Indicators of quality care and services for adults with acute ischemic stroke in different types of hospitals in Quebec (IndiQ-AVC): research protocol

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Summary of research project

Title of study	Care and service quality indicators for adults with acute ischemic stroke in differently designated Quebec hospitals (IndiQ-AVC)
Target hospitals	1) Primary care hospital for stroke management 2) Secondary care hospital for stroke management 3) Tertiary care hospital for stroke management
Objectives and research questions	**Objective 1:** Describe performance of care and services based on measurement of clinical and organizational quality indicators of acute stroke care in differently designated Quebec hospitals (primary, secondary and tertiary). **Research question 1:** What is performance of care and services based on measurement of clinical and organizational quality indicators of acute stroke care in differently designated Quebec hospitals (primary, secondary and tertiary)? **Objective 2**: Identify the sociodemographic and clinical characteristics of patients that may influence results regarding measurement of clinical and organizational quality indicators of acute stroke care. **Research question 2:** What are the sociodemographic and clinical characteristics of patients that may influence results regarding measurement of clinical and organizational quality indicators of acute stroke care?
Target population	Adults with ischemic stroke All persons hospitalized for ischemic stroke within the 6 months preceding approval of the Research Ethics Board (REB). The study will be conducted based on their health records.
Inclusion criteria	Adults 18 years old or over with ischemic stroke requiring hospitalization in an acute care unit or special stroke unit
Exclusion criteria	Adults with hemorrhagic stroke
Type of study	Retrospective descriptive-correlational study
Period covered by study	6-month period preceding approval of the REB
Sample size	Given that about 660 patients are hospitalized for ischemic stroke each year in the three hospitals under study and the data will be collected over a period of 6 months, sample size is estimated to be about 130 health records. Because the minimal effect size is not known, an effect size of 50 % is used. A power calculation in G*Power on analyses of group averages indicates

	this sample size is largely sufficient to have a power of 95 %, an alpha set at 0.05 and a minimal effect size of 0.5. The number of patient records retained will provide a sample representative of the hospitalized population in the three hospitals. Finally, a records evaluation test (n=6) will be performed in advance to estimate the time needed to examine each record and allow needed adjustments to be made to conduct research within the context of a doctoral study.
Data collection	***Results measurement****:* • Retrospective data collection performed on patients' health records included in the study (patients' sociodemographic and clinical data, results of evaluation of clinical and organizational quality indicators) • Description of hospitals through data collected on their characteristics based on an analysis of the environment and context of the different centers. This data collection will be performed using a structured interview guide (targeted questions) to identify hospitals' characteristics according to the clinical documentation and consultations with various clinicians, managers and doctors available in the centers under study.
Data analysis	Statistical analyses will be conducted using SPSS software to meet the study's objectives. **Objective 1:** Retrospective descriptive analysis based on patients' health records **Objective 2:** Univariate and multivariate analyses; type of analysis based on type of variable (linear and logistical) and according to distribution (parametric and nonparametric tests)
Anticipated impacts	• Broaden the state of knowledge regarding acute ischemic stroke by drawing a picture of stroke patient management in three differently designated Quebec hospitals; • Identify the sociodemographic and clinical determinants that may influence the results of certain indicators; • In the long term, this project may contribute to reduce the gap between current practices and guidelines regarding post-acute stroke management; • Optimize acute stroke care and services across Quebec through improved understanding of different hospital contexts.

1. Introduction

In Canada, ischemic stroke is the fourth leading cause of death (Statistics Canada, 2020) and one of the main causes of severe disability in adults (Krueger et al., 2015). The literature clearly shows that rapid management, access to revascularization treatments and an offer of structured, well-coordinated care are necessary, even essential, for the physical, cognitive and psychological recovery of persons experiencing a stroke (Boulanger et al., 2018). In Quebec, ischemic stroke is the most common cause of hospitalization (Institut national de santé publique du Québec [INSPQ], 2018). An increase of about 17,000 hospitalized patients was identified, notably, in the decade between 2003-2004 and 2013-2014, representing an increase of about 46 % accompanied by a parallel rise in the needs for care and services for these patients (INSPQ, 2018).

To ensure equity and quality of care and services at the national level, Canadian and international guidelines are regularly published, disseminated and updated consistent with evolution of the state of knowledge regarding, notably, ischemic stroke. These guidelines are deployed on a continuum of stroke-related care and services involving six phases: 1) public awareness raising, 2) primary prevention, 3) hyperacute management, 4) acute management, 5) rehabilitation, and 6) return and maintenance in the community. This continuum guides the offer of care and services and contributes to optimal follow-up in persons with stroke or at risk of stroke and their caregivers concerning immediate recognition of signs of stroke, rapid restoration of blood flow to the brain with hyperacute revascularization treatments, and organization of care and services based on predefined care trajectories (Ministère de la Santé et des Services Sociaux [MSSS], 2017a). In ischemic stroke, the first aim of treatment is to restore blood flow to the brain as rapidly as possible in order to limit deficits and thus facilitate early rehabilitation supported by caregivers. For a number of years now, the administration of intravenous thrombolysis (IVT) to dissolve blood clots obstructing blood vessels has been the first treatment of choice for persons with ischemic stroke who meet eligibility criteria (Adams et al., 2007; Boulanger et al., 2018; Lindsay et al., 2005). In addition to type of stroke, the main eligibility criterion involves access to the treatment within 4.5 hours from onset of symptoms, which unfortunately restricts its administration (Boulanger et al., 2018; Wardlaw et al., 2014). Studies conducted in Canada report certain issues regarding IVT. Notably, in Québec, in 2016, the Institut national d'excellence en santé et services sociaux (INESSS) revealed that 23 % of all candidates in the province considered eligible for thrombolysis IV had received the treatment (INESSS, 2016). With the advance in treatments since 2015, thrombectomy, which involves removing clots blocking an artery with specialized devices, has become an additional recognized, privileged practice for treating ischemic stroke caused by obstruction of the large vessels (Goyal et al., 2016; Menon et al., 2016; Vidale et Agostoni, 2017). In Quebec, this type of treatment is available in tertiary hospital centers, i.e., specialized centers offering neurointervention. However, according to

the data collected by the INESSS in 2013-2014, of the 3,134 persons admitted for stroke in 70 hospitals in Quebec, only 14.2 % presented in a tertiary center for symptoms of stroke (INESSS, 2014). This indicates that the majority of those with ischemic stroke must be transferred to access this advanced treatment. In 2017-2018, in Quebec, the rate of thrombectomy was 4.5 %, while the anticipated rate of potentially eligible patients rose to about 10 % (INESSS, 2019). Accordingly, different care trajectories are envisaged to promote accessibility to optimal treatments based on geographic location, eligibility criteria and available resources.

To date, the international literature has highlighted hyperacute stroke management regarding accessibility of and equity of access to revascularization treatments, an issue even in Canada (Eswaradass et al., 2017). Although the hyperacute phase is important and therefore extensively documented, guidelines maintain that the acute phase including early rehabilitation is also paramount in the post-stroke care trajectory to foster the ongoing improvement of cognitive, language and functional capabilities (Boulanger et al., 2018; Teasell et al., 2019).

The acute phase involves hospitalization in an acute care unit of a patient with ischemic stroke whose revascularization treatment may have been administered based on their clinical condition. It generally occurs within the seven days following the stroke, and its duration may vary consistent with the patient's state of health and needs for care and services. Favorably involving admission to a special stroke unit depending on the designation of the patient's hospital and its available resources, this phase also includes early rehabilitation and the implementation of an interdisciplinary intervention plan carried out by a team composed of different clinicians in collaboration with the patient and caregivers. Finally, this phase also involves referral based on the patient's needs including inpatient or outpatient rehabilitation and secondary prevention to limit the risk of a recurrent attack (MSSS, 2017a). In Québec, in the last decade, only two studies of the acute phase evaluated patient management to discern if clinical practice regarding certain interventions complied with Canadian guidelines. In fact, a provincial field assessment conducted in 2013-2014 revealed that only 14 % of patients had been admitted to a stroke care unit and that screening for dysphagia using a standardized tool was registered in only 16 % of patient records (INESSS, 2016). Furthermore, in 2015-2016, a regional study conducted in a hospital in Centre-du -Québec revealed that screening for dysphagia using a standardized tool was performed in 65% of the cases analyzed and that screening for risk of falls was recorded for 29 % of these same cases (Bélanger and Cloutier, 2021). Moreover, in addition to the introduction of thrombectomy in 2015 in Quebec, which called for the reorganization of certain care and services, modifications surrounding the governance of the health system subsequent to Bill 90 (which modified existing organizational structures for patient care) produced substantial changes in terms of accessibility and offer of care and services (MSSS, 2014). Since then, no study has evaluated acute stroke clinical practice in the province. Furthermore, reports describe the clinical and organizational effects

of the Covid-19 pandemic since 2020, which potentially influence the decisions of managers, role of the clinical staff and involvement of families and caregivers during a stroke (Montaner et al., 2020; Rudilosso et al., 2020; Smith et al., 2020).

To optimize practice and support managers and clinicians in hospitals, experts have formulated recommendations aimed at enhancing the offer of care and services. These recommendations are regularly updated as the science evolves and enable a personalized action plan to implement within each organization depending on its mission. In terms of acute stroke, they stress the development of interdisciplinary approaches to improve management of stroke patients by outlining individualized interventions and including caregivers in care and decision-making. These interventions involve the evaluation of physical, mental and cognitive state of health, patient management, support for caregivers, and follow-up on the improvement or deterioration of cognitive, language and motor functioning in order to promote recovery, prevent the potential complications of a recurrent attack or offer palliative care if necessary (Boulanger et al., 2018; MSSS, 2017b; Powers et al., 2018; Teasell et al., 2019). To this effect, the authors of guidelines, scientific studies and the gray literature also propose numerous quality indicators to measure the results of an action plan and make needed adjustments at the clinical and organizational levels (Boulanger et al., 2018; MSSS, 2017b; Powers et al., 2018; Teasell et al., 2019). A quality indicator is defined as a reliable and valid measurement of a state of health, a practice or an organization of care (MSSS, 2012). Moreover, the current state of knowledge highlights certain discrepancies between the guidelines for achieving quality indicator targets associated with the time dependency of certain clinical medical interventions and practices related to the hyperacute management of patients with ischemic stroke in Quebec (INSPQ, 2019). Some such discrepancies are explained by, among other things, geographic and contextual issues based on types of patient management centers.

In Quebec, temporary designations have been issued for primary, secondary and tertiary care hospitals meeting the criteria established by the MSSS (MSSS, 2013). A primary care hospital can diagnose a stroke and offer revascularization treatments such as thrombolysis IV or telethrombolysis IV. A secondary care hospital can offer thrombolysis IV at any time and houses a stroke care unit with a rehabilitation team composed of different clinicians. In keeping with the criteria established by the ministry, these types of center should also provide follow-up with a secondary prevention clinic. Finally, a tertiary care hospital offers specialized neurovascular treatments including thrombectomy or neurosurgery (INESSS, 2016, 2019).

Researches, however, have highlighted disparities regarding types of hospitals managing stroke patients. One study in particular revealed that hospitals' profiles had a significant impact on patients' clinical results, mainly

because the availability of stroke units and number of patients admitted increased the exposure of clinicians and the medical team to stroke cases (Park et al., 2019). It also showed that hospitals with a higher level of care processes demonstrated improved performance of stroke healthcare based on measurement of quality indicators and therefore generated more favorable clinical results in patients, for example, a lower mortality rate (Yu-Chi et al., 2016). Moreover, a 10-year longitudinal study in the United States pointed to a persistent significant difference between rural and urban environments, the reason being rural patients' less privileged access to hyperacute revascularization treatments and a higher 90-day mortality rate (Wilcock et al., 2020). This difference was also observed in Canada through a higher 30-day post-stroke mortality rate in hospitals in rural areas compared with those in urban centers. However, the province of Quebec was not included in this study in which 89 % of the hospitals lacked tomography services and 79 % had no intensive care unit (Fleet et al., 2018). In Quebec, super-specialized (tertiary care) hospital centers are located in large cities, and hospitals in remote areas are less likely to have a stroke unit (INESSS, 2019). However the current state of knowledge does not allow for an overall picture of the issues surrounding acute stroke care in Quebec.

Other studies have focused on the clinical profiles of stroke patients as possible factors contributing to differences in measurement of quality indicators irrespective of the center where these patients are hospitalized. Notably, the severity of the stroke evaluated by the National Institute Health Stroke Scale (NIHSS), the state of consciousness, aphasia at admission and duration and type of symptoms at admission were associated with different time intervals for getting a CT scan or receiving hyperacute thrombolysis (Ungerer et al., 2020). However the current literature does not associate patients' clinical profile with the achievement of targets of certain acute stroke quality indicators. What's more, it points to sociodemographic characteristics such as age, sex and ethnicity as possible influences on the achievement of quality indicator targets and optimal patient management. Moreover, it appears that women receive fewer hyperacute revascularization treatments than men (Colello et al., 2018; Falsetti et al., 2017; Mainz et al., 2020; Strong et al., 2020) and that they generally take longer to present at the stroke unit compared with men, mainly because they wait longer to consult (Falsetti et al., 2017; Mainz et al., 2020). Reasons appear to be more advanced age and the higher proportion of women living alone when the stroke occurs (Mainz et al., 2020). Regarding the hyperacute phase, several other studies discuss the impact of age during revascularization treatments including the decisional process involved in administering a thrombectomy to patients above 80 years old and the post-treatment clinical results of these patients (Al-Mufti et al., 2021). Now, to our knowledge, no study has evaluated the impact of age on the achievement of targets regarding acute stroke quality indicators in Quebec. The national data of the Institut national de santé publique (INSPQ) show that the prevalence of ischemic stroke increases sharply with age in groups 50 years old and over (INSPQ, 2018). In addition

to sex and age, cultural differences are seen to influence the achievement of certain targets during measurement of quality indicators for stroke including mortality within a year and the administration of antithrombotics and statins for secondary prevention at discharge Gardener et al., 2021).

These observations enable an understanding of the importance of evaluating practices using quality indicators to reduce the gap between acute stroke guidelines and practice. Prior to the present study, we conducted a scoping review of the Arskey and O'Malley methodological framework (2005) to identify the clinical and organizational indicators attributable to the acute phase. A total of 26 articles were included in the review and over 300 indicators were identified based on the grey literature, guidelines and scientific studies. A summary of these indicators followed. A stroke care advisory committee including a patient partner validated the indicators identified in the literature. This approach allowed us to identify 29 priority indicators to measure in clinical practice during the acute phase of the stroke continuum in terms of relevance, validity and feasibility. These clinical (n=19) and organizational (n=10) quality indicators were classified based on dimensions of care performance, namely, accessibility of services (accessibility and equity of access), optimization of resources (efficiency and viability) and quality of care (safety, effectiveness, continuity and reactivity) (Bélanger et al., 2024). Nevertheless, despite this broad inventory of acute stroke indicators, the way they have been validated, tested and integrated at the organizational level and in clinical practice remains unclear (Jolley et al., 2017).

Prior knowledge indicates that quality indicators have been generally measured using patients' health records to obtain a picture of the state of practices. Retrospective data collection is a method frequently employed in research and epidemiology to describe the achievement of quality indicator targets to evaluate the management of a large number of patients with a shared pathology or clinical condition (Simpson et al., 2017). When guidelines are issued in line with a particular care trajectory such as the stroke continuum of care, it's important for health records to show that all patients receive care and services in compliance with guidelines irrespective of their sociodemographic data, clinical profile or geographic location. Now, in Quebec, no study on the measurement of clinical and organizational indicators takes into account the context of the different patient care centers. Nor does the state of knowledge identify the sociodemographic and clinical determinants of patients that may influence the results of measurement of acute stroke quality indicators.

The aim of the present study is to get to discover the current state of acute stroke practice by evaluating the performance of stroke care and services based on measurement of clinical and organizational quality indicators. The achievement of these indicators during hospitalization for acute stroke in differently designated Quebec hospitals will be evaluated using patients' health records. This research project is consistent with the guidelines

of the Ministère de la Santé et des Services Sociaux (MSSS), which aims to improve the performance of the health system in terms of accessibility of services, quality of care and optimization of resources (MSSS, 2017b).

2. Objectives, questions and research hypotheses

The aim of this research project is to describe performance of care and services of acute stroke care in differently designated Quebec hospitals

1. Identify the sociodemographic and clinical characteristics of patients that may influence the results regarding measurement of clinical and organizational quality indicators of acute stroke care.

More specifically, this research project aims to answer the following questions:

1. What is performance of care and services based on measurement of clinical and organizational quality indicators of acute stroke care in differently designated Quebec hospitals (primary, secondary and tertiary)?
2. What are the sociodemographic and clinical characteristics of patients that may influence results regarding measurement of clinical and organizational quality indicators of acute stroke care?

Research hypotheses

1. Results highlight gaps between guidelines and practice following measurement of clinical and organizational quality indicators during acute management of patients with ischemic stroke.
2. Gaps between guidelines and practice resulting from measurement of the clinical and organizational quality indicators of acute stroke care may present similarities or differences between types of hospital centers.
3. Some of patients' clinical and sociodemographic characteristics influence the achievement of the clinical and organizational quality indicators of acute stroke care.
4. Patients' sociodemographic and clinical characteristics identified as influencing the achievement of clinical and organizational quality indicators may vary depending on types of centers.

3. Methodology

3.1 Type of study

To meet the objectives of the research questions, a retrospective descriptive-correlational study will be conducted based on methods of collecting and analyzing quantitative data. The decision to conduct a retrospective study was made for two reasons: first, the nature of the data collected from records allows us to describe the current state of clinical and organizational practices during the length of patients' stay; and second, this type of study

allows for the inclusion of a sample of patients hospitalized during a fixed six-month period. Finally, the feasibility of a retrospective study was considered within the context of a doctoral project with limited resources, time and budget.

In keeping with these considerations, the present study involves a multicentric investigation to take place in three differently designated Quebec hospitals in terms of stroke care. The choice of a multicentric study is based on using a larger sample of patients from different areas to obtain a broad overall view of clinical and organizational practice in stroke management in Quebec. In this study, the primary care center is a multi-vocational center including hospital care that is located in a remote area. The second participating center is a secondary care university hospital that plays an important role in the optimization of stroke care and services throughout its territory given its status as a regional center. The third hospital targeted by the study is a specialized tertiary care center which is nationally recognized for stroke treatment and performs the most thrombectomies in Quebec.

Having different and welldefined missions, these centers maintain an interdependent relation through the offer of proposed care and services. Notably, the patients from the primary care center requiring a thrombectomy are generally transferred to the tertiary center participating in this study to receive treatment. Additionally, although the tertiary care hospital is a thrombectomy center, the patients transferred there must also be returned to the secondary care referral center quickly after treatment to begin rehabilitation as early as possible. Since the majority of guidelines apply in all types of centers irrespective of where the patient is managed, each center must self-compare regarding the achievement of quality indicators.

3.2 Target population

The target population consists of adults 18 years old and over with ischemic stroke who are hospitalized in an acute care unit or a specialized stroke care unit. The only exclusion criterion is a hemorrhagic stroke.

3.3 Sample

3.3.1 Sampling methods

A random sample composed of the health records of patients hospitalized during a fixed period who meet inclusion and exclusion criteria will be included in the study. The list of randomly selected records of patients admitted to hospital for ischemic stroke in each of the participating centers during the six months prior to the date of approval by the Research Ethics Board (REB) will be transmitted by the archives service to the principal investigator. Data collection based on health records relative to clinical and organizational quality indicators will be performed by the principal investigator and a research assistant if needed. Additionally, the principal

investigator will collect data on the characteristics of each hospital center by consulting the health professionals and managers available at the time of observation and data collection.

3.3.2 Sample size

Calculation of number of records aims for a certain representativity of the target population at the time of data collection. Given that about 660 patients are hospitalized each year with ischemic stroke in the three centers under study - 400 in the tertiary center, 250 in the secondary center and 12 in the primary center - and the data were collected over a period of 6 months, the sample size is estimated to be some 130 health records, i.e., about 75, 45 and 8 to 10 records respectively. A power calculation in G*Power on analyses of group averages indicates this sample size is largely sufficient to have a power of 95 %, an alpha set at 0.05 and a minimal size effect of 0.5. When the size effect is not known, a minimal size effect of 50 % is acceptable (Julien, 2019). However, a first phase test will be performed with the health records of patients (n =6) hospitalized prior to the date set for the start of data collection to evaluate the average time required to analyze a record. This phase test will be performed on three health records from the secondary center and three from the tertiary center. Finally, this phase will enable needed adjustments to be made regarding implementation of research within the context of a doctoral study. Additionally, the principal investigator will have access to resources to validate the statistical analysis plan for the study duration.

3.4 Tools and data collection

Data collection will begin once ethical approval is given (REB) and will be conducted using the health records of patients hospitalized during the 6 months preceding this approval. Archivists in each center in the study will provide randomly selected lists of the health records of patients meeting inclusion criteria. Data collected on each of the variables under study will be stored in a password-secured file. The complete list of clinical and organizational quality indicators in the scoping review is presented in Appendix 1. The data collection sheet on patients' characteristics and clinical and organizational quality indicators is given in Appendix 2.

3.4.1 Data collection on patients' characteristics

Patients' characteristics refer to certain sociodemographic data such as age, sex and ethnic or cultural origin as well as a patient's clinical profile including stroke diagnosis, type of treatment (thrombolysis IV, thrombectomy), list of medications, presence of a previous stroke, stroke risk factors, comorbidities, severity of stroke (National Institutes of Health Stroke Scale [NIHSS]) and pre-stroke functional independence (modified Rankin score [mRs])

(Gonzalez-Suarez et al., 2018; Langhorne et al., 2018; Mohammed et al., 2020; Muñoz Venturelli et al., 2019; Nathan et al., 2018; Nishimura et ral., 2019).

3.4.2 Data collection on clinical and organizational quality indicators

Quality indicators will be measured using the health records of acute stroke patients. Those measured will be classified based on dimensions of performance of care (accessiblity of services [accessibility and equity of access], optimization of resources [efficiency and viability] and quality of care [safety, effectiveness, continuity and reactivity]).

3.4.3 Data collection on hospitals' characteristics

Data on hospitals' characteristics will be collected using an environmental analysis method (environmental scan) together with a data collection guide to identify the characteristics of hospitals based on the current clinical documentation and consultations with various clinicians, managers and doctors available. Environmental analysis is used to gather information on events and their relation to the internal and external environment of an organization. The method's main objective is to gather, evaluate and disseminate data for strategic purposes (Clagett, 1987). The data collection guide will be developed using hospital characteristics identified in certain studies retained in the 2024 scoping review (Bélanger et al., 2024) and will be rooted in the conceptual framework Consolidated Framework for Implementation Research (CFIR) to obtain a broad view of the characteristics defining the organizational, contextual and clinical composition of a hospital. The CFIR is a metatheory that allows us to deepen the implementation of innovative interventions within organizations. Its concepts underscore five spheres of influence including, in the present study, 1) characteristics of interventions (e.g., complexity, accessibility), 2) strength and quality of conclusive results), 3) external context (e.g., available resources, guidelines), 4) internal context (e.g., type and number of staff available, structural characteristics) and 5) process (e.g., engagement, planning, execution, reflection). The CFIR takes into account the different actors working with a target clientele and focuses attention on both clinical and organizational contexts and the many complex issues in the field of health (Damschroder et al., 2009). Data will be collected on characteristics including type of center (primary, secondary or tertiary); description of mission and respective role of each center in line with type of designation; geographic distribution; number of persons served by the center; average number of stroke patients admitted each year; number of beds in the stroke care unit; type and number of medical staff available (nurses, nursing assistants, patient care assistants, occupational therapists, physiotherapists, speech therapists, nutritionists, kinesiologists, etc.); presence of multidisciplinary teams (conduct and frequency of meetings); ratio of patients to nurses, nursing assistants, clinicians and patient care assistants; average number of years of experience of nurses

and different clinicians; proportion of nurse technicians and nurse clinicians; number of neurointerventionists, neurovascular specialists, neurologists, internists and general practitioners; protocols and procedures in effect; frequency, type and content of stroke training offered to different medical workers; internal and external resources (material resources, patients' needs, organizational networking, policies, plans or programs in effect, etc.); and methods of communication for transmitting important information to the teams (Gonzalez-Suarez et al., 2018; Langhorne et al., 2018; Muñoz Venturelli et al., 2019; Nishimura et al., 2019). An environmental analysis will be conducted based on observations in the healthcare setting and on consultations with health professionals, different clinicians, doctors and managers available in the different centers. An analysis of protocols, procedures and other documents in effect will also be performed to obtain a detailed picture of each center. First, we will start by collecting needed information from managers and nurse-managers in each establishment by setting up a meeting in advance based on their availability. Second, in the event of missing information, we will arrange with managers to target persons who can supply the missing data. All meetings with clinicians and managers will be scheduled to ensure the availability of the persons concerned. This data collection will serve to paint a portrait of the healthcare centers under study.

3.5 Projected statistical analyses

In response to the first research question, descriptive analyses will be conducted based on measurement of the clinical and organizational quality indicators identified in the acute phase. Medians and interquartile ranges, means and standard deviations and proportions will be used to describe performance of care and services for each center under study and comprehensively for all three centers. Additionally, a contextual description of each center will be presented using data collected on the hospitals' characteristics.

Results of the first objective will highlight indicators that do or do not meet the guidelines for quality of care for persons with ischemic stroke and their caregivers. For indicators presenting extensive data, regression analyses will be performed to identify the determinants likely to influence results regarding these indicators.

Dependent variables are clinical or organizational quality indicators, while independent variables correspond to the sociodemographic characteristics and clinical profile of patients with ischemic stroke. Type of regression analysis will vary consistent with the nature of the dependent variables (dichotomous or continuous) and their distribution (parametric or nonparametric tests).

A univariate regression analysis will first allow us to associate determinants (independent variables) with results for the indicators (dependent variables). Variables with a statistically significant association will then be introduced into a linear or logistic regression model. Additionally, these regression analyses will include

confounding variables that may also influence results from the measurement of clinical and organizational quality indicators. To be statistically significant, results must obtain a value of $p < 0.05$ and have a confidence interval of 95 %. All statistical analyses will be conducted using SPSS 28.0 software. Results will be presented comprehensively for the three centers; they may also be presented individually for the secondary and tertiary centers to see if the associations in them are similar or different. If the number of records in one of these hospitals is not enough for statistical power, the analysis will not be performed.

4. Consent process

This study will be carried out retrospectively by analyzing the health records of patients meeting the admissions criteria. This type of study is more in line with a practice assessment process where the patient's consent is not considered necessary according to the 2018 Tri-Council Policy Statement (TRPS2). However, authorization by the Direction des services professionnels et de la pertinence clinique (DSPPC) following ethical approval of the research is needed to access patients' health records.

5. Project progress

After the ethics certificate and a letter authorizing access to health records have been obtained from the Direction des services professionnels et de la pertinence clinique (DSPPC), the random list of 130 health records of patients admitted within the preceding 6 months can be transmitted to the principal investigator to initiate data collection. Random lists of health records meeting the criteria will be drawn up by an archivist in each of the centers. The data will be collected in all three hospital centers at once based on availability of records.

6. Ethical and regulatory considerations

6.1 Tri-Council Policy Statement (TCPS2)

As defined, this protocol is intended to confirm that the principal investigator respects the principles of the Tri-Council Policy Statement ensuring the security and confidentiality of the data collected in patients' health records.

6.2 Ethics review

This research protocol and the documents in the appendices will be evaluated and approved by the Research Ethics Board. A convenience evaluation must be obtained and conducted for each center included in the multicentric study. The ethics certificate must be issued before the project is started. Additionally, this protocol must be evaluated and approved by the ethics committee of the UQTR, the university hosting the principal investigator, whose project will be implemented within the context of her doctoral studies.

6.3 Confidentiality

Every effort will be made to ensure the anonymity of patient health records included in the research. None of the records will be photocopied, and data will be collected in an area designated for this purpose in each of the three centers. Records will be assigned a digital identification code in a password-secured file stored separately from the collected data. It will be possible to trace the identity of patients, but only the principal investigator and her research assistant can access the records. At no time will the names of patients in the records be divulged. The data extraction grid needed to perform statistical analyses will contain no identifiable information allowing patients to be traced. Data collection sheets will be stored in a locked filing cabinet in Local G2 110D located in the Centre hospitalier affilié universitaire régional (CHAUR) de Trois-Rivières. The data will be entered into a database in a password-protected Excel file on the password-protected research computer belonging to the principal investigator. No document identifying the participants will leave the investigational site.

6.4 User data retention and archiving

All documents associated with this project will be kept by the principal investigator. Electronic data will be deposited in a UQTR institutional data repository server, Borealis (Dataverse), which is available to institutions and research organizations in Canada only. Borealis ensures the long-term retention of data, access to the data, and the attribution of unique and permanent digital object identifiers (DOI). Two types of data will be deposited in this server: raw data (untreated data drawn directly from patients' records) and treated data (raw data manipulated in preparation for transfer to SPSS for statistical analyses). Data are anonymous and contain no direct identifiers. Additionally, the hospital centers under study will be identified as primary, secondary or tertiary in the data dictionary accompanying the databases. To facilitate interoperability, data will be saved in an open-access Excel file (CSV). Data can be accessed by contacting the principal investigator. To ensure continuity of access, a second person may be charged with managing data deposit and granting access to data upon request.

6.5 Benefits

Anticipated benefits include contribution to the advancement of knowledge aimed at improving the acute care management of adults with ischemic stroke and their caregivers.

6.6 Risks for patients

There are no concerns regarding risks to patients. Every effort will be made to protect patients' privacy and the confidentiality of the results obtained. The file containing records' identifying numbers will be kept separate from the data collection file, thus ensuring that patients cannot be identified.

7. Source of funding

Previous or pending grants

A grant from the Fonds de soutien à la recherche de la Fondation régionale de Trois-Rivières (RSTR) in the amount of $12,000 was obtained in May 2021. This sum covered a portion of the expenses incurred during the scoping review prior to conducting this study and will allow us to engage a research assistant to help with data collection.

The following internship grants and scholarships were also obtained.

1) Scholarship from Tremplin-Fonds de recherche du Québec-Santé (FRQS) to perform an internship at the Institut national d'excellence en santé et services sociaux (INESSS). Obtained in 2021/05.
2) Scholarship from MES-Universités-Bourses d'études doctorales-Concours 2020-2021. Obtained in 2020/09 and 2021/09.
3) Scholarship from university partners of the Réseau de recherche en interventions en sciences infirmières du Québec (RRISIQ). Obtained in 2020/10 and 2021/10.

8. Impacts of this research project

First, this research project will help broaden the state of knowledge regarding acute ischemic stroke by describing how these patients are managed in three differently-designated Quebec hospitals. Additionally, the results will allow for a clinical and organizational look at performance of care and services by highlighting concepts with the highest-performing results regarding measurement of indicators or, conversely, the lowest-performing. Indeed, this study is the first that measures quality indicators for acute stroke based on dimensions of performance of care in order to shed light on clinical and organizational practices relating to accessibility of services (accessibility and equity of access), optimization of resources (efficiency and viability) and quality of care (safety, effectiveness, continuity and reactivity). Furthermore, the results of measuring clinical and organizational quality indicators will highlight indicators calling for improvement and those for which variations have been observed.

Second, the project will also identify the sociodemographic and clinical determinants potentially able to influence the results of certain indicators. This new knowledge will greatly help strengthen our understanding of the possible impact of certain determinants on patient management and would favor the development of an interdisciplinary intervention model better adapted to the needs of patients and caregivers in terms of improved physical, psychological and cognitive post-stroke recovery.

In the long term, this project may help reduce the gap between current practices and guidelines regarding post-stroke patient management. Finally, because it is conducted in different types of Quebec hospital centers, this project will enable a better understanding of various contexts that is conductive to the optimization of acute stroke care and services across Quebec. Based on the project's results, strategies of improvement through innovative interdisciplinary interventions could be developed that favor optimal management adapted to stroke patients' needs.

8.1 Strengths

This first study on the measurement of acute stroke quality indicators in Quebec allows for an evaluation of performance of care and services based on various clinical and organizational aspects. Indeed, the study's main strength is the measurement of diverse dimensions of performance of care that enables a picture of interdisciplinary practice for the entire acute phase of ischemic stroke. The implementation of the study in three different Quebec hospitals will also provide a better understanding of their distinct geographic and structural contexts. Inclusion of health records from three different centers also allows for better representativity of the population with stroke. As well, the rigorous method employed during implementation can be used by other organizations to obtain results specific to their own establishment. Finally, this retrospective study including a data collection close in time will enable an accurate picture of clinical and organizational management within the context of current healthcare.

8.2 Limitations

The study's main limitation involves the level of data collection in the health records of different hospitals whose different and separate databases complicate the research. Additionally, retrospective research has certain limitations including the possibility of missing data during measurement of indicators or data that vary depending on the quality of notes in the records, factors the researcher cannot control for. What's more, input errors may occur during data collection. To limit this type of error during data collection in health records, an automated coding system will be inserted in the file with a drop-down menu to enter textual data. A validation system will be integrated to issue an error message if aberrant data are recorded. As well, a data validation will be regularly performed to ensure the quality of the data collected by the research assistant. Although the number of indicators to measure ensures good representativity of acute patient management, priority indicators must be chosen to make data collection feasible within the context of a doctoral study. Additionally, certain hospital characteristics must be collected through observation and consultations with various available on-site stakeholders given the lack of written documentation on the subject in the different centers. Finally, the association between

determinants and results will not explain the cause of the different results, but will further identify the elements likely to influence the results obtained.

8.3 Dissemination of results

Results will be presented in a scientific article, as a poster presentation, during an oral communication at conferences and within different local and regional organizations with stakeholders delivering care and services to stroke patients and their caregivers. The confidentiality of patients whose records have been analyzed will be protected during dissemination of results.

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APPENDIX 1

List of clinical and organizational indicators for optimal management of acute ischemic stroke management in adults

Accessibility of services

Accessibility

Indicator 1

Proportion of patients with a wait time of 48 hours or less between emergency triage and first rehabilitation evaluation

***Numerator*:** Number of post-stroke patients with a wait time of 48 hours or less between emergency triage and first rehabilitation evaluation

Denominator: Total number of patients with ischemic stroke

Indicator 2

Average and median time interval between hospital admission and initial evaluation for each professional involved in early acute rehabilitation (Record the average and median time interval for each professional: nurse, physiotherapist, occupational therapist, speech therapist, nutritionist, doctor.)

Indicator 3

Proportion of patients admitted to a stroke care unit within 4 hours or within 24 hours following arrival in triage (Record the average and median wait time between emergency triage and admission to a stroke care unit [Not applicable in a primary care center].).

Numerator 1: Number of patients admitted to a stroke care unit within 4 hours

Numerator 2: Number of patients admitted to a stroke care unit within 24 hours

Denominator: Total number of patients hospitalized for ischemic stroke

Indicator 4

Average and median time interval between patient's arrival in triage and initial screening of dysphagia by a medically trained health professional using a valid screening tool

Equity of access

Indicator 5

Percentage of remote communities with access to the Telehealth/Telestroke program which facilitates access to organized ischemic stroke care across the continuum of care, notably evaluation of needs and delivery of care related to post-stroke rehabilitation

Numerator: Total number of remote communities served by the center and having access to the Telehealth/Telestroke program which facilitates access to organized stroke care across the continuum of care, notably evaluation of needs and delivery of care related to post-stroke rehabilitation
Denominator: Total number of remote communities that could treat ischemic stroke

Indicator 6

Percentage increase of the Telehealth/Telestroke program's coverage of remote communities to support organized stroke care across the continuum of care

Optimization of resources

Efficiency

Indicator 7

Proportion of hospitalized patients treated in a stroke care unit (Not applicable in a primary care center)

Numerator: Number of hospitalized patients treated in a stroke care unit
Denominator: Total number of hospitalized patients diagnosed with stroke

Indicator 8

Average length of stays: Average number of days waiting for transfer to an inpatient intensive functional rehabilitation unit (IFRU) from the time the patient is ready to begin rehabilitation until his or her admission/Average and median lengths of stay including emergency department (ED) and hospitalization/Average and median lengths of stay in intensive care/Average and median lengths of stay in stroke care unit (Determine ratio of number of days in stroke care unit compared with total number of days in hospital including stay in ED and not including stay in ED.)

Indicator 9

Proportion of acute stroke patients evaluated by a physiotherapist, occupational therapist, speech therapist, social worker, nutritionist, nurse or doctor (Proportion by type of health professional)

***Numerator*:** Number of acute stroke patients evaluated by a physiotherapist, occupational therapist, speech therapist, social worker, nutritionist, nurse or doctor during hospitalization for acute stroke
Denominator: Total number of patients hospitalized for acute stroke

Indicator 10

Proportion of patients screened for dysphagia at admission and evaluated by a speech therapist, occupational therapist, nutritionist or other medically trained health professional

Numerator: Number of patients screened for dysphagia at admission and evaluated by a speech therapist, occupational therapist, nutritionist or other medically trained health professional
Denominator: Total number of patients screened for dysphagia at admission

Quality of care

Safety

Indicator 11

Proportion of post-stroke patients investigated for cardiac arrhythmia (electrocardiogram, heart monitor, telemetry, etc.)

Numerator: Number of post-stroke patients investigated for cardiac arrhythmia
Denominator: Total number of post-stroke patients

Indicator 12

Proportion of post-stroke patients screened for dysphagia within 4 hours following triage or within 24 hours following admission or prior to all oral intake of substances and liquids

Numerator 1: Number of post stroke patients screened for dysphagia within 4 hours following triage
Numerator 2: Number of post-stroke patients screened for dysphagia within 24 hours following admission
Numerator 3: Number of post-stroke patients screened for dysphagia prior to all oral intake of substances and liquids
Denominator: Total number of post-stroke patients

Indicator 13

Proportion of post-stroke patients evaluated for pressure sore risk and regularly evaluated to prevent these sores using a valid tool (Braden Scale)

Numerator: Number of post-stroke patients evaluated for pressure sore risk and regularly evaluated using a valid tool

Denominator: Total number of post-stroke patients

Indicator 14

Proportion of post-stroke patients neurologically evaluated using a valid scale (e.g., Canadian Neurological Scale [CNS], National Institutes of Health Stroke Scale [NIHSS])

Numerator: Number of post-stroke patients neurologically evaluated using a valid scale

Denominator: Total number of post-stroke patients

Indicator 15

Proportion of post-stroke patients screened or evaluated for risk of fall

Numerator: Number of post-stroke patients screened or evaluated for risk of fall

Denominator: Total number of post-stroke patients

Indicator 16

Proportion of post-stroke patients with complication of symptomatic intracranial hemorrhage following thrombolytic or endovascular therapy

Numerator: Number of post-stroke patients with complication of symptomatic intracranial hemorrhage following thrombolytic or endovascular therapy

Denominator: Total number of post-stroke patients given thrombolytic or endovascular therapy

Indicator 17

Proportion of post-stroke patients with one of the following complications during hospitalization: aspiration pneumonia, deep vein thrombosis, fever, pulmonary thromboembolism (PTE), shoulder subdislocation, urinary tract infection, contracture, malnourishment, depression/anxiety, gastrointestinal bleeding, convulsions (Result by type of complication)

Numerator: Number of post-stroke patients with one or more of these post-stroke complications during hospitalization

Denominator: Total number of post-stroke patients

Indicator 18

Proportion of patients given a carotid Doppler test within 24 hours

Numerator: Number of post-stroke patients given a carotid Doppler test within 24 hours

Denominator: Total number of post-stroke patients

Effectiveness

Indicator 19

Proportion of patients who die from stroke in hospital within 7 days and within 30 days following admission

Numerator 1**:** Number of patients who die from stroke within 7 days following admission to hospital

Numerator 2**:** Number of patients who die from stroke within 30 days following admission to hospital

Denominator*:* Total number of ischemic stroke patients hospitalized or discharged from hospital

Indicator 20

Proportion of patients with severe disability at discharge (mRS 0-3) (Calculate proportion of patients for each modified Rankin score, mRS of 1 to 5.)

Numerator: Number of patients with a modified Rankin score (mRS) between 0 and 3 at discharge

Denominator: Total number of patients with a modified Rankin score recorded at discharge

Indicator 21

Proportion of patients with increased shoulder pain based on pain intensity score evaluated with a valid tool using reference data during hospitalization

Numerator: Number of post-stroke patients with increased shoulder pain based on pain intensity score evaluated with a valid tool

Denominator: Number of post-stroke patients with shoulder pain

Indicator 22

Proportion of patients readmitted to short-term hospital care for a stroke-related issue after discharge (post 30 days)

Numerator: Number of patients readmitted to short-term hospital care for a stroke-related issue within 30 days after discharge

Denominator: Total number of post-stroke patients re-hospitalized after discharge

Continuity

Indicator 23

Proportion of post-stroke patients prescribed an anticoagulant, lipid-lowering medication, an antiplatelet, an antihypertensive, or a hypoglycemic at discharge (Result per medication)

Numerator: Number of post-stroke patients prescribed an anticoagulant, lipid-lowering medication, an antiplatelet, an antihypertensive, or a hypoglycemic at discharge

Denominator: Total number of post-stroke patients prescribed one or more medications

Indicator 24

Proportion of post-stroke patients with a record that includes a therapeutic nursing plan (TNP), an individualized intervention plan (IIP) or a care plan (CP)

Numerator: Number of post-stroke patients with a record that includes a therapeutic nursing plan (TNP), an individualized intervention plan (IIP) or a care plan (CP)
Denominator: Total number of post-stroke patients

Indicator 25

Transfer at discharge: Proportion of post-stroke patients transferred at discharge to inpatient rehabilitation, outpatient rehabilitation, return to residence, long-term care centre or palliative care (Result by patient's place of transfer)

Numerator: Number of post-stroke patients transferred to inpatient rehabilitation, outpatient rehabilitation, return to residence, long-term care center or palliative care

Denominator: Total number of post-stroke patients discharged from hospital

Indicator 26

Proportion of post-stroke patients referred at discharge to a secondary prevention program (Specify type of referral)

Numerator: Number of post-stroke patients referred at discharge to a secondary prevention program
Denominator: Total number of post-stroke patients discharged

Reactivity

Indicator 27

Proportion of post-stroke patients and caregivers met by the team to discuss management of the patient and his or her needs following discharge

Numerator: Number of post-stroke patients and caregivers met by the team to discuss management of the patient and his or her needs following discharge
Denominator: Total number of post-stroke patients discharged

Indicator 28

Proportion of post-stroke patients and caregivers instructed prior to discharge on the following stroke-related topics of interest: modifiable risk factors, warning signs and symptoms of stroke, how to activate medical emergency services, post-discharge services available, prescribed medications and community resources

Numerator: Number of post-stroke patients and caregivers instructed prior to discharge on these topics of interest
Denominator: Total number of post-stroke patients

Indicator 29

Proportion of post-stroke patients and caregivers who were invited to participate in advance planning of care or had a documented conversation with a health professional regarding resuscitation and level of care

Numerator: Number of post-stroke patients who were invited to participate in advance planning of care or had a documented conversation with a health professional regarding resuscitation and level of care
Denominator: Total number of post-stroke patients

APPENDIX 2

Detailed list of data to collect on patients' characteristics and clinical and organizational quality indicators

<table>
<tr><th colspan="2">A. Data collection information</th></tr>
<tr><td colspan="2">A1. Date of collection DD/MM/YYYY ____ /____ /_____ A2. Name. Collector: _____
A3. Patient ID ☐</td></tr>
<tr><th colspan="2">B. Sociodemographic characteristics</th></tr>
<tr><td>B1. Center ○ 1-Tertiary ○ 2-Secondary ○ 3-Primary
B2. Age at admission _____ years</td><td>B3. Sex
○ 1-Male ○ 2-Female
○ 3-Other: _____
○ 99-Missing data</td></tr>
<tr><td>B4. Ethnicity
○ 1-White
○ 2-South Asian (e.g, Indian from India, Pakistani, SriLankan, Chinese)
○ 3-Black
○ 4-Filipino
○ 5-Arab
○ 6-Latin American
○ 7-Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai)
○ 8-Mideastern (e.g., Iranian, Afghan)
○ 9-Other: _____</td><td>B5. Home region
○ 1-Mauricie
○ 2-Centre du Québec
○ 3-Estrie
○ 4-Montreal
○ 5-Laval
○ 6-Lanaudière
○ 7-Montérégie
○ 8-Other: _____
○ 99-Missing data</td></tr>
</table>

○ 99-Missing data	
B6. Number of km between residence and hospital center: _____km ○ 99-Missing data	

C. Clinical characteristics	
C1. Stroke diagnosis ○ 1-Left Sylvian ○ 2-Right Sylvian ○ 3-Other: _____ ○ 99-Missing data	**C2. Administration of thrombolysis IV (alteplase)** ○ 1-No ○ 2-Yes ○ 3-Not applicable ○ 99-Missing data **C3. Administration of thrombectomy** ○ 1-No ○ 2Yes ○ 3-Not applicable ○ 99-Missing data
C4. History of stroke ○ 1-No ○ 2-Yes ○ 99-Missing data	**C5. Other diagnoses** _____ _____
C6. Pre-stroke medications (relevant with ischemic stroke) ○ 1-Anticoagulant ○ 2-Antihypertensive ○ 3-Cholesterol-lowering medication ○ 4-Lipid-lowering medication ○ 5-Antiplatelet ○ 6-Other: _____ ○ 7-Other: _____ ○ 8-Other: _____ ○ 99-Missing data	
C7. Covid-positive ○ 1-No ○ 2-Yes ○ 99-Missing data	

C8. First NIHSS evaluation (initial) ○ 1-No ○ 2-Yes ○ 99-Missing data	C9. Initial NIHSS result: _____
C10. First modified Rankin assessment (initial mRS) ○ 1-No ○ 2-Yes ○ 99-Missing data	C11. Initial mRS result: _____

D. Risk factors	
D1. Smoking ○ 1-No ○ 2-Yes ○ 99-Missing data	**D2. Physical inactivity** ○ 1-Yes ○ 2-No ○ 99-Missing data
D3. Obesity ○ 1-No ○ 2-Yes ○ 99-Missing data	**D4. Poor nutrition** ○ 1-No ○ 2-Yes ○ 99-Missing data
D5. Alcohol consumption ○ 1-No ○ 2-Yes ○ 99-Missing data	**D6. Drug use** ○ 1-No ○ 2-Yes ○ 99-Missing data
D7. Arterial hypertension ○ 1-No ○ 2-Yes ○ 99-Missing data	**D8. Dyslipidemia** ○ 1-No ○ 2-Yes ○ 99-Missing data
D9. Type 2 diabetes ○ 1-No ○ 2-Yes ○ 99-Missing data	**D10. Carotid stenosis** ○ 1-No ○ 2-Yes ○ 99-Missing data
D11. Sleep apnea	

○ 1-No ○ 2-Yes ○ 99-Missing data	

E. Patient flow / Time intervals
E1. Date and time of arrival at triage DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E2. Date and time of admission to a short-term unit (regardless of unit) DD/MM/YYYY ____ /____ /_____ HH : MIN ____ : ____
E3. Admission to stroke care unit ○ 1-No ○ 2-Yes ○ 3-Not applicable ○ 99-Missing data
E4. Date and time of admission to stroke care unit DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E5. Admission to intensive care unit ○ 1-No ○ 2-Yes ○ 3-Not applicable ○ 99-Missing data
E6. Date and time of admission to intensive care unit DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E7. Presence of nursing evaluation note in the record ○ 1-No ○ 2-Yes ○ 99-Missing data
E8. Date and time of first nursing evaluation note DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E9. Presence of physical therapy evaluation note in the record ○ 1-No ○ 2-Yes ○ 99-Missing data
E10. Date and time of first physical therapy evaluation note DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E11. Presence of occupational therapy evaluation note in the record ○ 1-No ○ 2-Yes ○ 99-Missing data
E12. Date and time of first occupational evaluation note

DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E13. Presence of speech therapy evaluation note in the record O 1-No O 2-Yes O 99-Missing data
E14. Date and time of first speech therapy evaluation DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E15. Presence of nutrition evaluation note in the record O 1-No O 2-Yes O 99-Missing data
E16. Date and time of first nutrition evaluation note DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E17. Presence of social worker evaluation note in the record O 1-No O 2-Yes O 99-Missing data
E18. Date and time of first social worker evaluation DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E19. Presence of doctor's evaluation note in the record O 1-No O 2-Yes O 99-Missing data
E20. Date and time of first doctor's evaluation DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E21.Documented discussion of levels of patient's care O 1-No O 2-Yes O 99-Missing data
E22. Dysphagia screening by a nurse or rehabilitation team member O 1-No O 2-Yes O 99-Missing data
E23. Date and time of dysphagia screening DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E24. Date and time of first oral administration DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
E25. Presence of dysphagia

○ 1-No	○ 2-Yes	○ 99-Missing data	
E26. Evaluation by a clinician in presence of dysphagia ○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
E27. Referral to IFRU by a doctor ○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
E28. Date and time of referral to IFRU DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____			
E29. Admission to IFRU ○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
E30. Date and time of admission to IFRU DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____			
E31. CT carotid angiogram ○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
E32. Date and time of CT carotid angiogram DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____			

F. Evaluations			
F1. Medical evaluation for cardiac arrhythmia ○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
F2. Presence of cardiac arrhythmia ○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
F3. Evaluation of pressure sore risk (Braden Scale) by the nurse ○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data

F4. Result of pressure sore evaluation (Braden Scale): _____
F5. Re-evaluation of pressure sore risk (Braden Scale) by the nurse O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F6. Evaluation of risk of fall by a nurse O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F7. Neurological evaluation by a nurse using the Canadian Neurological Scale O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F8. Result of neurological evaluation on the CNS: _____
F9. Neurological evaluation by the doctor using the NIHSS post revascularization treatment O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F10. Result of NIHSS post revascularization treatment: _____
F11. Neurological evaluation by a nurse using the Glasgow Coma Scale post revascularization treatment O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F12. Result of Glasgow Coma Scale post revascularization treatment: _____
F13. Shoulder pain evaluation by the physiotherapist O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F14. Presence of shoulder pain O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F15. Result of first shoulder pain evaluation: _____
F16. Shoulder pain re-evaluation by physiotherapist O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
F17. Result of second shoulder pain evaluation: _____

G. Complications during hospitalization	
G1. Intracranial hemorrhage O 1-No O 2-Yes O 99-Missing data	G2. Urinary tract infection O 1-No O 2-Yes O 99-Missing data
G3. Aspiration pneumonia O 1-No O 2-Yes O 99-Missing data	G4. Other pneumonia (nosocomial, ventilator-associated, etc.) Specify: _____ O 1-No O 2-Yes O 99-Missing data
G5. Malnourishment O 1-No O 2-Yes O 99-Missing	G6. Convulsions O 1-No O 2-Yes O 99-Missing data
G7. Deep vein thrombophlebitis O 1-No O 2-Yes O 99-Missing data	G8. Depression O 1-No O 2-Yes O 99-Missing data
G9. Temperature increase O 1-No O 2-Yes O 99-Missing data	G10. Anxiety O 1-No O 2-Yes O 99-Missing data
G11. Pulmonary embolism O 1-No O 2-Yes O 99-Missing data	G12. Gastrointestinal bleeding O 1-No O 2-Yes O 99-Missing data
G13. Shoulder subdislocation O 1-No O 2-Yes O 99-Missing data	G14. Contracture O 1-No O 2-Yes O 99-Missing data

H. Discharge / Transfer
H1. Death O 1-No O 2-Yes O 99-Missing data
H2. Date and time of death DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
H3. Short stay discharge O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H4. Date and time of short stay discharge DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
H5. Date and time of stroke unit discharge

DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
H6. Date and time of intensive care unit discharge DD/MM/YYYY ____ /____ /_____ HH: MIN ____ : ____
H7. Presence in the record of functional independence evaluation using modified Rankin Scale (mRS) O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H8. Clinician performing the functional independence evaluation using modified Rankin Scale (mRS) in the record O 1-Nurse O 2-Neurologist O 3-Occupational therapist O 4-Other: _____ O 99-Missing data
H9. mRS result at discharge: _____
H10. Anticoagulant prescribed at discharge O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H11. Lipid-lowering medication prescribed at discharge O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H12. Antiplatelet prescribed at discharge O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H13. Hypertensive prescribed at discharge O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H14. Hypoglycemic prescribed at discharge O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H15. Discussion with patient about targeted goals for discharge O 1-No O 2-Yes O 3-Not applicable O 99-Missing data
H16. Individualized intervention plan developed with patient and caregivers O 1-No O 2-Yes O 3- Not applicable O 99-Missing data
H17. Therapeutic nursing plan developed by nurse with patient and caregivers O 1-No O 2-Yes O 3- Not applicable O 99-Missing data
H18. Beneficiary assistant work plan developed by nurse

○ 1-No	○ 2-Yes	○ 3- Not applicable	○ 99-Missing data
H19. Patient's walking program developed by nurse or interdisciplinary team			
○ 1-No	○ 2-Yes	○ 3- Not applicable	○ 99-Missing data
H20. Transfer at discharge			
○ 1-Return to place of residence		○ 2- Outpatient rehabilitation services	
○ 3- Inpatient rehabilitation		○ 4- Long-term care center	
○ 5- Palliative care		○ 6-Not applicable	
○ 7- Other: _____			
H21. Referral regarding secondary prevention			
○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
H22. Clinician who referred to secondary prevention services			
○ 1-Nurse	○ 2-Neurologist	○ 3-Other: _____	
○ 99-Missing data			
H23. Readmission within 30 days for stroke-related issue			
○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data

I. Discharge education			
I1. Information on modifiable risk factors			
○ 1-No	○ 2-yes	○ 3-Not applicable	○ 99-Missing data
I2. Information on stroke symptoms			
○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
I3. Information on the urgency of consulting in the presence of stroke symptoms			
○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
I4. Information on post-stroke follow-up			
○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
I5. Information on prescribed medications			
○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data
I6. Information on available community resources			

○ 1-No	○ 2-Yes	○ 3-Not applicable	○ 99-Missing data

I7. Professionals providing information to patient and caregivers

○ Nurse	○ Physiotherapist	○ Speech therapist
○ Neurologist	○ Occupational therapist	○ Nutritionist
○ Autre : _____		○ 99-Missing data

APPENDIX 3

Collection sheet on hospital characteristics

A. Hospital center	
A1. Collection data DD/MM/YYYY ____ /____ /_____ A2. Center ☐	
B. Geographic and demographic characteristics	
B1. Type of designation O 1-Primary O 2-Secondary O 3-Tertiary	B2. Description of center's mission and role in relation to type of designation _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
B3. Geographic distribution (regions served) O Mauricie O Centre du Québec O Estrie O Montreal O Laval O Lanaudière O Montérégie O Other: _____	
B4. Population served (approximate number of persons): _____	
B5. Total annual average number of patients admitted: _____	
B6. Total annual average number of patients admitted with a diagnosis of ischemic stroke: _____	
B7. Total number of short-term beds: _____	

B8. Total number of beds on stroke unit or reserved for stroke patients: _____
B9. Annual number of satisfactions and complaints related to patients' stay in stroke unit: Satisfactions: _____ Complaints: _____
B10. Annual number of incident/accident reports (e.g., medication errors, falls, etc.) related to patients' stay in stroke unit: _____
B11. Annual number of restraint and seclusion measures related to patients' stay in stroke unit: _____
B12. Number of continuous observations of a stroke unit patient by a patient care assistant (PCA), a security guard, or a member of the family or the establishment: _____

C. Characteristics of human resources	
C1. Type and number of clinicians available in neurovascular department/neurology (stroke) O Nurse technician: _____ O Nurse clinician: _____ ONurse specialist: _____ O Nursing assistant: _____ O Patient care assistant (PCA): _____ O Occupational therapist: _____ O Physiotherapist: _____ O Speech therapist: _____ O Nutritionist: _____	C2.Interdisciplinary (multidisciplinary) meetings O No O 2-Yes C3. Frequency of multidisciplinary meetings Frequency: _____ C4. Progression of multidisciplinary meetings _____ _____ _____ _____ _____ _____

○ Kinesiologist: _____ ○ Doctor: _____ ○ Internist: _____ ○ Neurologist : _____ ○ Neurointerventionnist: _____ ○ Other: _____	_____

C5. Ratio patients/clinicians

Ratio	**Day**	**Evening**	**Night**
Patients/Nurse			
Patients/Nursing assistant			
Patients/PCA			
Patients/Occupational therapist			
Patients/Physiotherapist			
Patients/Speech therapist			

C6. Mandatory overtime on stroke unit ○ No ○Yes Frequency: _____

C7. Rate of staff turnover on stroke unit: _____

C8. Rate of absenteeism on stroke unit: _____

C9. Average number of years of experience

Clinicians	**Day**	**Evening**	**Night**
Nurse			
Nursing assistant			
Patient care assistant			
Occupational therapist			
Physiotherapist			
Speech therapist			

C10. Proportion of nurse technicians and of nurse clinicians (total number of nurses)

Nurse technicians: _____

Nurse clinicians: _____

D. Documentation and dissemination
D1. Clinical and organizational documentation in effect (protocols, procedures, prescriptions, health records, etc.) _____ _____ _____ _____ _____ _____ _____ _____ _____ _____
D2. Action plans or projects designed for continuous improvement of quality of care and services _____ _____ _____
D3. Frequency and type of content regarding training offered to different clinicians Frequency: _____ Content of training: _____ _____ _____ _____ _____ _____
D4. Internal and external resources (material resources (organizational networking; policies, plans or programs in effect; service corridors and agreements, etc.) _____ _____

_____

D5. Methods of communication for transmitting information to the teams

_____

_____

E. Remote communities
E1. Percentage of remote communities with access to the Telehealth/Telestroke program which facilitates access to organized ischemic stroke care across the care continuum, notably evaluation of needs and delivery of care related to post-stroke rehabilitation. Percentage: _____ Comments: _____ _____
E2. Increase in percentage of Telehealth/Telestroke coverage of remote communities to support organized stroke care across the continuum of care in recent years Percentage: _____(YYYY) Percentage: _____(2021-2022) Comments: _____ _____