Amount and Content of Sensorimotor Therapy Delivered in Three Stroke Rehabilitation Units in Quebec, Canada

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ABSTRACT

Purpose: This study creates a baseline clinical portrait of sensorimotor rehabilitation in three stroke rehabilitation units (SRUs) as a first step in implementing a multi-centre clinical research platform. **Method:** Participants in this cross-sectional, descriptive study were the patients and rehabilitation teams in these SRUs. Prospective (recording of therapy time and content and a Web-based questionnaire) and retrospective (chart audit) methods were combined to characterize the practice of the rehabilitation professionals. **Results:** The 24- to 39-bed SRUs admitted 100–240 inpatients in the year audited. The mean combined duration of individual occupational and physical therapy was 6.3–7.5 hours/week/patient. When evening hours and the contributions of other professionals as well as group therapy and self-practice were included, the total amount of therapy was 13.0 (SD 3) hours/patient/week. Chart audit and questionnaire data revealed the Berg Balance Scale was the most often used outcome measure (98%–100%), and other outcome measure use varied. Clinicians favoured task-oriented therapy (35%–100%), and constraint-induced movement therapy (0%–15%), electrical stimulation of the tibialis anterior (0%–15%), and body weight–supported treadmill training (0%–1%) were less often used. **Conclusions:** This study is the first to provide objective data on therapy time and content of stroke rehabilitation in Quebec SRUs.

Key Words: rehabilitation; sensorimotor area therapy; stroke.

RÉSUMÉ

Objectif : créer un portrait clinique de base de la réadaptation sensorimotrice offerte après un accident vasculaire cérébral dans trois unités de réadaptation fonctionnelle intensive (URFI) comme première étape en vue de la mise en œuvre d'une plateforme de recherche clinique multicentrique. **Méthodologie :** les participants à cette étude descriptive transversale étaient des patients et des équipes de réadaptation de ces URFI. Les chercheurs ont combiné la méthode prospective (consignation de la durée et du contenu du traitement et questionnaire en ligne) et la méthode rétrospective (audit de dossiers) pour caractériser la pratique des professionnels en réadaptation. **Résultats :** les URFI de 24 à 39 lits ont admis de 100 à 240 patients hospitalisés pendant l'année de l'audit. Les interventions en ergothérapie et physiothérapie étaient d'une durée moyenne combinée de 6,3 à 7,5 heures par semaine par patient. Lorsqu'on incluait les soirées, l'apport d'autres professionnels, la thérapie de groupe et la pratique autonome, le total s'élevait à 13,0 heures (ÉT 3,0) par semaine par patient. Les données tirées de l'audit des dossiers et des questionnaires ont révélé que l'échelle d'évaluation de l'équilibre de Berg était la plus utilisée (98 % à 100 %), alors que l'utilisation des autres mesures était variable. Les cliniciens favorisaient les traitements orientés vers les tâches (35 % à 100 %), et utilisaient moins la thérapie par contrainte induite (0 % à 15 %), la stimulation électrique du jambier antérieur (0 % à 15 %) et l'entraînement sur tapis roulant avec support de poids (0 % à 1 %). **Conclusions :** la présente étude est la première à fournir des données objectives sur la durée et le contenu de la réadaptation après un accident vasculaire cérébral dans les URFI du Québec.

In 2011, stroke was the second leading cause of death around the world, and in 2010, approximately 17 million people had a stroke and 33 million were living with the

consequences of a stroke.¹ In Canada, Krueger and colleagues² estimated that 405,000 individuals experienced the effects of stroke in 2013, for a prevalence of 1.15%.

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Covert strokes may outnumber overt strokes by five to one, and they are associated with neurological deficits, including high rates of dementia, depression, and abnormal gait.³ Approximately 315,000 Canadians are living with the consequences of a stroke,⁴ and fewer than 50% of them return to work. The annual cost of stroke in Canada (health care costs and lost economic output) is approximately \$3.6 billion.

Despite advances in acute care that focus on vascular pathology, procedures such as thrombolysis benefit only a small proportion of stroke victims, and the majority are affected by stroke-related impairments.⁵ Although evidence of the benefits of stroke rehabilitation is growing, evidence-based rehabilitative care is not always provided, and there is a need to promote the uptake and maintenance of best-practice recommendations for delivering rehabilitation services.⁶

In 2011, the Canadian Institutes of Health Research awarded an emerging 5-year team grant to the Sensorimotor Rehabilitation Research Team (SMRRT); this was an initiative involving 30 researchers in the basic and clinical sciences from five Quebec universities and three rehabilitation centres. The overall objective of the SMRRT was to study the recovery mechanisms of the central nervous system after stroke or spinal cord injury and to propose innovative rehabilitation interventions. A prerequisite of the clinical research program was establishing a multi-centre, interdisciplinary, translational clinical research platform (CRP) to (1) standardize clinical outcomes, (2) allow patients to benefit from in-depth laboratory evaluations, (3) facilitate subject recruitment, and (4) engage clinicians in planning, executing, and evaluating the effects of innovative research protocols.⁷

Creating this multi-centre CRP was also deemed to be a knowledge translation (KT) strategy that would promote best practices and foster clinicians' participation in research activities. Creating a baseline portrait of clinical practice in the three stroke rehabilitation units (SRUs) in the rehabilitation centres associated with the SMRRT was a necessary first step in developing the multi-centre CRP to enable its future impact to be evaluated. Because evidence continues to emerge linking greater adherence to stroke rehabilitation guidelines with optimal patient outcomes,^{8–11} compliance with guidelines is becoming a quality-of-care indicator in post-acute stroke rehabilitation.⁹ Thus, international guidelines^{12–14} and Canadian Best Practice Recommendations for Stroke Care (CBPRSC)¹⁵—including SRU organizational guidelines, standardized assessment procedures, the amount of time devoted to therapy, and therapeutic approaches—provided a framework for development of the baseline portrait.

Many procedures have been developed to try to unravel the so-called black box of post-stroke rehabilitation interventions. For example, discipline-specific forms have been developed to capture activities such as bed mobility,

sitting, transfers, and gait training that are administered by physiotherapists at the point of care.^{16,17} These forms include a coded list of interventions that may be associated with the activities, and therapists record their interventions in 5-minute increments. For group therapy, therapists record the number of patients, therapists, and assistants involved.^{17–19} Different versions of behavioural mapping, to be carried out by trained observers,^{20–24} have been developed to observe patient–therapist interactions—for example, observing a random selection of patients at 10-minute intervals.²⁵

Other procedures have attempted to define and compare the content of physiotherapy (PT) and occupational therapy (OT) interventions by first videotaping treatment sessions and then having trained observers use a scoring list of therapeutic activities to define the content.^{26,27} Chart audits have been used to evaluate compliance with guidelines for outdoor mobility and transport training delivered to stroke survivors,²⁸ and workload measurement data,²⁹ or total time scheduled for therapy have been used as an indicator of amount of therapy time.³⁰ This array of methods to document therapy time and content reflects the complexity of the exercise and the need to match the chosen methodology to the specific needs, objectives, and resources available in different milieus. To our knowledge, prospective and retrospective methods of data collection have not been combined to document intensive inpatient rehabilitation after stroke. The purpose of this study was to describe the pragmatic approach taken by the SMRRT to create a baseline clinical portrait using prospective and retrospective methods of data collection. This clinical portrait, which describes the constitution of the SRUs and the assessment, therapy time, and content of the rehabilitation, is the first step in developing and implementing a multi-centre CRP in three SRUs located in three cities and associated with three universities in the province of Quebec.

METHODS

Study design

A cross-sectional, pragmatic, descriptive design was used to create baseline clinical portraits of three SRUs. At the end of a collaborative exercise involving the researchers, stroke program managers, and clinicians, consensus was reached on the methodology to be used to obtain the baseline data. In addition to describing the SRUs, three methods were used: (1) a chart audit of selected patients in the previous year, (2) documentation of the amount and content of therapy over a 1-week period prospectively, and (3) a Web-based questionnaire to capture occupational therapists' and physiotherapists' current perceptions of their practice.

Information from the chart audits was combined with that derived from the questionnaire answers to describe the use of outcome measures and selected components

(a)	SRU		
	1	2	3
Chart audit selection	100 inpatient stroke admissions per year 52 charts Rehabilitation began after 2011 Apr. 1 and ended before 2012 Mar. 31	240 inpatient stroke admissions per year 103 charts Rehabilitation began after 2011 Apr. 1 and ended before 2012 Mar. 31	172 inpatient stroke admissions per year 68 charts Rehabilitation began after 2011 Nov. 30 and ended before 2012 Dec. 1
<ul style="list-style-type: none"> • Minimum 4 wk of rehabilitation • OT and PT services provided • Representative of the different therapists 	20 charts selected FIM < 40, <i>n</i> = 1 FIM 40–59, <i>n</i> = 2 FIM 60–80, <i>n</i> = 8 FIM > 80, <i>n</i> = 9	25 charts selected FIM < 40, <i>n</i> = 2 FIM 40–59, <i>n</i> = 1 FIM 60–80, <i>n</i> = 6 FIM > 80, <i>n</i> = 16	20 charts selected FIM < 40, <i>n</i> = 1 FIM 40–59, <i>n</i> = 3 FIM 60–80, <i>n</i> = 8 FIM > 80, <i>n</i> = 8
(b)			
Therapy time frame and contributing professionals	2012 Apr. 30–May 4 38 (occupational therapist, physiotherapist, PRT, Kin, NS)	2012 Jun. 18–22 15 (occupational therapist, physiotherapist)	2012 Dec. 4–8 13 (occupational therapist, physiotherapist)
Date questionnaire sent and no. of occupational therapist and physiotherapist respondents/eligible	2012 Jun. 11 12/12	2012 Aug. 1 22/24	2012 Nov. 24 12/12

Figure 1 Flow chart of data collection at the three SRUs: (a) selection of charts for the chart audit, including dates and criteria (shown on left), and (b) information regarding intensity of therapy and questionnaire.

SRU = stroke rehabilitation unit; OT = occupational therapy; PT = physiotherapy; PRT = physical rehabilitation technician; Kin = kinesiologist; NS = nursing staff.

of OT and PT rehabilitation practice. The occupational therapists and physiotherapists logged the amount (at all three SRUs) and content (at SRU 2 and SRU 3) of individual therapy they had provided for 5 consecutive days, along with the time they had spent providing group therapy and other supervised activities, during daytime hours. At SRU 1, the time associated with sensorimotor therapy contributed by other professionals, including nursing staff, was recorded for the same 5 consecutive days and extended into the evenings (8:00 a.m.–9:00 p.m.); the rehabilitative therapy content delivered by the nursing staff was also noted.

Participants

Patients included in the chart audit were selected from among those who received their post-stroke rehabilitation in a 1-year period preceding study onset. Eligible charts included those of patients with ischemic or hemorrhagic stroke who had received a minimum of 4 weeks of both OT and PT, without other neurological, musculoskeletal, intellectual, visual, or cognitive impairments likely to affect their rehabilitation potential. Patients who had strokes classified as mild, moderate, severe, and very severe on the basis of FIM scores (Figure 1) treated by a selection of different occupational therapists and physiotherapists at each site were included.

For the week in which data on the amount and content of therapy were gathered, all patients receiving therapy and the occupational therapists and physiotherapists at all three SRUs and the other rehabilitation professionals, including nursing staff at SRU 1, were included. No attempt was made to control for initial stroke severity, age, or stage of recovery of the patients. All occupational therapists and physiotherapists treating patients at the three SRUs when the questionnaire was sent were eligible to respond to it.

The occupational therapists and physiotherapists at the three SRUs, as well as the physical rehabilitation technician (PRT), rehabilitation assistants, kinesiologist, and nurses contributing to rehabilitation interventions at SRU 1, signed an informed consent granted by the SRU ethics committees. Ethics approval was obtained for the chart audits.

Description of the stroke rehabilitation units

Details on the size of each SRU (i.e., number of beds), location of the beds in the rehabilitation centre, personnel (all rehabilitation professionals contributing to rehabilitative care), number of patients admitted in the previous year, and organizational methods (e.g., initial and discharge assessments, individual team treatment plans) were collected by the site research staff.

Amount of data collection and content of therapy

All three sites used a self-reporting system of therapy practice (except for the nursing personnel, outlined later) similar to that described by others^{16–19,31} to document the sensorimotor rehabilitation of the upper and lower extremities. The amount of therapy time and content provided by the occupational therapists and physiotherapists at SRU 2 and SRU 3 were logged on point-of-care documentation forms.^{20,32–34} Thus, therapists agreed on two general domains (assessments and therapy) and then divided the therapy domain into specific interventions. They recorded their practice in 5-minute increments.

At SRU 1, in addition to individual OT and PT therapy time, the therapy time contributed by the PRT, rehabilitation assistants, kinesiologist, and nursing staff, as well as group therapy and self-practice time, were combined to obtain an estimate of total therapy time. Data forms were created to capture the different types of therapy (one to one, group, supervised by rehabilitation assistants, and self-practice). Self-practice time was estimated by the treating therapists on the basis of questions they posed to the patients.

Information on the content of the rehabilitative therapy provided by the nursing staff was obtained using a type of behavioural mapping technique.^{20–24} A nursing data log sheet, which documented each 5-minute increment of the nurses' training in activities of daily living (ADLs), was developed, pretested, and modified accordingly. It was completed by the research staff, who debriefed the nurses immediately after they had provided ADL training to the patients.

Data collection from the chart audits

The regulatory boards require occupational therapists and physiotherapists to provide workload data information on clinical log forms that document the therapy provided to each patient each day. Thus, it is possible, in a chart review, to extract information about the outcome measures used and the therapy delivered. A practical decision was made, given personnel and budget constraints, to target a minimum of 20 charts of patients with different stroke severity on the basis of their FIM scores (see Figure 1).

At each site, charts were reviewed using a data abstraction form that had three general domains: (1) treatment, (2) use of standardized outcome measures, and (3) patient characteristics. The treatment domain reflected the CBPRSC,¹⁵ and the extraction grid was based on one developed for a previous gap analysis.³⁵ It was divided into 10 sections: transfers and sit to stand, lower extremity basic, lower extremity task specific, gait training, treadmill training and aerobic training, upper extremity basic, upper extremity task specific, modalities, education, and other interventions. Thus, we noted the use of outcome measures and their scores, the therapeutic modalities, and the therapeutic approaches reported by the occupa-

tional therapists and physiotherapists as well as patient characteristics, medical history, comorbidities, and length of stay.

We then developed protocols and guidelines for data abstraction. For example, we noted the outcome measures used at either admission or discharge and recorded the delivery of a specific treatment, such as treadmill training, at least once during the patient's length of stay. A coding manual that instructed the reviewers how to capture the data provided rules for decision making in ambiguous situations and outlined procedures for dealing with missing data; the manual and the abstraction grid were pretested and revised.^{36–38} The abstractors were four physiotherapists who were experienced in stroke rehabilitation; they were not blind to the study objectives.

Data collection from the questionnaires

With the help of a colleague who had expertise in questionnaire development, two authors (AD and FM) created a questionnaire using the SurveyMonkey platform to capture how the occupational therapists and physiotherapists perceived their practice. The questionnaire was based on a previously developed gap analysis questionnaire³⁵ and the CBPRSC.¹⁵ The questionnaire was revised by the authors and then pretested by one occupational therapist and two physiotherapists experienced in stroke rehabilitation, revised again for clarity, and shortened to favour completion in about 90 minutes.

The final version included questions about the therapists' use of therapeutic approaches for rehabilitation of the upper and lower extremities, shoulder pain, mobility and transfers, and gait rehabilitation and their use of outcome measures. Clinicians were asked to estimate on a scale ranging from 0% to 100%, the proportion of their patients in the previous 3 months (a) for whom it would have been appropriate to use the interventions listed and (b) who had actually received the interventions. Clinicians were also asked to identify the facilitators of and obstacles to the application of the interventions.

Chart audit and questionnaire data from the three SRUs were combined to give the percentage (minimum to maximum) use of outcome measures and therapy content. For example, the Berg Balance Scale (BBS) was used 98%–100% of the time (98% perceived use in SRU 1 and 100% use in the chart audits for all three SRUs).

Data analysis

We used Microsoft Excel and Microsoft Access (Microsoft Corp., Redmond, WA) for data management. We extracted the amount of therapy information from the self-report, discipline-specific data logs, and, for the nursing staff, the behavioural maps, and we calculated descriptive statistics (means, SDs, and percentages) for the selected variables (therapy time, outcome measures, and therapeutic approaches). To calculate the amount of individual therapy provided in each SRU, the total therapy time provided by occupational therapists and

Table 1 Characteristics of the Three SRUs

Characteristic	SRU, no.		
	1	2	3
Beds	24	39	32
Discipline			
Occupational therapist	5.0	7.4	5.2
Physiotherapist	5.0	6.8	5.2
Neuropsychologist	2.1	4.0	2.0
Speech therapist	3.0	4.5	3.0
Special care counsellor	2.0	2.2	0.5
Nutritionist	1.0	1.3	1.0
Social worker	2.5	5.0	1.8
Clinical coordinator	1.5	1.3	1.5
Physiatrist	0.4	1.0	0.2
General practitioner	2.0	2.0	1.0
Kinesiologist	0.5	—	—
Physical rehabilitation technician	0.5	—	—
Leisure technician	0.25	—	—
Rehabilitation assistant	2	—	—
Total FTEs	27.8	35.5	21.4

SRU = stroke rehabilitation unit; FTE = full-time-equivalent.

physiotherapists over the 5 days was divided by the number of patients to determine the mean number of hours per week per patient.

The OT and PT content (at SRU 2 and SRU 3), such as the time devoted to evaluations, was expressed as a percentage of the total therapy time per week delivered by the occupational therapists and physiotherapists. At SRU 1, the time devoted by each professional—group and self-practice—was expressed in the number of hours contributing to the total therapy hours per patient per week. The time devoted to ADL training by the nursing staff (content of rehabilitative nursing care) was extracted from the behavioural mapping logs and expressed as the mean number of minutes per day per patient.

For the graphical representation of the questionnaire answers, the responses (as a percentage) to each question were summed and divided by the number of responders to give a mean percentage. The same type of calculation was made for the outcome measure responses. For the chart audit, however, the use of the different therapy elements or outcome measures was expressed as a percentage of the number of charts audited in each SRU. For example, if gait speed was measured in 15 of the 20 charts at admission and in 18 at discharge, the percentage use of gait speed as an outcome measure was 18 out of 20, or 90%.

RESULTS

Description of the stroke rehabilitation units

The characteristics of the three SRUs are given in Table 1. The number of beds varied from 24 to 39; the disciplines most represented were OT and PT; and only

SRU 1 included rehabilitation assistants, a PRT, a part-time leisure technician, and a kinesiologist. All SRUs occupied a geographically distinct location, had beds reserved for patients post-stroke, and were staffed by a dedicated, multidisciplinary team of professionals. They provided an organized approach to rehabilitation that included initial and discharge assessments, a personalized treatment plan proposed by the team, and setting rehabilitation goals in collaboration with the patient and family members, caregivers, or both.

Figure 1a depicts the sequence of file selection for the chart audit. Altogether, the SRUs had 95 beds and admitted 512 persons for post-acute stroke rehabilitation in the 1-year audit time frame. We selected 65 charts from among those eligible—more charts of patients with moderate or mild stroke than of those with severe or very severe strokes; these charts reflected the distribution of stroke severities admitted and represented the occupational therapists and physiotherapists.

The extraction of data was time consuming and took about 3.5 hours per chart. The problems we encountered included deciphering handwriting, abbreviations, and missing information.

Figure 1b gives the number of professionals involved and the time frame for and content of the therapy data collection. A total of 66 rehabilitation professionals (38, 15, and 13 at SRU 1, SRU 2, and SRU 3, respectively) who had treated 67 patients (18, 23, and 26 at SRU 1, SRU 2, and SRU 3, respectively) participated in the data collection. Of the 48 occupational therapists and physiotherapists eligible to respond to the questionnaire on practice perception, 46 did, for a response rate of 95.8%.

The amount of individual therapy delivered by the occupational therapists and physiotherapists in the three SRUs is illustrated in Figure 2a. Therapy sessions were scheduled for 60 minutes and 45 minutes at SRU 2 and SRU 3, respectively, five times per week and for 60 minutes four times per week at SRU 1. At SRU 1, combined therapy time (OT and PT) was 7.5 (SD 1.4; range 4.6–10.5); at SRU 2, 6.3 (SD 2.4; range 1–10.5); and at SRU-3, 6.3 (SD 1.2; range 3.6–9.2) hours per week per patient.

The reported content and time devoted to the various therapy components by the occupational therapists and physiotherapists at SRU 2 and SRU 3 are shown in Figure 2b. The physiotherapists at both sites, as expected, emphasized mobility and locomotor function. At SRU 2, the occupational therapists devoted about 25% of their time to ADLs and home visits, and those at SRU 3 spent more than 70% of their time on motor training and strengthening, coordination training of the upper and lower extremities, and sitting and standing balance. Evaluations took up about 7%–20% and educational activities and recommendations less than 5% of the time at both sites during the week monitored.

Figure 2 Intensity of therapy over a 1-week period and time dedicated to specific OT and PT interventions: (a) mean (SD 1) number of hours of individual sessions and (b) percentage of total time dedicated to components of individual sessions at SRU 2 and SRU 3.

OT = occupational therapy; PT = physiotherapy; SRU = stroke rehabilitation unit; UE = upper extremity; LE = lower extremity; ADL = activities of daily living; IADL = instrumental activities of daily living.

Figure 3a shows the increase in therapy time per patient per week when individual OT and PT hours (7.5 [SD 1.4] h) are combined with the contributions of the other rehabilitation staff, group therapy, and self-practice, as recorded at SRU 1 from 8:00 a.m. to 9:00 p.m. These contributions to total therapy time added a mean of 5.5

(SD 2.5; range 1.3–11.9) hours per week per patient of therapy to give a total therapy time of 13.0 (SD 3.0; range 9–22) hours per week per patient. The total therapy time ranged from about 10 hours ($n = 3$) to 15 or more hours ($n = 3$) because of contributions from the kinesiologist, group therapy, and self-practice. The contribution of the

Figure 3 Distribution of therapy time provided by members of the rehabilitation team and self-practice at SRU 1 and types of rehabilitation tasks performed by nursing staff: (a) contributions of the team members to therapy time for the 18 patients and (b) mean time per day dedicated to each nursing task; number of patients trained above each bar.

Note: In Figure 3a, Patient 16 refused one OT and three PT individual therapy sessions because of behavioural problems; in Figure 3b, four patients did not require any nursing training.

OT = occupational therapy; PRT = physical rehabilitation technician; PT = physiotherapy; SRU = stroke rehabilitation unit.

nursing staff varied among the patients, with some requiring much ADL training and three requiring none or only minimal help (see Figure 3a). Over the week, mean individual OT (31% [SD 8], range 18%–46%), PT (28% [SD 10]; range 0%–44%), and nursing staff (16% [SD 16];

range 0%–53%) contributed much of the total therapy time ($n = 18$).

The type of rehabilitative care provided by the nursing staff is depicted in Figure 3b. More than half the patients were trained in self-care and dressing, and nursing staff

Figure 4 Comparison of clinicians' perceptions of the use of selected outcome measures and the chart audits at the three sites. SRU = stroke rehabilitation unit; CMSA-AI = Chedoke McMaster Stroke Assessment Activity Inventory; CMSA-II = Chedoke McMaster Stroke Assessment Impairment Inventory; BBS = Berg Balance Scale; 6MWT = 6-minute walk test; 10mWT = 10-m walk test; NHPT = Nine-Hole Peg Test; CAHAI = Chedoke Arm and Hand Activity Inventory.

devoted a mean of 22 minutes per day per patient for these two ADLs. Of the 18 patients, 4 were independent in ADLs.

Figure 4 compares the outcome measure use gleaned from the questionnaire with that obtained from the chart

audits. Some outcome measures, such as the BBS, comfortable gait speed, and the Chedoke McMaster Stroke Assessment Impairment Inventory, were used widely and documented in the charts. Others, such as the Chedoke Arm and Hand Activity Inventory (CAHAI),

Figure 5 Comparison of clinicians' perceptions of appropriate use, and estimated use, of selected therapeutic approaches in their practice with the results of the chart audits at the three sites.

SRU = stroke rehabilitation unit; RT novel = repetitive training of novel tasks; UE = upper extremity; ICIMT = intensive constraint-induced movement therapy; mCIMT = modified constraint-induced movement therapy; LE = lower extremity; TA = tibialis anterior; TOT = task-oriented training; BWSTT = body weight-supported treadmill training.

were perceived to be used much less often and, if so, rarely documented. In contrast to SRU 1 and SRU 2, the Chedoke McMaster Stroke Assessment Activity Inventory was rarely reported to be used and was not documented in the charts at SRU 3.

Figure 5 illustrates the comparison between perception of use by clinicians (answers to questionnaire) and documentation of use (chart audits) of therapeutic approaches for the upper and lower extremities and shoulder evaluation. For the upper extremity, repetitive training

of novel tasks and strengthening were appropriate, used, and documented at all sites. Shoulder pain evaluation was captured in the chart audit at SRU 1, whereas it was rarely or not at all captured at SRU 2 and SRU 3. For the lower extremity, transfer skill training, sit to stand, standing balance training, strengthening, and task-oriented gait training were appropriate, used, and documented. The use of repetitive training of novel tasks for the upper extremity and task-oriented gait training indicates that therapists favoured task-oriented training (35%–100%). Clinicians at all three sites judged intensive constraint-induced movement therapy (ICIMT) or modified CIMIT (mCIMIT), functional electrical stimulation (FES) of the tibialis anterior muscle and body weight-supported treadmill training (BWSTT) to be appropriate for only a low percentage of their patients. Their perceived use (questionnaire) and chart documentation of use were even lower or absent: ICIMT and mCIMIT together, 0%–15%; FES, 0%–15%; and BWSTT, 0%–1%. Barriers were noted by many of the 46 therapists who responded to the questionnaire for use of CIMIT ($n = 29$ of 46; 63%), BWSTT ($n = 16$ of 46; 35%), and FES ($n = 13$ of 46; 28%). They included access to and familiarity with the methods of application, equipment, and the time needed to prepare and monitor a patient during these interventions.

DISCUSSION

This is the first study to create portraits of clinical practice in three SRUs in the province of Quebec. These portraits were developed to provide comparative baseline data before a multi-centre CRP was implemented. Because the CRP concerns primarily the sensorimotor rehabilitation of the upper and lower extremities, the focus was primarily on the clinical practice of the occupational therapists and physiotherapists, but it also included the contributions of other professionals at one site. Three discrete methodologies were combined to provide information on the use of standardized outcome measures and the amount and content of therapy delivered.

The evidence supporting the organization of rehabilitation services in SRUs to optimize recovery post-stroke is very strong. The three SRUs met the structural and organizational aspects of best-practice recommendations³⁹ in that the beds reserved for patients post-stroke occupied a geographically distinct location in the rehabilitation establishments and they were staffed by a dedicated, multidisciplinary team of professionals. The SRUs provided an organized approach to rehabilitation that included the patient and family members, caregivers, or both in setting rehabilitation goals.⁶

Amount of time devoted to sensorimotor rehabilitation

This study provided information regarding the amount of individual therapy delivered by occupational therapists and physiotherapists, determined from their self-reports, made on discipline-specific data logs, during the day on 5 consecutive weekdays. Although the therapy time data

derived from these self-reports may have been somewhat overestimated,³⁹ they were gathered in the same manner as previous reports.^{16–19,31} We thought that monitoring over a typical week, and including all patients receiving therapy from the physiotherapists and occupational therapists in the SRU that week, would provide a better estimate, and would interfere only minimally with clinical practice, than other methods such as capturing intervals of practice using behavioural mapping on selected days,^{21,25} randomly selecting patients,²⁵ using scheduled times as an estimate for therapy intensity,³⁰ and capturing workload measurement data.³¹ Monitoring the amount and content of therapy over 1 week provides a snapshot of the therapy delivered in a typical week to patients with different stroke severity in various stages of recovery.

The total mean time dedicated to individual OT and PT sessions together varied from 6.3 (SD 1.2) to 7.5 (SD 1.4) hours. For the two sites providing individual therapy 5 days per week, this corresponded to 1.26 hours per day. These numbers are close to the 1.25 hours (75 minutes) per day reported for the combined OT and PT provided to patients in a single rehabilitation unit in Ontario²⁹ but less than the “recommended three hours per day of direct task-specific therapy, five days a week, delivered by the interprofessional stroke team.”^{6(p.467)} Other guidelines have recommended a minimum of 45 minutes to 1 hour of OT and PT each day.^{13,40} These recommendations, based on consensus expert opinion, do not consider patient severity, tolerance, cognitive deficits, or even refusal to attend therapeutic sessions, all of which affect the amount of therapy time documented, such as in the present study.

A large American study³² reported a combined PT and OT individual therapy time of about 85 minutes per day (~ 1.42 h/d) for patients with moderate stroke and about 80 minutes per day (~ 1.33 h/d) for those with severe stroke. De Wit and colleagues,²⁵ in a comparative study of four European centres (United Kingdom, Switzerland, Belgium, and Germany), reported that the time spent in therapy in a day (7:00 a.m.–5:00 p.m.) ranged from 1 hour in the United Kingdom to about 3 hours in Switzerland. PT took up about 40% of the total therapy time in all centres, followed by OT, except for the United Kingdom. The present results concur with these previous reports and clearly indicate that the actual time dedicated to individual PT and OT interventions per day does not meet the intensity recommended by the CBPRSC³⁹ and that trying to meet these recommendations may be unrealistic if the therapy time calculation is restricted to individual sessions provided by occupational therapists and physiotherapists.

This study also provides new information on the total amount of rehabilitative therapy provided daily per patient from 8:00 a.m. to 9:00 p.m. when combining the individual therapy delivered by the occupational therapists and physiotherapists with the contributions of other rehabilitation professionals, including nursing staff,

and the time dedicated to group therapy and self-practice. In the week monitored at SRU 1, the mean total therapy time per patient per week was 13.0 (SD 3) hours (range 9–22; $n = 18$). On average, these other professionals, and the time devoted to group and self-practice, augmented the amount of time spent in individual OT and PT sessions by 5.5 (SD 2.5) hours per patient per week (range 1.3–11.9). The large range is indicative of stroke severity, patient tolerance or collaboration, and the degree of recovery of the individual patients.

Individual OT and PT sessions contributed 32% and 28%, respectively, of the total amount of therapy. The amount of time devoted by the nursing staff to rehabilitative care (training in ADL) was variable, taking up 16% (SD 16; range 0%–53%), of the total amount of therapy time from 8:00 a.m. to 9:00 p.m.; some patients required much ADL training, and others were independent in their ADLs. Nursing care during the day (the present study included evenings) in the European study²⁵ took up more than 35% of therapy time in the United Kingdom, 10% in Belgium, and about 5% in Switzerland and Germany. These studies did not specify, however, that the nursing care included only rehabilitative nursing care, as in the present study.

To our knowledge, this is the first report of the relative contributions of occupational therapists, physiotherapists, and nursing staff to total rehabilitation therapy time from the moment a patient rises in the morning until bedtime. More important, including the contributions of other professionals and self-practice provided a truer measure of the amount of therapy. Three patients (see Figure 3a) received more than 15 total hours of therapy per week, demonstrating that it is possible to attain an amount of therapy approaching recommended levels, albeit not all as one-to-one therapy. Also, it was notable that these three patients' therapy time was augmented by group therapy, self-practice, and kinesiology training. If speech and language therapy as well as cognitive therapy had been included in the analysis, the total rehabilitation time would have been greater.

Although there is ever-increasing evidence that more therapy results in improved outcomes,^{30,41–43} the optimal amount of individual therapy and time spent in other therapeutic activities is unknown. Moreover, the best dose of therapy provided daily and over weeks and months is no doubt intimately related to individual patients' needs, tolerance, and motivation; therapy content and its diversity; and patient and therapist factors, as well as their interactions.

Therapy content

Converging data from the clinical data logs,^{18,19} chart audits, and responses to the questionnaire indicate that the occupational therapists and physiotherapists promoted sensorimotor recovery by having their patients practise novel tasks and strengthening exercises for the

upper extremity and balance, walking tasks, and strengthening exercises and transfer of skill training for the lower extremity, in accordance with the CBPRSC.⁶ Also, the questionnaire revealed that even though the therapists had considered interventions such as CIMT, FES of the tibialis anterior muscle, or walking on a treadmill with or without body weight support—an appropriate choice for some of their patients—they reported little, if any, use of these approaches.

As expected, information derived from the chart audit did not always agree with the questionnaire responses because a sample of 24%–38% of the patient charts audited were from the previous year, whereas the questionnaire related to therapists' practice in the previous 3 months. It is also likely that shoulder pain was evaluated but not documented in the charts. In general, however, the combined information from the two sources was helpful. It gave an overall picture of the use of outcome measures and practice content that showed good knowledge of, and adherence to, best-practice guidelines. It also revealed a need to acquire information and expertise in applying more recently recommended interventions such as CIMT and BWSTT as well as outcome measures such as the CAHAI.

The low perceived appropriateness of CIMT at all three sites may be related to its stringent motor recovery criteria and identified patient needs. Also, a lack of comfort with this modality may explain why it was not at all used at two of the sites and very rarely at the third. The little use of BWSTT and FES has previously been documented;³⁵ as noted in the answers to the questionnaire, it may be affected by access to and familiarity with the equipment as well as the time needed to prepare and monitor a patient during these interventions. It will be interesting to see whether use of these interventions changes once the CRP has been implemented.

Outcome measures

Information on the use of outcome measures was derived from answers to the questionnaire and the chart audits. In general, clinicians' perceptions of their use of outcome measures were corroborated by the chart audits and supported the widespread use of recommended outcome measures to evaluate impairments and activity limitations of the upper and lower extremities. As expected, some measures, like the BBS, gait speed, and the Chedoke McMaster Stroke Assessment Impairment Inventory were used more often than the more recently developed, and less well-known, CAHAI.

The findings from this study indicate that among the occupational therapists and physiotherapists at the three sites rehabilitation practice follows many of the best-practice recommendations for the use of outcome measures and the choice and application of therapeutic interventions. This is not surprising given that two of the sites had participated in previous studies involving

the application of best-practice recommendations^{8,35} and that all three sites are affiliated with a university and have participated in training professional occupational therapists and physiotherapists. These baseline clinical portraits will provide the basis of comparison for examining the impact of implementing the future CRP on any change in clinical practice.

Nevertheless, this study did have limitations. The first concerns different data logs. Creating baseline clinical portraits of three SRUs in three different cities with different local care cultures and constraints was a complex, real-life project. The experience of the researchers who had been involved in another project at SRU 2 and SRU 3 led them to choose a different data-logging form to document the amount and content of therapy than that used at SRU 1. This choice turned out to be fortuitous because it became possible to measure not only the individual therapy time of the occupational therapists and physiotherapists in a usual day but also the time allocated to various therapy components. The data logs at SRU 1, however, documented only the amount of therapy, and not the content, provided by the individual occupational therapists and physiotherapists, as well as the contributions of other professionals, group therapy, and self-practice, during the day and evenings. It is important to note that the methods used to garner the information limited the active participation of the clinicians to 5–10 minutes per day for 5 days to fill out the data logs and about 90 minutes (at one time) to complete the questionnaire.

The second limitation concerns the chart audit. It proved to be a difficult and time-consuming task that took about 3–4 hours per chart by experienced therapists and was prone to error because of absent information and poor handwriting. Moreover, the relatively small number of charts analyzed (20–25) is a limitation when estimating the percentage use of outcome measures or therapeutic components. Although an effort was made to select the charts of patients treated by different therapists, we did not control for a possible clustering effect, whereby the practice of one or a few therapists could dominate the results. However, the corroboration of the prospective questionnaire data, which represented 96% of the therapists, supported using the chart audit in our multiple-methods approach.

KEY MESSAGES

What is already known on this topic

Occupational therapists, physiotherapists, and other professionals delivering post-stroke rehabilitation do not always adhere to best-practice recommendations, and various knowledge translation (KT) strategies have been developed to promote their uptake.

What this study adds

The present study introduces a multiple-methods approach to document rehabilitation practice post-stroke

and demonstrates its application. Furthermore, the process of creating a practice portrait is a means of KT: It alerts clinicians to best practices (outcome measures, therapy time, and its content) and gaps in their own practice that lead to actions to improve their practice, both as a group and individually. It is also the first study to provide objective data on the stroke sensorimotor rehabilitation delivered in Quebec stroke rehabilitation units (SRUs). The methodology used in this study may inspire other SRUs to establish baseline clinical portraits.

REFERENCES

- Feigin VL, Forouzanfar MH, Krishnamurthi R, et al.; Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010) and the GBD Stroke Experts Group. Global and regional burden of stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. *Lancet*. 2014;383(9913):245–55. [http://dx.doi.org/10.1016/S0140-6736\(13\)61953-4](http://dx.doi.org/10.1016/S0140-6736(13)61953-4). Medline:24449944
- Krueger H, Koot J, Hall RE, et al. Prevalence of individuals experiencing the effects of stroke in Canada: trends and projections. *Stroke*. 2015;46(8):2226–31. <http://dx.doi.org/10.1161/STROKEAHA.115.009616>. Medline:26205371
- Vermeer SE, Longstreth WT Jr, Koudstaal PJ. Silent brain infarcts: a systematic review. *Lancet Neurol*. 2007;6(7):611–9. [http://dx.doi.org/10.1016/S1474-4422\(07\)70170-9](http://dx.doi.org/10.1016/S1474-4422(07)70170-9). Medline:17582361
- Public Health Agency of Canada. Tracking heart disease and Stroke in Canada—stroke highlights 2011. Ottawa: Public Health Agency of Canada; 2011.
- Teasell R, Hussein N, McClure A, et al. Stroke: more than a “brain attack.” *Int J Stroke*. 2014;9(2):188–90. <http://dx.doi.org/10.1111/ijls.12233>. Medline:24444115
- Hebert D, Lindsay MP, McIntyre A, et al. Canadian stroke best practice recommendations: stroke rehabilitation practice guidelines, update 2015. *Int J Stroke*. 2016;11(4):459–84. <http://dx.doi.org/10.1177/1747493016643553>. Medline:27079654
- Richards CL, Nadeau F, Fung J, et al. Clinical-research platforms as a model of knowledge translation to promote best practices in stroke rehabilitation. *Stroke*. 2013;44(12):e199. <http://dx.doi.org/10.1161/01.str.0000338095.11293.72>.
- Bayley MT, Wood Dauphinee S, Richards CL, et al. Facilitated knowledge translation improved stroke rehabilitation outcomes: the SCORE-IT cluster randomized controlled trial. *Forthcoming*.
- Duncan PW, Zorowitz R, Bates B, et al. Management of adult stroke rehabilitation care: a clinical practice guideline. *Stroke*. 2005;36(9):e100–43. <http://dx.doi.org/10.1161/01.STR.0000180861.54180.FF>. Medline:16120836
- Perry SB, Zeleznik H, Breisinger T. Supporting clinical practice behavior change among neurologic physical therapists: a case study in knowledge translation. *J Neurol Phys Ther*. 2014;38(2):134–43. <http://dx.doi.org/10.1097/NPT.0000000000000034>. Medline:24637932
- Reker DM, Duncan PW, Horner RD, et al. Postacute stroke guideline compliance is associated with greater patient satisfaction. *Arch Phys Med Rehabil*. 2002;83(6):750–6. <http://dx.doi.org/10.1053/apmr.2002.99736>. Medline:12048651
- Furie KL, Kasner SE, Adams RJ, et al.; American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Clinical Cardiology, and Interdisciplinary Council on Quality of Care and Outcomes Research. Guidelines for the prevention of stroke in patients with stroke or transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2011;42(1):227–76. <http://dx.doi.org/10.1161/STR.0b013e3181f7d043>. Medline:20966421
- National Stroke Foundation. Clinical guidelines for stroke management [Internet]. Melbourne (VIC): National Stroke

- Foundation; 2010 [cited 2012 Feb 10]. Available from: http://www.pedro.org.au/wp-content/uploads/CPG_stroke.pdf.
14. Stroke Foundation of New Zealand and New Zealand Guidelines Group. Clinical guidelines for stroke management 2010 [Internet]. Wellington: Stroke Foundation of New Zealand; 2010 [cited 2012 Feb 10]. Available from: <http://www.stroke.org.nz/resources/NZClinicalGuidelinesStrokeManagement2010ActiveContents.pdf>.
 15. Lindsay M, Gubitz G, Bayley M, et al. Canadian best practice recommendations for stroke care [Internet]. Ottawa: Canadian Stroke Strategy/La Stratégie canadienne de l'AVC; 2010 [cited 2010 Sep 15]. Available from: http://www.strokebestpractices.ca/wp-content/uploads/2011/04/2010BPR_ENG.pdf.
 16. Maulden SA, Gassaway J, Horn SD, et al. Timing of initiation of rehabilitation after stroke. *Arch Phys Med Rehabil*. 2005;86(12 Suppl. 2):S34–40. <http://dx.doi.org/10.1016/j.apmr.2005.08.119>. Medline:16373138
 17. DeJong G, Horn SD, Gassaway JA, et al. Toward a taxonomy of rehabilitation interventions: using an inductive approach to examine the “black box” of rehabilitation. *Arch Phys Med Rehabil*. 2004;85(4):678–86. <http://dx.doi.org/10.1016/j.apmr.2003.06.033>. Medline:15083447
 18. Horn SD, Gassaway J. Practice-based evidence study design for comparative effectiveness research. *Med Care*. 2007;45(10 Suppl. 2):S50–7. <http://dx.doi.org/10.1097/MLR.0b013e318070c07b>. Medline:17909384
 19. Jette DU, Latham NK, Smout RJ, et al. Physical therapy interventions for patients with stroke in inpatient rehabilitation facilities. *Phys Ther*. 2005;85(3):238–48. Medline:15733048.
 20. Åstrand A, Saxin C, Sjöholm A, et al. Poststroke physical activity levels no higher in rehabilitation than in the acute hospital. *J Stroke Cerebrovasc Dis*. 2016;25(4):938–45. <http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2015.12.046>. Medline:26851969
 21. Bernhardt J, Chan J, Nicola I, et al. Little therapy, little physical activity: rehabilitation within the first 14 days of organized stroke unit care. *J Rehabil Med*. 2007;39(1):43–8. <http://dx.doi.org/10.2340/16501977-0013>. Medline:17225037
 22. Bernhardt J, Dewey H, Thrift A, et al. Inactive and alone: physical activity within the first 14 days of acute stroke unit care. *Stroke*. 2004;35(4):1005–9. <http://dx.doi.org/10.1161/01.STR.0000120727.40792.40>. Medline:14988574
 23. Hokstad A, Indredavik B, Bernhardt J, et al. Hospital differences in motor activity early after stroke: a comparison of 11 Norwegian stroke units. *J Stroke Cerebrovasc Dis*. 2015;24(6):1333–40. <http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2015.02.009>. Medline:25906937
 24. Lang CE, Macdonald JR, Reisman DS, et al. Observation of amounts of movement practice provided during stroke rehabilitation. *Arch Phys Med Rehabil*. 2009;90(10):1692–8. <http://dx.doi.org/10.1016/j.apmr.2009.04.005>. Medline:19801058
 25. De Wit L, Putman K, Dejaeger E, et al. Use of time by stroke patients: a comparison of four European rehabilitation centers. *Stroke*. 2005;36(9):1977–83. <http://dx.doi.org/10.1161/01.STR.0000177871.59003.e3>. Medline:16081860
 26. De Wit L, Putman K, Lincoln N, et al. Stroke rehabilitation in Europe: what do physiotherapists and occupational therapists actually do? *Stroke*. 2006;37(6):1483–9. <http://dx.doi.org/10.1161/01.STR.0000221709.23293.c2>. Medline:16645135
 27. De Wit L, Putman K, Schuback B, et al. Motor and functional recovery after stroke: a comparison of 4 European rehabilitation centers. *Stroke*. 2007;38(7):2101–7. <http://dx.doi.org/10.1161/STROKEAHA.107.482869>. Medline:17540968
 28. McCluskey A, Ada L, Kelly PJ, et al. Compliance with Australian stroke guideline recommendations for outdoor mobility and transport training by post-inpatient rehabilitation services: an observational cohort study. *BMC Health Serv Res*. 2015;15(1):296. <http://dx.doi.org/10.1186/s12913-015-0952-7>. Medline:26220778
 29. Foley N, McClure JA, Meyer M, et al. Inpatient rehabilitation following stroke: amount of therapy received and associations with functional recovery. *Disabil Rehabil*. 2012;34(25):2132–8. <http://dx.doi.org/10.3109/09638288.2012.676145>. Medline:22524794
 30. Lohse KR, Lang CE, Boyd LA. Is more better? Using metadata to explore dose-response relationships in stroke rehabilitation. *Stroke*. 2014;45(7):2053–8. <http://dx.doi.org/10.1161/STROKEAHA.114.004695>. Medline:24867924
 31. Gassaway J, Horn SD, DeJong G, et al. Applying the clinical practice improvement approach to stroke rehabilitation: methods used and baseline results. *Arch Phys Med Rehabil*. 2005;86(12 Suppl. 2):S16–33. <http://dx.doi.org/10.1016/j.apmr.2005.08.114>. Medline:16373137
 32. Conroy BE, Hatfield B, Nichols D. Opening the black box of stroke rehabilitation with clinical practice improvement methodology. *Top Stroke Rehabil*. 2005;12(2):36–48. <http://dx.doi.org/10.1310/L3X7-9Y2R-AABF-NF5M>. Medline:15940583
 33. Horn SD, DeJong G, Smout RJ, et al. Stroke rehabilitation patients, practice, and outcomes: is earlier and more aggressive therapy better? *Arch Phys Med Rehabil*. 2005;86(12 Suppl. 2):S101–14. <http://dx.doi.org/10.1016/j.apmr.2005.09.016>. Medline:16373145
 34. Whyte J, Hart T. It's more than a black box; it's a Russian doll: defining rehabilitation treatments. *Am J Phys Med Rehabil*. 2003;82(8):639–52. <http://dx.doi.org/10.1097/01.PHM.0000078200.61840.2D>. Medline:12872021
 35. Bayley MT, Hurdowar A, Richards CL, et al. Barriers to implementation of stroke rehabilitation evidence: findings from a multi-site pilot project. *Disabil Rehabil*. 2012;34(19):1633–8. <http://dx.doi.org/10.3109/09638288.2012.656790>. Medline:22631218
 36. Banks NJ. Designing medical record abstraction forms. *Int J Qual Health Care*. 1998;10(2):163–7. <http://dx.doi.org/10.1093/intqhc/10.2.163>. Medline:9690890
 37. Gearing RE, Mian IA, Barber J, et al. A methodology for conducting retrospective chart review research in child and adolescent psychiatry. *J Can Acad Child Adolesc Psychiatry*. 2006;15(3):126–34. Medline:18392182.
 38. Worster A, Haines T. Advanced statistics: understanding medical record review (MRR) studies. *Acad Emerg Med*. 2004;11(2):187–92. <http://dx.doi.org/10.1111/j.1553-2712.2004.tb01433.x>. Medline:14759964
 39. Bagley P, Hudson M, Green J, et al. Do physiotherapy staff record treatment time accurately? An observational study. *Clin Rehabil*. 2009;23(9):841–5. <http://dx.doi.org/10.1177/0269215509102949>. Medline:19457978
 40. Intercollegiate Stroke Working Party. National clinical guideline for stroke, 4th edition. London: Royal College of Physicians; 2012 [accessed 2013 Mar 10]. Available from: <http://bsnr.org.uk/wp-content/uploads/2014/05/national-clinical-guidelines-for-stroke-fourth-edition.pdf>.
 41. Kwakkel G, van Peppen R, Wagenaar RC, et al. Effects of augmented exercise therapy time after stroke: a meta-analysis. *Stroke*. 2004;35(11):2529–39. <http://dx.doi.org/10.1161/01.STR.0000143153.76460.7d>. Medline:15472114
 42. Lohse KR, Wadden K, Boyd LA, et al. Motor skill acquisition across short and long time scales: a meta-analysis of neuroimaging data. *Neuropsychologia*. 2014;59:130–41. <http://dx.doi.org/10.1016/j.neuropsychologia.2014.05.001>. Medline:24831923
 43. Teasell R, Norhayati H, Foley N. Managing the stroke rehabilitation triage process. In: Teasell R, Hussein N, Foley N, Cotoi A, editors. Evidence-based review of stroke rehabilitation [Internet]. 16th ed. London (ON): Evidence-Based Review of Stroke Rehabilitation; 2015 [cited 2016 Oct 2]. Available from: <http://www.ebrsr.com/evidence-review/4-managing-stroke-rehabilitation-triage-process>.