatments (n=8)	Delay	Lack of immediate prescription (9%) (18_PT_47). A delay in performance of epilepsy-related tests occurred in 37 patients (14.5%). Routine EEG was the test most often delayed (n = 11; 29.7%), followed by MRI (n = 9; 24.3%) and video-EEG monitoring (n = 8; 21.6%). (8_PT_133)

Empathy (n=5) (The provision of individual care and attention to customers)	Personal attention (n=3)	Present Embarrassing	Felt more present and focused (9_PT_103). … embarrassing nature of the teleconsultation ... were unfavorable to satisfaction of the patient (4_PT_183).

Appendix B Chapter 3 Multimedia Appendix

Multimedia Appendix 1

Survey Consent Sheet for Participants

Researchers from the University of Waterloo are conducting a study to learn your perception on your virtual consultation with the Stroke Clinic at Southlake Regional Health Center since the start of the COVID-19 pandemic. We would like to understand your experiences with the service quality at the Stroke clinic during this unprecedented time.

We are interested in your views and your experiences during the virtual consultation, both positive and negative.

The survey includes a few demographic questions, a questionnaire, and open-ended questions. It should take approximately 15 minutes to complete. Participation in the project is voluntary. You may skip any questions you do not wish to answer, and you may withdraw from the study at any time by expressing this to the researcher during the survey.

Your identity will be considered confidential. Your name will not be included in any presentations or publications arising from this project. Your interview will be audio recorded to ensure an accurate recording of your responses. The data collected from the telephone survey will be kept on a secure server hosted in the Southlake Regional Health Center.

There is the potential for risks or discomfort associated with participation since the questions may ask you to recall a time that was stressful or distressing. You may exit the telephone survey at any time by expressing this to the researcher and your data will not be submitted. Once submitted, data cannot be withdrawn.

We cannot promise any personal benefits to you from your participation in this study. However, the information you share with us will be used to understand the impact of the service interruptions in outpatient clinic services quality by COVID-19 from the patients' perspective. This information will help us to identify strategies on how to maintain the service quality in a future pandemic situation.

We appreciate your participation and contributions.

Some demographic questions such as income, education, marital status, and ethnicity helps to describe the participants' characteristics in the study.

An example of the type of open-ended questions asked in the survey is:

What are the main challenges in using telemedicine services during COVID 19 lockdown?

Your name will not be collected in the survey, and your data will be grouped with other participants' data, separate from any identifying information. The data will be stored for a minimum of 7 years. This study has been reviewed and has received exemption from Southlake Research Ethics Board. Southlake Hospital will receive summary data from the study to use for quality improvement purposes. This study has also been reviewed and cleared by the University of Waterloo Research Ethics Committee (ORE #42686). If you have questions for the committee, contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

Thank you in advance for your interest in this project. I agree to participate in the research study as described. I understand the purpose and nature of this study and I am participating voluntarily. I understand that I can withdraw from the study at any time, without any penalty or consequences. Check on the "Yes" below indicates that I have read the above information and voluntarily agree to participate. By agreeing to participate in the study, I am not waiving my legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

1. Yes___
2. No___

If the substitute decision-maker is consenting for the participant:

By checking "Yes," you consent that you are willing to help the participant to answer the questions in this survey.

3. Yes__
4. No__

If you have questions, please contact Guangxia Meng by email g3meng@uwateloo.ca or by phone at 905-895-4521 extension XXXX.

Multimedia Appendix 2

Cover letter for mail-in package

Hello,

My name is Guangxi Meng, and I am a PhD's student working under the supervision of Dr. Helen Chen and Dr. Carrie McAiney in the school of Public Health and Health System at the University of

Waterloo. As part of my PhD's degree, I am conducting a research study on patient's perceptions of teleconsultation service quality at a stroke prevention clinic. Given your experiences, I feel that you are well suited to provide insight into this topic, and I would like to invite you to participate in this study.

I am sending this letter as you expressed the interest in participating in the survey. Your participation will consist of a one-on-one telephone survey and interview that will take approximately 15-20 minutes of your time. During the interview you will be asked questions such as "what are the main challenges in using teleconsultation services during COVID 19 lockdown?" With your permission, I would like to audio-record the interview to ensure accurate transcription and analysis.

I would like to assure you that the study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (#42686). It is also a quality improvement project at Mackenzie Health and received ethics exemption. However, the final decision about participation is yours.

This package includes a telephone survey consent and the questionnaires. This package is not intended for you to fill out; instead, it offers you the opportunity to read and understand the consent and the study thoroughly before arranging a telephone call. I will call you within a week to see if you are interested in the telephone survey. A researcher from the University of Waterloo will contact you and will complete the survey by phone. She will also ask a few open-ended questions. If you require ire additional information to assist you in reaching a decision about participation, please do not hesitate to contact me at 905-895-4521 ext. XXXX or by email g3meng@uwaterloo.ca, also contact my supervisor at 519-888-4567 ext. 42132 or by email hele.chen@uwaterloo.ca.

You sincerely

Guangxia

Multimedia Appendix 3

The description of 18-items used in the Service Performance Model questionnaire

Dimension description	Item description
Tangible:	1. Comfort level using virtual equipment 2. Technical difficulties during the teleconsult

Technical and the home environment experiences	3. The effect of home environment
Reliability: ability to perform the promised service responsibly and accurately	4. The clinic informs and prepares the patient before the visit 5. The clinic offers the service in adequate time 6. The clinic provides its services at the time it promises to do so
Responsiveness: willingness to provide help and a prompt service to customers	7. The teleconsult is convenience for the patient. 8. The clinic is easy to be contacted by the patient 9. The clinic prompt responds to the patient 10. The clinic has provided the services as they promised to meet the medical needs
Assurance: the knowledge and courtesy of the clinicians and their ability to inspire trust and confidence	11. The patient understood the advice 12. The clinician has the knowledge-making diagnosis 13. The behaviour of the clinician instills confidence in the patient 14. The patient feel able to understand the conversation easily 15. The behaviour of the clinician instills trust in the patient
Empathy Caring and understanding which provides and/or offers its customers in terms of its individualized and personalized attention	16. The staff provide service in a friendly and courteous way 17. The clinician listens to the patient 18. The patient feels personal attention

Multimedia Appendix 4

Round one survey: The patients' satisfaction of teleconsultation service quality at stroke prevention clinics during the COVID-19 pandemic

1. The first set of questions are about you.
    A. How old are you? _____
    B. What gender do you identify with
        - Man/Male
        - Woman/Female
        - Trans* / Non-binary
        - Prefer to self-identify (option to specify)
        - Prefer to not answer

    C. Were you diagnosed with a stroke or mini-stroke (TIA) by the clinic?
        - Yes __

            If yes, do you have any disability (such as weakness, numbness, speech, vision problems) left from this event? Yes____, No____
        - No __

    D. At the time of your first teleconsultation (consultation by phone or video) at the Stroke prevention clinic, were you a new patient at the clinic?
        - Yes __
        - No __

    E. How many teleconsultations (by phone or video) did you have in total at the stroke prevention clinic? _____
    F. Please check all medical conditions that you currently have been diagnosed or taking medication for:
        - High blood pressure ___
        - High cholesterol ___
        - Diabetes (high blood sugar) ____
        - Heart disease____
        - Previous stroke ____
        - Smoker____

- Vascular disease (blood vessel plaques or narrowing)____
- Others____

G. What is the highest level of education you have completed :

- Grade 8 and below__
- High School__
- College__
- University__
- Graduate Degree__

H. Employment during COVID-19

- Retired__
- Working__
- Unemployed__
- Self-employed__
- On disability__

I. Marital status

- Married__
- Single__
- Widowed__
- Divorced/separated__

J. Living situation

- Alone__
- Living with others

K. How far do you live from the hospital? Please enter a distance in kilometers (KM)____

L. Type of transportation most you commonly used for clinic visits prior to the COVID-19 pandemic:

- Self
- rely on others or public transportation

M. Do you need any assistance with walking (use of a cane, walker, wheelchair, or the support of another person)?

- No

- Yes

N. Do you have any difficulty understanding and speaking English during a medical visit?

- Yes
- No

H. Do you have hearing loss?

- No
- Yes, ___ Does it affect your ability to hear people when you are talking to them on the telephone? YES,__ NO__

I. Do you have vision loss?

- No
- Yes,____ Does it affect your ability to use electronic devices such as an iPad or computer Yes___ NO__

2. Please think back to your teleconsultation experiences:

A. Was your most recent teleconsultation at the stroke prevention clinic done by telephone or video?

- telephone
- video

B. Before COVID-19, did you ever use the patient connect portal? If so, how often did you use it before COVID-19?

- None
- A little (used 1-2 times)
- Some (used 3-5 times)
- A lot (used more than 5 times)

C. Before COVID-19, did you ever have a teleconsultation? If so, how often did you use it before COVID-19?

- None
- A little (used 1-2 times)

- Some (used 3-5 times)
- A lot (more than 5 times)

D. Before your teleconsultation, did the clinic contact you on how to use the video appointment function?
   - YES____
   - NO_____

E. Do you have the equipment for virtual visits at home (such as a tablet or mobile phone with Wi-Fi, camera, and speaker)?
   - YES___
   - NO____

3. The Modified SERVPERF questionnaire

How would you evaluate the most recent teleconsultation you have received from the stroke prevention clinic during the COVID-19 pandemic?

Using the scale below, please rate your experiences with each of the following:
SD = strongly disagree
D = disagree
N = neither disagree nor agree
A = agree
SA = strongly agree

	Question	**SD**	**D**	**N**	**A**	**SA**
1	I am comfortable using the virtual equipment (phone, iPad or computer) on my own.					
2	I have experienced technical difficulties during the visit.					

3	Being at home for my visit makes me feel more relaxed.					
4	The stroke prevention clinic staff contacted me to prepare for the visit.					
5	My virtual visit started on time.					
6	The length of the visit is about right.					
7	Having a teleconsultation is convenient for me					
8	The stroke prevention clinic staff were easy to contact.					
9	The stroke prevention clinic staff quickly responded to my questions and concerns.					
10	I feel all my needs and questions were addressed during the visit.					
11	I understood the advice that I received during the visit.					
12	The doctor or nurse practitioner was competent in making diagnoses during my visit.					
13	I trusted the doctor or nurse practitioner during the visit.					
14	During the visit, I was able to follow the conversation easily.					
15	I am confident in the care I received during this visit.					
16	The stroke prevention clinic staff provide the service in a friendly and courteous way.					

17	I felt listened to during the visit.					
18	The lack of personal contact affected my experiences with the visit.					
19	Overall, I was satisfied with the quality of the service at the stroke clinic					

4. Semi-structured interview questions:

   A. What three words or phrases come to mind when you think about your experience with teleconsultation at the secondary stroke prevention clinic?

   B. What difficulties did you have in using the teleconsultation at the stroke prevention clinic?

   C. Did you feel the care you received through teleconsultation was as good as seeing the healthcare provider in person at the stroke prevention clinic? Please explain.

   D. What clinical activities do you wish to be carried out in person?

   E. When COVID 19 pandemic passes and thing goes back to normal, will you be interested to continue using the teleconsultation service?

   F. Is there anything the stroke prevention clinic staff can do to improve your experience with teleconsultation – or whatever term you use?

The COVID-19 pandemic has been very difficult for many people. If you need to speak with someone about your feelings, please reach out to your family doctor. You also can reach out to Southlake Regional Health Center Office of Patient Experience at 1-905-895-4521 ext. 2290. If you were contacted by Mackenzie Health, the Patient Relations office is at 1-905-883-1212 ext. 7494.

Thank you for participating in our patient perceptions of stroke prevention clinic service quality during COVID-19 survey! Your feedback is extremely valuable.

If you indicated on the survey that you would like a summary of the results, you can contact me by phone or email, they will be sent to you at the end of 2021.

This study has been reviewed and received ethics clearance through the University of Waterloo Research Ethics Committee (ORE#42686). If you have questions for the committee, contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

For all other questions or general comments or questions related to this study, please contact Guangxia Meng by email at g3meng@uwateloo.ca or by phone at 905-895-4521, ext. XXXX.

Multimedia Appendix 5

Six questions to check the clarity of the survey questions

From your point of view:

1. Are the questions clearly articulated? Yes/No. If not, which questions are problematic?
2. Are the response options relevant to you? Yes/ No. If not, which questions are not appropriate?
3. Are the response options comprehensive? Yes/Not. If not, Which question needs to be more thorough?
4. Does the language contain any obscure terminology or ambiguous words? Yes/No, If yes, which questions?
5. Do you need help understanding the questions? Yes/No. If yes, which question?
6. How long does it take to finish the survey?

Multimedia Appendix 6

Ten demographic, seven clinical and six technical-related independent variables definitions

Independent variables	Description
Demographic	
Age	Years
Gender	Female and male

Distance	Kilometers from patients' residence to the stroke prevention clinic
Education	Self-reported less than high school, high school, college, university or graduate study
Marital status	Self-reported married, divorced, widowed, or single
Living arrangement	Self-reported living with others or alone
Transportation	Self-reported still driving or relying on others
Mobility	Self-reported independent or using a cane or walker
Language barrier	Self-reported having any difficulty understanding and speaking English
Hearing impairment	Self-identified having a hearing loss
Visual impairment	Self-identified having a vision loss
Survey consent by substitute decision-maker	indicated that the survey was consented to and answered with the help of a substitute decision-maker
Wen-survey	The survey was done via web-based method
Clinical	
Stroke diagnosis	Self-reported was diagnosed with a stroke by the stroke prevention clinic
Residual symptoms	Disability such as weakness, numbness, speech, vision problems) left from this event
Stroke risk factors	Medical diagnosis of high blood pressure, high cholesterol, diabetes, heart disease, smoking, vascular disease (blood vessel plaques or narrowing), previous stroke.
Telemedicine-related	
Number of stroke prevention clinic Teleconsult	Self-reported numbers of consultations via telephone or video were done with the stroke prevention clinic
Portal use before COVID	Self-reported the usage of a patient-connect portal within the electronic medical record platform offered by the hospital of the stroke prevention clinic before COVID
Telemedicine use before COVID	Self-reported usage of teleconsultation before COVID

Pre-visit contact by the stroke prevention clinic Owning virtual equipment at home	Self-reported if the clinic contacted on how to use the video appointment function before the teleconsultation. Self-reported owning equipment for virtual visits at home such as a tablet or mobile phone with Wi-Fi, camera, and speaker

Multimedia Appendix 7

Cronbach α reliability statistics and Item-total Statistics of the SERVPERF questionnaire

Cronbach's Alpha		# of items		
0.89		18		
Item number	Scale means if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronach's Alpha if item deleted
Question 1	65.74	99.84	0.17	0.91
Question 2	65.47	102.19	0.16	0.9
Question 3	65.72	96.9	0.41	0.89
Question 4	65.40	96.68	0.45	0.89
Question 5	65.08	98.71	0.54	0.89
Question 6	65.10	96.59	0.62	0.89
Question 7	65.29	92.55	0.66	0.88
Question 8	65.58	93.55	0.59	9.89
Question 9	65.31	94.11	0.65	0.88
Question 10	65.23	91.37	0.85	0.88
Question 11	65.05	95.42	0.72	0.88
Question 12	65.14	94.45	0.72	o.88
Question 13	64.99	96.73	0.7	0.88
Question 14	65.12	96.32	0.58	0.89
Question 15	65.10	93.46	0.78	0.88
Question 16	64.75	97.55	0.65	0.89
Question 17	64.95	95.12	0.71	0.88

Question 18	66.05	98.1	0.34	0.9

Multimedia Appendix 8

Positive and negative categories among patients with low global satisfaction (score of ≤3; N=24).

Dimension	Positive feedback		Negative feedback	
	Number of participants	Subcategory and example quotes	Number of participants	Subcategory and example quotes
Assurance: the knowledge and courtesy of employees and their ability to inspire trust and confidence	3	• Informative o "Good review of my medical situation, informative." [R57]	26	• Missing clinical components (n=15) o "I feel there is something missing over the phone with a medical diagnosis." [R21] o "The doctor can control and check you better." [R73] o "Decision Decisions made were good but needed more information to make complete

				decisions." [R90] • Inadequate communication (n=11) o "Can't discuss needs properly." [R11] o "Too hard to explain myself." [R12] o "Things I could not explain but could show was not possible." [R21] o "It is hard to describe your problem, you can talk with her by your body and face too." [R73] • Lack of rapport with the clinician (n=2) o "Very artificial, because you can talk, talk, talk on the phone, but lose

				credibility." [R77]
Reliability: ability to perform the promised service responsibly and accurately	0	NA	13	• Lack of follow-up booking (n=6) o "Didn't have trouble with the appointment itself, but didn't seem to follow through on anything they were supposed to be doing other than the MRI[a]. Didn't get test results." R32] • Wait time (n=4) o "Most of the time the waiting period isn't guaranteed, but they try to be on time. Plus the short-staffing, it's very very hard." [R77] • Administrative process issues (n=3)

				○ "Missed a call by two minutes and did not get an appointment again." [R27]
Empathy: caring and understanding, which a company provides or offers its customers in terms of its individualized and personalized attention	1	• Polite ○ "Polite." [R85]	10	• Lack of personal connection (n=10) ○ "Didn't feel any personal connection." [R12] ○ "Acted like they weren't interested in me." [R32] ○ "Remote, impersonal." [R97]
Tangibles: technical and home environment experiences	0	NA	4	• Concerned with phone visit (n=3) • "Miss the in person or video view when talking. Only was by phone." [R45] • Connectivity issue (n=1) ○ "Did not connect." [R17]
Responsiveness: willingness to provide help	2	• Convenient and prompt	3	• Not responding to calls (n=3)

and a prompt service to customers		o "Convenient for me." [R79] o "Prompt at first." [R27]		o "[Need to] call people back when they leave phone messages." [R32]
Overall impression	0	NA	10	• Negative o "Confusing tiring trying." [R10] o "Terrible, frustrating." [R12]

[a]MRI: Magnetic resonance imaging.

Multimedia Appendix 9 Positive and negative categories among patients with high global satisfaction (score of >3; N=73).

Dimension	Positive feedback		Negative feedback	
	Number of participants	Subcategory and example quotes	Number of participants	Subcategory and example quotes
Assurance: the knowledge and courtesy of the clinicians and their ability to inspire trust and confidence	54	• Effective communication (n=24) o "Practitioner was really great and went over and above." [R35] o "Since I had the first interview, that was fine and everything was well	58	• Incomplete clinical components (n=28) o "If physical exams are necessary, they should be done in person." [R35] o Incomplete clinical components (n=28) o "If physical exams are necessary, they should be done in person." [R35]

		explained to me." [R43] o "The nurse practitioner was very informative. I was put at ease." [R87] • Competent clinician (n=14) o "I think that they were knowledgeable of the medications I was taking." [R31] o "Was very professional." [R40] o "Competent." [R39] • Appropriate to their situations (n=11) o "I think all the clinical activities that need to be done have been done. I've been perfectly aware		o "Explaining diagnoses, or adjusting medications that can be complex." [R62] o "Sometimes doctors can spot something that he or she won't see during phone calls." [R15] o "An initial consultation would be best in person." [R55] • Inadequate communication (n=29) o "Sometimes I don't feel like I can explain or take the time." [R15] o "There is much to gain in a face-to-face situation. Body language, additional prompts, etc., are helpful in person." [R86] o "The practitioner had an accent that I found a little

		of the medications and feel quite fine." [R31] • Trust (n=5) o "In good hands." [R15		challenging to understand all her words on a cell phone call." [R50] o "Also email the doctor's advi(s)ce as it is on the phone and one can lose some attention." [R6] o "Explaining diagnoses, or adjusting medications that can be complex." [R62] • Lack of rapport and confidence (n=2) o "You have more rapport: facial expressions, personal contact as opposed to a voice [R18]
Empathy: caring and understanding, which a company provides or offers its	34	• Friendly (n=14), attentive (n=4), care (n=5), helpful (n=4), good listener (n=4), patient (n=4), and ease (n=3)	11	• Lack of personal connection (n=11) o "It's the personal contact that I like. Being an older person, I think we need that, because

customers in terms of its individualized and personalized attention		○ "Pleasant and friendly manner." [R69] ○ "Attentive." [R31] ○ "Showed that they cared." [R37] ○ "They are sincere and helpful at all times." [R61] ○ "Let me express myself without interrupting." [R39] ○ "F was very nervous before the meeting, but once he meet her, she put him at ease." [R84]		we've always had that in the past." [R44] ○ "Distant." [R48]
Responsiveness: willingness to provide help and a prompt service to customers	29	• Convenience (n=18) ○ "The more that can be done over the phone, the better. It saves time, travel, energy." [R6] • Prompt consult (n=10)	7	• Slow response and difficulty reaching the clinic (n=7) o "When you leave a message, I know that they're not going to get back to you immediately, but should at least

		○ "Much faster and [convenient in the comfort of my own home]." [R28] • Accommodating (n=1) ○ "Accommodating." [R24]		acknowledge." [R37]
Reliability: ability to perform the promised service responsibly and accurately	11	• Efficient (11) ○ "They are right on the ball." [R61]	14	• Administrative issues—lack of preparation (n=9) ○ "I don't know what the purpose of the appointment, what the telecommunications service is going to be about." [R43] ○ "I had been told when I went to the stroke clinic that I was going to be seeing a Dr. M." [R43] ○ "Perhaps they could communicate better with the cardiac doctor before phoning me." [R53] • During the visit—short and rushed (n=2)

				○ "It feels a bit rushed." [R80]
Tangibles: technical and home environment experiences	5	• No technical problems (n=3) ○ "No technical problems as it was a phone call." [R89] • Home comfort (n=2) ○ "It's better for me to be at home." [R23]	8	• Adding video (n=3) ○ "The only thing I would suggest is maybe using Zoom, but I found them easy to talk to." [R88] • Connectivity issues (n=3) ○ "I am in the tech field, and even I had issues connecting to the video call quickly." [R6] • Poor quality of the voice (n=1) ○ "The SPC[a] staff had echo in her phone." [R54] • Lack of confidence in technology (n=1) ○ "Younger people are more computer-savvy, and can express themselves over the phone or video more easily." [R44]

Appendix C Chapter 4 Supplemental Materials

Supplemental Materials File S1

Delphi study invitation email

Hello,

I am Guangxia Meng, a Ph.D. Candidate in the School of Public Health Sciences at the University of Waterloo, under the supervision of Dr. Helen Chen and Dr. Carrie McAiney. This email is being sent to you on behalf of the researchers. My Ph.D. research focuses on developing "teleconsultation service quality indicators (QIs)" tailored for Ontario's Secondary Stroke Prevention Clinics (SSPC). Since COVID-19, most Ontario SPCs have adopted some model of teleconsultation (via telephone or video). Many SPCs maintained a hybrid care model post-pandemic, including in-person visits and teleconsultations. However, there are no pre-existing teleconsultation-specific QIs to evaluate the model of care. This study is a series of studies aimed at developing teleconsultation-specific QIs to maintain health quality and tracking the hybrid care model to measure its performance.

The Delphi method is the process of gathering a panel experts and engaging in several rounds of questions about how to make certain decisions or solve problems. Given your role as an Ontario SSPC clinician, your insights would be invaluable for this research. Your participation in the Delphi panel and contribution to this important initiative is greatly appreciated.

If you choose to participate in this study, it will involve completing one or two online surveys, each estimated to take about 10 minutes of your time.

1. First Round: I will share a questionnaire featuring a list of teleconsultation-QIs derived from my earlier studies. You will receive the supporting documents of my early studies. You will be asked to rate these quality statements based on two criteria – importance and ease of monitor in your clinical practice – using the Likert scale.
2. Second Round, after analyzing and summarizing the feedback from the first round, I will present a refined list of teleconsultation-QIs by selecting QIs with a high level of agreement. If there is high disagreement, you will rate these quality indicators using the aforementioned criteria.
3. Final Round: Based on your feedback, I will draft the definitive set of QIs . A follow-up survey will then be sent out, allowing you to review and comment on them.

The study has been reviewed and received ethics clearance by the University of Waterloo Research Ethics Board (#45727). The final choice to participate remains entirely yours. For our appreciation, a 20-dollar online gift card will be provided via your email after each survey.

If you are interested in participating, you can find the consent information by clicking the link below.
Delphi Study Invitation emailhttps://ppcentre.uwaterloo.ca/redcap/surveys/?s=MD3E8YYJJXTARM9X

For any further details or if you have questions to assist you in your decision, please feel free to reach out to me at 905-895-4521 ext. 6479 or g3meng@uwaterloo.ca. Alternatively, you can get in touch with my supervisor Dr. Helen Chen at 519-888-4567 ext. 42132 or hele.chen@uwaterloo.ca

Your involvement would be invaluable to our research.

Guangxia Meng

Supplemental Material File S2

Delphi Survey Consent for Participant

Survey Description

Study Title: Teleconsultation service quality indicators for Ontario Secondary Stroke Prevention Clinic: a Delphi study

Faculty Supervisors: Helen Chen, PhD, School of Public Health Sciences, University of waterloo. Phone 1-519-8884567 x42132, email: helen.chen@uwaterloo.ca.. Carrie McAiney, PhD, School of Public Health Sciences, University of waterloo. Phone 1-519-8884567 x 45642, Email: carrie.mcainey@uwaterloo.ca

Student Investigators: Guangxia Meng, MsN, School of Public Health Sciences, University of Waterloo. Email: g3meng@uwaterloo.ca

What is the study about?

Researchers from the University of Waterloo are conducting a study to identify quality indicators (QIs) for the hybrid care (in-person and telephone or virtual platform) service offered by the Ontario Secondary Stroke Prevention Clinics (SSPCs). These QIs are developed by conducting a scoping review, a document analysis, Virtual Care for Secondary Stroke Prevention (New 2020) in Canadian Stroke Best Practice Recommendations, an SSPC patient satisfaction survey and interviews with key informants from Ontario SSPC clinicians with working experiences of teleconsultation. We will send you the support documents, including the synthesis of the results, and their level of evidence.
We are interested in your expert opinion on the teleconsultation-specified QIs that emerged from these research activities.

What does participation involve?

The survey includes three questionnaires rating the QIS. It should take approximately 5 to 15 minutes to complete each survey. Each survey is approximally two weeks apart. Participation in the project is voluntary. The first round of surveys will list proposed teleconsultation service quality indicators with

support documents to provide the source and evidence level. You will be asked to rate these QIs using a 5-point scale for the two indicator-selection criteria: importance for healthcare quality and ease of measure. We would also like to know if there are any new QIs you would like to add to your rationale. Second, after reviewing and summarizing all the participants' feedback, I will select QIs with a high level of agreement. You will be asked to rate these quality indicators using the same criteria. For the last survey, I will draft the final Quality indicators based on the feedback and send out a follow-up survey for all participants to review. Anonymous quotations may be used from open ended questions. After you complete each survey, I recommend you download a PDF of your responses at the end of the survey. This option will display a button for the participant to download a PDF file of your responses to the survey you just completed. Saving your response may help you reflect and answer the following survey. Some demographic questions, such as your gender, age, professional destination, education and years of experience working at the SSPC, help to describe the participants' characteristics in the study.

An example of the type of rating questions in the survey is: how do you rate the importance of this teleconsultation QI from the least to most significant (1-5)?

Who may participate in the study?

To participate in the study, you need to work or manage one of the Ontario SSPCs.

Is participation in the study voluntary?

Your participation in this study is voluntary. You may decline to answer any question(s) you prefer not to answer by skipping to the next question and may stop participating at any time by not submitting your responses and closing your web browser.

Will I receive anything for participating in the study?

If you participate in this study, you will receive a $20 electronic gift card after each survey. You can simply skip questions that you do not want to answer and submit the partially completed survey, we will still send the electronic gift card. The amount received is taxable. It is your responsibility to report this amount for income tax purposes.

How is data collected, stored, and protected?

We will ask for your email address to send you the support documents and gift cards. Your responses will be de-identified by being associated with a study ID and will not be labelled with your email Only those associated with this study will have access to these records. The survey will be administered using the Research Electronic Data Capture (REDCap) Platform, hosted on a secure

server at the University of Waterloo. When information is transmitted over the internet, privacy cannot be guaranteed. There is always a risk that a third party may intercept your responses (e.g., hackers). The University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information that could link your participation to your computer or electronic device without informing you. We will keep our study records for a minimum of seven years. All records are destroyed according to the University of Waterloo policy.

What are the possible benefits of the study?

. We cannot promise you any personal benefits from participating in this study. However, the information you share will help us fill the knowledge gap and provide a starting point to identify teleconsultation-specific QIs for stroke prevention hybrid care. These results will inform the development of a standard set of teleconsultation QIs, which healthcare organizations could implement to improve the service quality in Ontario stroke prevention hybrid care. We appreciate your participation and contribution.

What are the risks associated with the study?

There are no known or anticipated risks associated with participation in this study. If a question or the topic makes you uncomfortable, you can choose not to provide a response. The survey invitation is being sent out on behalf of the University of Waterloo researchers, and your decision on participation will not affect your employment at the SSPC. The SSPC will not know whether you decide to participate.

Who is sponsoring/funding this study?

This study has no finding and sponsoring.

Has the study received ethics clearance?

This study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Board (ORE#45727). If you have questions for the Board contact the Office of Research Ethics, at 1-519-888-4567 ext. 36005 or reb@uwaterloo.ca.

Who should I contact if I have questions regarding my participation in the study?

If you have any questions about this study or need more information before you decide whether to participate, please contact one of the researchers named above.

Thank you in advance for your interest in this project.

Consent

I agree to participate in the research study as described. I understand the purpose and nature of this study, and I am participating voluntarily. I know that I can withdraw from the study at any time without any penalty or consequences.

Clicking the "Yes" button below indicates that I have read the above information and voluntarily agree to participate. By agreeing to participate in the study, I am not waiving my legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

- Yes___
- No___

Your email address: _____

If you have questions, please contact Guangxia Meng by email g3meng@uwateloo.ca or by phone at 905-895-4521 x ####.

Supplemental Material File S3

Focus group round table agenda

SPC Hybrid Care Quality Considerations Focus Group

Background: Before COVID-19, stroke prevention care in Ontario was predominantly delivered through in-person consultation. During COVID-19, 97% (32/34) of Ontario stroke prevention clinics (SPCs) used telephone or video as an alternative care delivery model. Digital technology is incorporated into stroke prevention practices to increase patient access to services. Quality and safe health services are the health system's primary goal. There are no quality measures for teleconsultation in an SPC hybrid model of care. It is essential to establish quality measures to evaluate teleconsultation in hybrid care. At this focus group meeting, we are interested in learning your consideration on defining and measuring the quality of teleconsultation to improve SPC service quality and patient experiences.

Our core question is: "What are the quality considerations for teleconsultation in a hybrid care model for stroke prevention clinics?

Date and time 14:00-15:00 EST on Thursday, June 29, 2023

Location Zoom meeting online (in the meeting calendar)
https://uwaterloo.zoom.us/j/94094036370?pwd=NW5ERnJJWWxLbnozUk4rZHc0SG5tZz09

Meeting ID: 940 9403 6370
Passcode: 206714

Agenda

Time (in EST)	Activities
13:00-13:05	Open remark & introduction
13:05-13:30	Persona Cathy Price discussion
13:300-13:55	Persona Kourosh Hakimi discussion
13:55-14:00	Closing remark

Pre-reading

1. Personas of Cathy Price and Kourosh Hakimi
2. The SPC hybrid care decision tree and quality considerations of SPC teleconsultation identified from the document review
3. Virtual care in secondary stroke prevention: consideration and recommendation for a hybrid model of care https://www.corhealthontario.ca/Virtual-Care-in-SPC-Considerations-and-Recommendations-2022.pdf
4. Canadian Stroke Best Practice Recommendations: Secondary Prevention of Stroke Update 2020 page 21-24: Virtual Care for Secondary Stroke Prevention https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/secondary-prevention-of-stroke/csbpr7-spos-module-final-eng-2020.pdf?rev=2b5bc9a642c44e0eaefb63568c85cacf

Supplemental Material File S4

Online Focus Group Consent Letter

Title of the Study: Home-based Teleconsultation Quality Indicators for Quality Improvement in Secondary Stroke Prevention Clinics: A Modified Delphi Study

Faculty Supervisors: Helen Chen, Ph.D., and Carrie McAiney, Ph.D.

Student Investigator: Guangxia Meng, NP Southlake Regional Health Center (SRHC), and Ph.D. Candidate University of Waterloo

This letter explains the study's objectives, possible risks and benefits, and your rights as a research participant. Should you have any questions about this study or need clarifications, please do not hesitate to contact Guangxia Meng (g3meng@uwaterloo.ca). You will be provided with a copy of the information and consent form if you choose to participate in the online focus group.

What is the study about?

Researchers from the University of Waterloo are conducting a study to identify quality indicators (QIs) for home-based teleconsultation service offered by the Ontario Secondary Stroke Prevention Clinics (SSPCs). These quality considerations are developed by conducting a scoping review, a document analysis, Virtual Care for Secondary Stroke Prevention (New 2020) in Canadian Stroke Best Practice Recommendations, an SSPC patient satisfaction survey and survey of Ontario SSPC clinicians with working experiences of teleconsultation. We will send you the support documents, including the synthesis of the results, and their level of evidence.

We are interested in your expert opinion on the quality considerations and quality indicators of teleconsultation for SSPCs. We invite you to participate in an online focus group via Zoom to explore and verify this topic. First, online informed consent will be sent to members who could express their interest in joining the focus group. I will present the persona and their quality considerations in 10 minutes and host a 50-minute discussion to get your opinions and feedback. we are interested in learning your consideration on defining and measuring the quality of teleconsultation to improve SPC service quality and patient experiences. The study will provide insight into the quality indicators for SSPC virtual care.

I. Your responsibilities as a participant

What does participation involve?

Participation in the study will consist of attending 60 minutes online focus group. Participants who expressed interest will sign/reject consent after reading this letter. A doodle poll will be sent to the consented participants to find the most suitable time for the meeting. One week before the online focus group, the meeting link via Zoom meeting will be sent at a convenient time and date for most participants via the email you provided. The types of questions include "What quality consideration for teleconsultation could be used in X's persona?" or "How do you feel about the model of teleconsultation for this patient when considering the patient's demographic, digital literacy level, and physical or psychological factors?"

The session will be audio recorded to ensure an accurate transcript of your input. The recording will be kept on a password-protected computer at the University of Waterloo. We may include a quotation from your discussion but will ask your permission first before including your words. Your identity will not be included in the manuscript. Given the group format of this session, we will ask you to keep the information of a participant and their comments confidential.

Who may participate in the study?

The Ontario SSPC clinicians with teleconsultation experiences in the past year.

II. Your rights as a participant

Is participation in the study voluntary?

Your participation in this study is voluntary. You may leave the study anytime by communicating this to the focus group facilitator, Guangxia Meng. You may decline to answer any question(s) you prefer not to answer. Please note that due to the focus group format, we cannot remove your comment and don't record who said what.

Will I receive anything for participating in the study?

In appreciation of the time you have given to this study, you will receive a $50 gift card.

What are the possible benefits of the study?

Participation in this study may not provide any personal benefit to you. We seek input from the focus group to develop home-based teleconsultation-specific quality indicators for SSPCs in Ontario and contribute to the appropriate adoption of teleconsultation practice at SSPC from crisis mode to an evidence-based hybrid practice which combines teleconsultation and in-person visits in Secondary Stroke Prevention Clinics.

What are the risks associated with the study?

There are no known or anticipated risks associated with participation in this study. If a question or the discussion makes you uncomfortable, you can choose not to answer.

Will my identity be known to others?

The research team and the other participants in the focus group will know your identity and input.

Will my information be kept confidential?

Your identity will be kept confidential by the researchers. Identifying information will be removed from the transcripts, and the audio recordings will be deleted after transcription (expected to be in winter 2023). The transcripts and other electronic data will be retained for a minimum of 7 years, after which they will be destroyed. Data will be stored in an encrypted folder on a secure server hosted at the University of Waterloo. Only the research team will have access to study data. No identifiable information about a participant will be used in the thesis or any presentations or publications based on this research. Although we will ask all participants in your focus group to maintain confidentiality, we cannot guarantee that they will do so.

When information is transmitted over the internet, privacy cannot be guaranteed. There is always a risk a third party may intercept your responses (e.g., government agencies, hackers). University of Waterloo researchers will not collect or use internet protocol (IP) addresses or other information that could link your participation to your computer or electronic device without informing you.

III. Questions, comments, or concerns

Who is sponsoring/funding this study?

None.

Has the study received ethics clearance?

This study has been reviewed and approved by the University of Waterloo Research Ethics Committee (ORE#43018). If you have questions for the Committee, contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or oreceo@uwaterloo.ca.

Who should I contact if I have questions about my study participation?

If you have any questions regarding this study or would like additional information to assist you in deciding on participation, don't hesitate to contact Guangxia Meng at 905-895-4521x6479 or email at g3meng@uwaterloo.ca.

Guangxia Meng, NP SRHC, Ph.D. candidate University of Waterloo

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Consent Form

By providing your consent, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

Title of the study: Home-based Teleconsultation Quality Indicators for Quality Improvement in Secondary Stroke Prevention Clinics: A Modified Delphi Study

I have read the information presented in the letter about a study conducted by Guangxia Meng, under the supervision of Professors Helen Chen and Carrie McAiney, School of Public Health Sciences, University of Waterloo. I have had the opportunity to ask questions related to the study and have received satisfactory answers to my questions and any additional details.

I understand that participation in the study is voluntary, and I can withdraw this consent by informing the researcher.

□ I am aware the focus group will be audio recorded to ensure accurate transcription and analysis.

¨ I give permission to use anonymous quotations in any thesis or publication from this research.

I agree with my own free will to participate in the study.

□Yes

□No

Supplemental Material File S5

Round one survey

SPC Delphi Questionnaire

You are committed to providing excellent secondary stroke prevention service through teleconsultation. Your participation is crucial to helping us establish the teleconsultation-specific quality indicators that are most clinically relevant, patient-orientate and feasible to monitor in your practice. Please take a few moments to check the boxes that most appropriately describe your experience.

Please complete the survey below.

Thank you!

1. **General information:**
    a) Who is completing the survey?
        - Registered Nurse
        - Registered Practical Nurse
        - Physiotherapist
        - Occupational therapist
        - Clinical nurse specialist
        - Nurse practitioner
        - Neurologist
        - Internist
        - Other (specify)----_____

    b) What is your age group?
        - Less than 30

- 30-39
- 40-49
- 50-59
- 60 or over

c) What is your gender?
- Man/Male
- Woman/female
- Trans*/Non-binary
- Prefer to self-identify_____

d) What is your highest level of education you have completed?
- Diploma
- Bachelor's degree
- Master degree
- M.D.
- PhD

e) How long have you been practicing in stroke prevention?
- Less than 1 year
- 1-5 years
- 6-10 years
- Over 10 years

f) Have your clinic used teleconsultation (phone or video) in the past year?
- Yes___
- No ___

2. **Teleconsultation service quality indicators Delphi Survey #1**

Support documents show each domain of the QIs, the sources and the level of evidence (attached)

Some terms used in the QIs:

The patient intake checklist includes considerations of the patient's ability to participate in a virtual visit (such as cognitive impairments, physical deficits, functional abilities, sensory or perceptual deficits, vision/hearing, communication/language, safety, and available assistance from family and caregivers).

The pre-visit checklist includes the following factors to consider when preparing for a virtual visit and may require administrative support:

1. Patients: ensure patients are aware of the importance of attending the visit, even if it is in a virtual format; they should be aware of the need to maintain privacy, safety and confidentiality; patients should be prepared for the visit by having their blood pressure measurement and medication list ready for review if possible.
2. Technology: Assess availability and experiences with technology, set up, and run a trial to test the speaker and camera.
3. Environmental: ensure proper camera location, sufficient lighting, safety, and privacy.
4. Clinical: medication reconciliation, medical history, relevant diagnostic imaging results and clinical notes. etc.), and inclusion of caregiver/family during the visit (e.g. the patient has the technology and if they need to be set up, will support the planning process for the patient/family, etc.)

Reference: 2020 VIRTUAL CARE IN SECONDARY STROKE PREVENTION Considerations and Recommendations for Hybrid Models of Care

On a scale of one to five, how would you rate the service quality indicators for teleconsultation at the SSPC under the following criteria?

1. **Clinical Relevance:** The indicator should be closely related to the clinical outcomes, processes, or practices that directly affect patient care. It should be something that clinicians recognize as important and valuable to their work.
2. **Patient-Centeredness:** The indicators that reflect patient experiences, outcomes, and satisfaction are especially valuable and align with the overarching goal of improving patient care.
3. **Feasible:** The indicator is easy to collect data without imposing a significant additional workload on clinicians.

	Quality Indicator	**Criteria**	**1** least	**2** some	**3** fair	**4** very	**5** most
1	(Y/N) The SPC uses a virtual triage algorithm for new referrals.	Relevance					
		Patient-Centeredness					
		Feasible					
2	(Y/N) The staff had teleconsultation training or certification	Relevance					
		Patient-Centeredness					
		Feasible					
3	(Y/N) Teleconsultation stroke clinical outcomes are compared to in-person visits.	Relevance					
		Patient-Centeredness					
		Feasible					
4	(Y/N) Collecting patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsult.	Relevance					
		Patient-Centeredness					
		Feasible					
5	% of video converted to telephone monthly.	Relevance					
		Patient-Centeredness					
		Feasible					
6	% of video consult requires technical support monthly.	Relevance					
		Patient-Centeredness					
		Feasible					
7	(Y/N) The SPC uses a patient intake checklist for teleconsult.	Relevance					
		Patient-Centeredness					
		Feasible					
8	(Y/N) The SPC uses a patient pre-visit checklist for teleconsult.	Relevance					
		Patient-Centeredness					
		Feasible					
9	% of patients who have been given the choice of teleconsultation monthly	Relevance					
		Patient-Centeredness					

		Feasible					
10	% of patients who received their preferred model of consultation monthly	Relevance					
		Patient-Centeredness					
		Feasible					
11	(Y/N) Collecting patient perception of therapeutic relationship after teleconsultation.	Relevance					
		Patient-Centeredness					
		Feasible					
12	% of patients were unable to receive video consult due to language barrier, physical or cognitive impairment.	Relevance					
		Patient-Centeredness					
		Feasible					
13	% of patients were unable to receive video consult due to barriers to access or use technology.	Relevance					
		Patient-Centeredness					
14	% of patients were seen within target time as per Canadian Stroke Best Practice Recommendations using teleconsultation.	Relevance					
		Patient-Centeredness					
		Feasible					
15	% of patients had initial consult within the target time using video.	Relevance					
		Patient-Centeredness					
		Feasible					

Please list any modification of above QIs, and provide your rationales.

Please list any other quality considerations not listed above, and provide your rationales using the above criteria 1 (least)-5(most) scale.

Thank you for participating in the teleconsultation service quality indicator for the Ontario SSPC Delphi survey! Your feedback is extremely valuable. Your feedback will help identify important QIs to improve the teleconsultation service quality of SSPC. It will shape the future stroke prevention practice in Ontario.

If you wish receive a summary of the study findings on the third survey, you can leave your email here: _____

We ensure the confidentiality and security of the data. This study has been reviewed and received ethics clearance through the University of Waterloo Research Ethics Committee (ORE#45727). If you have questions for the Committee, contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

If you have other questions or general comments about this study, please contact Guangxia Meng by email at g3meng@uwateloo.ca or by phone at 905-895-XXXX, ext. XXXX.

Supplemental Material File S6

Round two survey

Delphi Study Follow-up Survey

Dear participants,

Thank you for participating in the survey to rate the teleconsultation service quality indicators for Ontario Secondary stroke prevention clinics. This study aims to fill the gap and provide a starting point to identify teleconsultation-specific QIs for stroke prevention care. For the second survey, we had a 92.3% response rate. Many participants felt the group consensus was relevant, sensible and useful, with no negative comments. The feasibility was difficult for the group to assess as the group commented on the need for a provincial database for SPC and feasibility reliant on whether the QIs are built into electronic medical records. All participants in the second round agreed with the modified QI, and one newly proposed QI reached a high agreement. Below are our final results, in which we have reached a high agreement on nine QIs on two criteria (clinically relevant and patient-orientated) in two rounds. We appreciate all the comments made by our participants. The results will inform the development of a standard set of teleconsultation QIs, which healthcare organizations could implement to improve the service quality in Ontario stroke prevention hybrid care. Please see the attached group consensus; feel free to comment in the text box.

Thank you for being so supportive

Guangxia Meng

1. **Group consensus results**

QIs	**Clinically relevant % (n/N)**	**Patient-orientate % (n/N)**
(Y/N) Collecting patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsult.	92.3 (12/13)	100 (13/13)
% of patients who received their preferred model of consultation monthly	92.3 (12/13)	92.3 (12/13)
(Y/N) The SPC uses a virtual triage algorithm for new referrals.	84.6 (11/13)	100 (13/13)
% of patients who have been given the choice of teleconsultation monthly.	83.3 (10/12)	92.3(12/13)
(Y/N) The SPC uses a patient pre-visit checklist for teleconsult.	83.3 (10/12)	91.7 (11/12)
% of patients were unable to receive video consults due to barriers to access or use technology.	83.3 (10/12)	91.7 (11/12)
% of patients were seen within target time as per Canadian Stroke Best Practice Recommendations using teleconsultation.	91.7 (11/12)	83.3 (10/12)
(Y/N) Collecting patient perception of therapeutic relationship after teleconsultation.	84.6 (11/13)	84.6 (11/13)

Please provide any comments for above QIs:

2. **Modified quality indicator**

	QI	Rational	Your feedback		
			Agree	disagree	Comment
Previous	% of patients seen within targeted time as per Canadian Stroke Best Practice Recommendations using teleconsult.	The Canadian Stroke Best Practice only covers the timeframes under 48 hours. The Ontario Triage algorithm for stroke prevention clinic referrals* was building from the 2020 CSBPR covers more options (within 24-hour, 1 week, 2 weeks, 1 month, 3 months).			
Modified	% of patients are seen within targeted time as per Triage Algorithm for Stroke Prevention Clinic Referrals* when using Teleconsult				

*CorHealth, 2022. Triage Algorithm for Stroke Prevention Clinic Referrals (page 4) https://www.corhealthontario.ca/Supplementary-Info-for-Internal-SPC-Triage-Algorithm-Aug-2022.pdf

3. New quality indicators

1) **Clinically Relevance:** The indicator is closely related to the clinical outcomes, processes, or practices that directly affect patient care. It should be something that clinicians recognize as important and valuable to their work.
2) **Patient-orientated:** Indicators reflect patient experiences, outcomes, and satisfaction are especially valuable and align with the overarching goal of improving patient care.

QIs	Criteria	1 least	2 some	3 fair	4 very	5 most
Proportions of patients with TIA/stroke were revisited ED or admitted to hospital due to recurrent stroke within 30 and 90 days after using teleconsult modalities.	Clinically relevant					
	Patient-orientated					
(Y/N) Understanding patient satisfaction with Teleconsult by reason and types (e.g. ER referral, post-discharge, or follow-up).	Clinically relevant					
	Patient-orientated					

1. **Narrative summary of general comments**

1) **Patient selections**: (related to triage, social determinant of health and digital determinant of health)
    - Age and digital literacy: younger patients and higher digital literacy work better with teleconsultation.
    - Disease characteristics: Teleconsult works better with TIA patients with a low probability of stroke.
    - Teleconsult works better with patients with limited access to SPC in their local communities
2) **Data collection** (related feasibility criteria)
    - Lack of ability to collect data: We don't have a provincial database yet.
    - Utilize EMR: Some of the indicators should be built into EMRs.
3) **Outcome of teleconsultation** (related to outcome comparison)
    - Difficulty linking clinical outcomes to teleconsultation.
4) **Standardized checklist** (related to intake checklist): beneficial for any modality of SPC appointment
5) One participant mentioned very low use of teleconsultation post-pandemic

Additional comments:

Thank you for participating in the teleconsultation service quality indicator for the Ontario SSPC Delphi survey! Your feedback is extremely valuable. Your feedback will help identify important QIs to improve the teleconsultation service quality of SSPC. It will shape the future stroke prevention practice in Ontario.You will receive a summary of the final QIs up on your request.

We ensure the confidentiality and security of the data. This study has been reviewed and received ethics clearance through the University of Waterloo Research Ethics Committee (ORE#45727). If you have questions for the Committee, contact the Office of Research Ethics at 1-519-888-4567 ext. 36005 or ore-ceo@uwaterloo.ca.

For all other questions or if you have general comments or questions related to this study, please contact Guangxia Meng by email at g3meng@uwateloo.ca or by phone at 905-895-4521, ext. XXXX.

Supplemental Material Table S1

Document included in the Canadian national-level virtual care recommendations, guidelines and reviews

Document	Purpose	Target audience	Comprehensive Or selective[1]	Authenticity	Credibility
1	An early diagnostique with policy recommendations	Federal provincial territorial virtual care table, health care policymakers	Comprehensive	High	High
2	Applying an equity lens to the design and	Canadian health care decision-	Selective	High	High

	implementation of virtual care and developing principle-based recommendations for a collaborative approach to equitable virtual care across stakeholders and jurisdictions.	makers, health care professionals, health systems leaders, and policymakers			
3	A general guide to support clinicians with their use and implementation of virtual care	Clinicians	Comprehensive	High	High
4	A description of how virtual visits are delivered and how virtual visits are used in Canada, and potential benefits and challenges	Canadian health care decision-makers, health care professionals, health systems leaders, and policymakers	Selective	High	High
5	A literature-based environmental scan to identify methods, standards, and guidelines for evaluating virtual care or completed real-world evaluations to understand how other jurisdictions are approaching	Canadian health care decision-makers, health care professionals, health systems leaders, and policymakers	Comprehensive	High	High

	virtual care evaluation				
6	Supporting a comprehensive approach to digital health evaluation for the country that includes measurement and analyses of virtual care.	Canadian health system decision-makers	Comprehensive	High	High
7	Outlining the actions required to promote excellence in virtual care in Canada and set the stage for broader discussion and more detailed efforts.	Canadian health system decision-makers; all members of health care teams	Comprehensive	High	High
8	Helping audience maximize their success when conducting virtual patient encounters in their daily practices	Canadian physicians	Selective	High	High
9	Developing principles and recommendations for promoting a pan-Canadian approach to the delivery of publicly insured medical services through virtual means.	Canadian health system decision-makers	Comprehensive	High	High

10	Reviewing the landscape of CVC[2] and its challenges and barriers, providing useful resources that facilitate the adoption of CVC in our day-to-day practice, and describe future developments in this method of care delivery	Healthcare professionals in cardiac care	Selective	High	Moderate: independent reviewers

[1]Commprehensive: document covers the topic completely or broadly; Selective: document covers only some aspect of the topic

[2]CVC: cardiovascular care

Documents

1. 2021 Health Canada (a): The state of virtual care in Canada as of wave three of the OCVID-19 pandemic: an early diagnostic and policy recommendations
2. 2021 Health Canada (b): Enhance equitable access to virtual care in Canada: Principle-based recommendation for equity
3. 2022 Healthcare Excellence Canada (HEC): Provision safe and high-quality virtual care: a guide for new and experienced users: clinician change virtual care toolkit version 1.0
4. 2021 Canadian Agency for Drug Technology in Health (CADTH): CADTH Horizon scan: An overview of direct-to-patient virtual visit in Canada
5. 2022 Canadian Agency for Drug Technology in Health (CADTH): CADTH health technology review" approaches to evaluations of virtual care in primary care
6. 2022 Canadian Institute for Health Information (CIHI): Virtual care in Canada: strengthen data and information
7. 2020 Canadian Medical Association (CMA): Virtual care: recommendations for sailing up virtual medical services
8. 2021 Canadian Medical Association and Royal College of Physicians and Surgeons of Canada: Virtual care playbook for Canadian physicians
9. 2022 Canadian Medical Association (CMA): Virtual care in Canada: progress and potential
10. 2021 Deliver Cardiac Virtual Care (CVC) - A Primer for Cardiovascular Professionals in Canada

Supplemental Material Table S2

Quality subcategories in Canadian virtual Care review (#of articles/# of counts)

Quality Domains	Quality subcategories		Sample quality measures
Equitable (10/86)	Individual SDoH[1] factors (9/51)		Percentage of patients with disabilities and are able to receive virtual care through adaptive technologies Percentage of patients who can receive virtual care in their desired language (CADTH, 2022)
	Individual level DDoH[2] factors (7/35)	Digital literacy[3]	
		Technology access	percentage of patients who delay virtual care as a result of barriers to access (e.g., lack of access to technology or internet connection) (CADTH, 2022)
		Attitudes towards to use[4]	Patient experience survey
Effective (3/64)	Participation outcomes (2/9)		Number of patients treated within virtual and in-person care Proportion of patients converted from in-person to virtual care No show rate of virtual vs in-person visit Numbers of cancelations of virtual vs in-person
	Health utilization outcome (2/13)		Number of virtual and in-person appointments, follow-up attendances, and referrals received. Number of Subsequent virtual care appointments. Determines average number of subsequent virtual appointments generated based on the first appointment per patient Measure of the patients' clinical problems being addressed from virtual visit.
	Clinical outcomes (3/31)		Same standard as in-person visit
	Continuity of care (1/2		Degree to which virtual care allows for continuity of care, follow-up care, and a

		smooth transition from traditional care to virtual care
	Technical effectiveness (1/7)	Percentage of sessions that involve technical difficulties affecting the quality of the session and ability to provide health services Number of hours or days the technological or operating issue prevents virtual care Numbers of video visit converted to telephone visit due to technical difficulties from providers and patients
Safety: appropriateness (8/38)	Clinical appropriateness (8/38)	The likelihood of virtual care would meet the requirement of professional standard and current best practice guidelines (HC, 2021) The likelihood of obtaining the necessary information to support clinical decision-making and a therapeutic relationship with a virtual visit. (HEC 2022) The likelihood of physical examination needed to make or confirm a diagnosis (HEC, 2022) The likelihood that virtual care could provide appropriate medication management and follow-up care (HEC, 2022)
	Patient appropriateness (see equitable section)	Number of patients were unable to attend the virtual visit due to hearing impairment
Patient centered (6/52)	Patient preference (4/31)	The numbers of patients who have given the choice of virtual visits
	Patient experiences (2/21)	Satisfaction of virtual visit The degree of importance of physical contact to establish a relationship with a clinician from the patient's view
Efficient (2/18)	Financial and logistic impact on patients or family	Potential less out-of-pocket cost Time saved for travel Time away from work
Timely (2/22)	Access timeliness indicators	Median wait times for virtual consultation

		Proportion of patients seen within targeted times as per CSBPR

[1] SDoH: social determinants of health defined by the Centers for Disease Control and Prevention as "conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.

[2] DDoH: digital determinants of health are conditions in the digital environment that affect a wide range of health, functioning, and quality of life outcomes and risks

[3]Digital literacy refers to the skills and abilities necessary for digital access, including an understanding of the language, hardware, and software required to successfully navigate the technology

[4]Attitute towards use technology perceived usefulness and perceived ease of use which predict technology adoption

Supplemental Material Table S3

Round one survey results APMO = (312+0)/375X100%=83.2%

QIs	**Agree**		**Disagree**		**N**	**Consensus**
	#	**%**	**#**	**%**		
1. (Y/N) The SPC uses a virtual triage algorithm for SPC referrals. C1[1]	11	84.6	2	15.4	13	yes
1. (Y/N) The SPC uses a virtual triage algorithm for SPC referrals. C2[2]	13	100	0	0	13	yes
2. (Y/N) The staff had teleconsultation training or certification. C1	8	61.5	5	38.4	13	no
2. (Y/N) The staff had teleconsultation training or certification. C2	12	92.3	1	7.7	13	yes
3. (Y/N) Teleconsultation stroke clinical outcomes are compared to in-person visits clinical outcomes. C1	10	76.9	3	23.1	13	no
3. (Y/N) Teleconsultation stroke clinical outcomes are	10	76.9	3	23.1	13	no

compared to in-person visits. C2						
4. (Y/N) Collecting patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsult. C1	12	92.3	1	7.7	13	yes
(Y/N) Collecting patients' feedback in understanding their diagnosis, treatment and risk factors after teleconsult. C2	13	100	0	0	13	yes
5. % of video converted to telephone monthly. C1	9	81.8	2	18.2	11	no
5. % of video converted to telephone monthly. C2	9	81.8	2	18.2	11	no
6. # of video consult requires technical support monthly. C1	7	58.3	5	41.7	12	no
6. # of video consult requires technical support monthly. C2	10	76.9	3	23.1	13	no
7. (Y/N) The SPC uses a patient intake checklist for teleconsult. C1	9	69.2	4	30.8	13	no
7. (Y/N) The SPC uses a patient intake checklist for teleconsult. C2	11	84.6	2	15.4	13	yes
8. (Y/N) The SPC uses a patient pre-visit checklist for teleconsult. C1	10	83.3	2	16.7	12	yes
8. (Y/N) The SPC uses a patient pre-visit checklist for teleconsult. C2	11	91.7	1	8.3	12	yes
9. # of patients who have been given the choice of teleconsult monthly. C1	10	83.3	2	16.7	12	yes

9. # of patients who have been given the choice of teleconsult monthly. C2	12	92.3	1	7.7	13	yes
10. % of patients who received their preferred model of consultation monthly. C1	12	92.3	1	7.7	13	yes
10. % of patients who received their preferred model of consultation monthly. C2	12	92.3	1	7.7	13	yes
11. (Y/N) Collecting perception of therapeutic relationship after teleconsult. C1	11	84.6	2	15.4	13	yes
11. (Y/N) Collecting perception of therapeutic relationship after teleconsult. C2	11	84.6	2	15.4	13	yes
12. % of patients were unable to receive video consults due to language, physical, or cognitive impairment. C1	8	66.7	4	33.3	12	no
12. % of patients were unable to receive video consults due to language, physical, cognitive impairment. C2	9	75	3	25	12	no
13. % of patients were unable to receive video consults due to barriers to access or use technology. C1	10	83.3	2	16.7	12	yes
13. % of patients were unable to receive video consults due to barriers to access or use technology. C2	11	91.7	1	8.3	12	yes
14. % of patients seen within targeted time as per	11	91.7	1	8.3	12	yes

Canadian Stroke Best Practice Recommendations using teleconsultation. C1						
14. % of patients were seen within targeted time as per Canadian Stroke Best Practice Recommendations using teleconsultation. C2	10	83.3	2	16.7	12	yes
15. % of patients had initial consults within the target time using video. C1	10	76.9	3	23.1	13	no
15. % of patients had initial consults within the target time using video. C2	10	83.3	2	16.7	12	yes
Total	312				375	

[1]C1: criteria 1 clinically relevant

[2]C2: criteria 2 patient-orientate

Supplemental Material Figure S1

Persona A Cathy Price

Cathy Price

Job Title

retired teacher

Age

71

Highest Level of Education

Teacher's Colledge

Industry

Elementary school

Goals or Objectives

- Stay connected with her daughter and grandchildren in BC
- Healthy Aging
- Maintain physically health
- Prevent stroke

Clinical information

- A history of diabetes with retinopathy and hypertension
- Had a 15-minute slurred speech and syncope episode and fell on her back, and was sent to the local ER.
- A CT head showed an old lacunar stroke at the basal ganglia; random glucose was 23.
- The ER physician ordered a diabetic education center consult and referred her to the SPC.

Biggest Challenges

- Caregiver for her husband, who has poor health and mobility
- 30-minute drive to the SPC.
- Poor eyesight and not driving

Digital literacy

- Never used a patient portal but had a telephone visit with her family doctor during the pandemic
- Has a smartphone and a computer with Wi-Fi at home
- Using Facetime with her grandchildren
- Feels not very confident with technology

Teleconsultation experiences

- Not informed to get her medication list and health care number ready before the visit.
- Convenient, helpful, and the clinician was knowledgeable.
- Able to ask questions and receive knowledgeable answers
- Challenging to remember all the information on a phone call.

Supplemental Material Figure S2

Persona B Kourosh Hakimi

Kourosh Hakimi

Job Title

retired small business owner

Age

79

Highest Level of Education

High school

Goals or Objectives

- Get healthier
- understand what is stroke
- understand the casue of the stroke
- prevent another stroke

Clinical information

- History of high blood pressure, type 2 diabetes, left macular degeneration and osteoarthritis
- Had a 30-minute painless transient vision loss in his right eye last week
- Saw the optometrist yesterday and was sent to the ER for a possible stroke in the eye
- A CT head did not show acute abnormality but an age-undetermined lacunar infarct at his left basal ganglia.
- A carotid Doppler showed mild soft plaques bilateral common carotid artery.

Biggest Challenges

- Speaks Persian
- Relay on his daughter to translate
- Lives with his daughter
- 16 km away from the SPC and does not drive
- Poor hearing and eyesight

Digital literacy

- Does not use a smartphone, tablet or computer, but his daughter has all the equipment with reliable Wi-Fi at home.
- Very nervous about technology
- Never used a patient portal but his daughter had telephone consult with his family doctor regarding to his health before

Teleconsultation experiences

- Felt the clinician was kind and patient.
- Hard to follow the conversation via telephone
- Easier to forget to ask questions during the phone call
- Missed the in-person visual cue to appreciate his medical situation better
- Had some difficulty contacting the clinic for follow-up.

Supplimental Material Figure S3

Development of quality indicators using Lens model