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Research Article

Stroke Rehabilitation Daily Intensity in Acute Stroke and Stroke Rehabilitation Units in Wellington New Zealand

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Abstract

Background: The ideal level and content of daily rehabilitation is unknown. We wished to measure the intensity of usual inpatient stroke rehabilitation in our stroke service and to compare this to guideline recommendations.

Method: Prospective cohort study of 51 consecutive patients with acute stroke, managed initially in the acute stroke unit (ASU) and followed to discharge into the community, either directly or via the stroke rehabilitation unit (SRU) at a single district health board in Wellington, New Zealand (NZ). Details of actual contact time between rehabilitation clinicians in rehabilitation activities were recorded for each day of the hospital stay. The type of activity and level were recorded for each contact. Descriptive statistics were used.

Results

There were 51 stroke patients of whom 47% were transferred for inpatient rehabilitation. Rehabilitation contact events were recorded on 773 days of which 551 were 'full days', excluding weekends, transfer days and days when the patient was medically unwell. Mean daily rehabilitation contact time on 'full days' was 64 minutes on the ASU and 53 minutes on the SRU. On the ASU and SRU, 55% and 40% respectively of 'full days' met the NZ stroke guideline target of 60 minutes or more contact time and only 3% of days met the recent United Kingdom National Institute of Clinical Excellence (NICE) guideline standard (2013) as we interpreted it.

Conclusion:

Mean daily rehabilitation intensity was lower than recommended in recent guidelines. Improving systems to consistently deliver adequate doses of rehabilitation clinician time should be a priority.

Keywords:

Stroke; Rehabilitation; Therapy; Intensity

Introduction

Stroke is the third highest cause of death [1], and the single most important cause of disability [2] in New Zealand (NZ) and other developed countries. Successful rehabilitation via organised stroke care can reduce mortality, the discharge rate to institutional care and the level of dependence for those discharged home [3]. Guidelines for stroke rehabilitation, from NZ and elsewhere recommend 'organised stroke care', expert stroke rehabilitation clinicians working in teams, and the use of guidelines for common problems following stroke [4,5]. Current NZ guidelines recommend the provision of a minimum of one hour per weekday physical therapy with each patient during inpatient rehabilitation [4]. The United Kingdom National Institute of Clinical Excellence (NICE) guidelines (2013) recommend 45 minutes per day (five days per week) of 'each relevant therapy', but recognise that more intensive therapy may deliver better outcomes [6].

Previous prospective cohort studies have suggested a link between more hours per day of rehabilitation clinician input and better outcomes [7-9]. However, recent evidence from randomised controlled trials has failed to show an improvement in outcomes with more hours per day and more days per week of inpatient rehabilitation [10,11]. Even before the results of recent RCTs were available some have questioned the evidence behind current guideline recommendations setting a minimum daily contact time for physical therapy [12]. Nevertheless, to rehabilitation clinicians, it is often hard to believe the evidence from previous observational studies that many patients in inpatient SRUs have very little face to face contact with clinicians each day [13] and most would accept that 60 minutes per day of contact time was a reasonable minimum. A recent survey of NZ SRUs [14] showed that fewer than 50% were able to provide 60 minutes per weekday contact time with therapists more than 50% of the time.

In Wellington, NZ, hospital acute stroke care is coordinated, with almost all patients initially admitted to the acute stroke unit (ASU) and about 35% of all patients transferred to the stroke rehabilitation unit (SRU) for inpatient rehabilitation at a separate facility. Rehabilitation is provided in both units with a general ethos of early intervention including mobilisation for all patients as tolerated. We aimed to investigate rehabilitation 'dose' at both sites as a first step in a quality improvement programme to optimise the delivery of individualised rehabilitation therapy throughout the inpatient stay for all patients.

Method

This was a prospective observational cohort study. Starting in August 2014, consecutive acute stroke patients managed on the ASU at Wellington Hospital, a 300-bed teaching hospital serving a catchment population of 300,000 people were considered for enrolment. Patients were not enrolled if they were considered likely to die in hospital where the focus was on pal-

liation rather than rehabilitation. A daily sheet of all contact by rehabilitation staff (including physiotherapists, occupational therapists, speech and language therapists, nurses, doctors, therapy assistants, health care assistants) was kept with each face-to-face rehabilitation contact recorded to the nearest five minutes. We purposefully included rehabilitation nursing as a critical component of rehabilitation intensity, even though guideline recommendations tend to focus on 'therapy' which is usually construed to mean either physiotherapy, occupational therapy or speech language therapy. We didn't consider that a mobility session assisted by a rehabilitation nurse should be treated differently from a mobility session assisted by a physiotherapist. A 'rehabilitation contact' was defined as one where the contact was undertaken to work towards a rehabilitation goal. Thus, a bed bath would not generally have been recorded but mobilisation onto a commode chair for a sitting shower with the patient at least in part actively involved would have been recorded. Each contact was further described: 1) as an 'Assessment' or 'Treatment' activity at the discretion of the treating clinician, 2) by treatment type – categories were: mobility, upper limb, self-care (subdivided into toileting, bath/shower, other self-care), communication, swallow, psychological, sensory, education, home visit, 3) by level of activity – some categories were further divided into basic impairment-level activities vs more complicated functional activities, 4) by clinician, including multiple clinicians involved, 5) by time of day – start time was recorded for each contact. Activity of Daily Living (ADL) function was assessed on Day 3 using the Barthel Index [15] (BI, scored 0-20). If a particular activity was attended by more than one discipline, the total time was divided by the number of disciplines and allocated accordingly (ie a 40 minute joint PT and OT session was allocated 20 minutes to PT and 20 minutes to OT).

A checklist of possible reasons why contact time might be reduced on a particular day was also filled in each day: weekend, transfer from another hospital or to home, medically unwell, unavailability of vital equipment. The checklist also covered major impairments (reduced alertness, unable to walk without assistance, paretic arm, communication disorder, swallowing disorder) the presence or absence of which might indicate the expectation of therapy of a particular type on that day. 'Full days' of rehabilitation were those days excluding weekend, admission, transfer or discharge days and where the patient was not listed as 'medically unwell'.

Daily sheets were completed manually by rehabilitation clinicians and entered into an electronic database by one of the authors. Documenting each rehabilitation contact took less than one minute (see appendix for copy of form).

On the ASU there are between four and 10 stroke patients at any one time, with medical management from a neurology team, changing weekly. Staff to patient ratios for physiotherapy, occupational therapy and speech language therapy are

1:10, 1:8 and 1:20 respectively based on six dedicated stroke beds. The multi-disciplinary team meet daily during the week. On the SRU there are between eight and 12 stroke patients at any one time, with medical management from a single rehabilitation physician. Staff to patient ratios for physiotherapy, occupational therapy and speech language therapy are 1:8, 1:8 and 1:20 respectively based on 10 dedicated stroke beds plus 1:12 therapy assistant time. The multi-disciplinary team meet weekly.

Descriptive statistics were used. As this was an observational study documenting current practice, the study was judged not to meet criteria for formal ethical review.

Results

Fifty one patients with acute stroke participated. Of these, 24 (47%) were transferred for inpatient rehabilitation. In all, 2046 rehabilitation contact events were recorded on 773 days. Mean age of the patients was 74.7 years, 59% were male. 74% were European, 16% Pacific, 4% Maori and 4% Indian or Asian. Twelve (24%) were dependent (modified Rankin Score [16] [MRS]>2) prior to this stroke. Most strokes were infarcts (92%). Of these 15% received intravenous thrombolysis. Mean BI at 3 days was 10.8 with 16% <4, 29% 4-10 and 55% >10. Compared to those patients transferred to the SRU, patients discharged from hospital from the ASU were younger (72.6 vs 78 years), had less severe strokes (BI at 3 days 13.4 vs 7.9) and had a shorter LOS (mean 4.6 vs 6.3 days). Similar proportions of patients were discharged home (81% vs 79%) and to institutional care (15% vs 21%) from the ASU and SRU respectively.

Comparison with NZ Stroke Guideline standard⁴ (one hour or more of physical therapy each week day): Including all rehabilitation contacts on 'full days' of potential rehabilitation, the ASU delivered a mean of 64 minutes of face-to-face contact time, but only delivered 60 minutes or more on 55% of these days. On the SRU, mean daily rehabilitation input was 53 minutes, with 60 minutes or more delivered on 40% of days.

Comparison with NICE Stroke rehabilitation standard [6] (45 minutes per day of each relevant discipline). In the ASU, the standard was met for physiotherapy on 3.3%, occupational therapy 14% and both disciplines on 3% of 'full days' and in the SRU for physiotherapy (PT) 14%, occupational therapy (OT) 11% and both disciplines on 2% of 'full days'.

Type and level of activity

There was a higher rate (21% vs 10%) of 'assessment' activities on the ASU compared to the SRU but 'treatment' activities remained the priority on both. Mobility and upper limb activities accounted for approximately half of all face-to-face time with a further 30% in self-care activities. Education accounted for 14% of activities on the ASU but only 2% of activities

on the SRU, this difference mainly explained by the input from the Stroke Nurse Specialist (SNS) on the ASU. Low amounts of psychological and cognitive activities occurred and home visits were either surprisingly few or not consistently recorded. Neither team have consistent access to psychologist input.

Most activities were at a functional level and task oriented. For mobility, 57% of the time, activities were at the highest level i.e. walking, wheelchair use and stairs, and a further 30% were for active transfers. For upper limb activities, 55% were coded as functional upper limb tasks.

Approximately 50% of activity time was provided by either OT or PT with the rest largely divided between therapy assistants (particularly on the SRU where they provided 23% of contact time), nurses (23% overall, more on the ASU), and SLT (8% overall, more on the ASU). Doctors were involved to a minor extent on the ASU, principally mobilising patients as part of the medical/SNS daily ward round.

Most sessions occurred in the morning, with more than 2/3rds starting between 8am and 12pm. There were significant variations in rehabilitation contact time from day to day. Figure 1 is the daily contact time for a single patient, representative of many, from the day of hospital admission until their discharge from the SRU showing a lack of consistent input, particularly on the SRU. There were no clear reasons for this with the likely explanation being staff scheduling i.e. a lengthy session on one day followed by no session the next day to fit in with the needs of other patients.

Discussion

This study was part of a programme of quality improvement in stroke rehabilitation services in a single District Health Board with a catchment population of around 300,000 people. It is the first study that we are aware of that has tried to document rehabilitation contact time across both an acute stroke unit and a stroke rehabilitation unit for individual patients. Although these data were collected primarily to inform changes to these services they have applicability to other services interested in a similar process of change. Both NZ and the UK have stroke rehabilitation guidelines, not firmly evidence-based, that specify recommended levels of 'therapy' for stroke rehabilitation, aimed primarily at stroke rehabilitation units rather than acute stroke units. However, over half our stroke patients spend their entire stroke admission on the ASU, receiving therapy input, prior to discharge and it makes some sense to include these units in the consideration of appropriate rehabilitation therapy 'dose'. The current study suggests that neither the ASU nor the SRU are meeting current New Zealand guideline standards for stroke rehabilitation intensity: 'for patients undergoing active rehabilitation, physical therapy (physiotherapy and occupational therapy) should be provided as much as possible but should be a minimum of one hour active practice

per day (at least five days a week). Our more liberal approach to the definition of 'therapy' in this study includes all rehabilitation activities rather than just 'physical therapy' delivered by physiotherapists and occupational therapists which we consider too restrictive when taken from the patient's perspective. Including all rehabilitation contacts on 'full days' of potential rehabilitation, the ASU delivers a mean of 64 minutes of face-to-face contact time, but only delivers 60 minutes or more on 55% of these days. On the SRU, mean daily rehabilitation input was 53 minutes, with 60 minutes or more delivered on 40% of days. These results are broadly in line with a comprehensive survey [13] of NZ stroke rehabilitation units where only 50% of units reported delivering 60 minutes of face to face contact more than 50% of the time. Results were worse when matched against the NICE UK standard [6] of 45 minutes per day of each relevant discipline and making the assumption that both physiotherapy and occupational therapy were relevant on every 'full day' as an inpatient. In the ASU, the standard was met for physiotherapy on 3.3%, occupational therapy 14% and both disciplines on 3% of 'full days' and in the SRU for physiotherapy (PT) 14%, occupational therapy (OT) 11% and both disciplines on 2% of 'full days'.

Table 1. Rehabilitation contact time.

Item	All n=51	ASU n=51	SRU n = 24
Hospital days, all	773	170	603
Hospital days, full**	551	118	433
Mean, min (all days)	44	46	40
Mean, min (full days only)	58	64	53
Full days >59 min contact, n (%)	243 (43%)	66 (55%)	177 (40%)
Full days >119 min contact, n (%)	54 (10%)	11 (9%)	43 (10%)
Full days where PT >44min, n (%)	64 (11%)	4 (3.3%)	60 (14%)
Full days where OT >44 min, n (%)	67 (12%)	17 (14%)	50 (11%)
Full days where both PT and OT >44 min, n (%)	14 (2%)	4 (3%)	10 (2%)

ASU = acute stroke unit, SRU = stroke rehabilitation unit, PT = physiotherapy, OT = occupational therapy. ** 'Full days' of rehabilitation were those days excluding weekend, admission, transfer or discharge days and where the patient was not listed as 'medically unwell'.

Some consideration of the appropriate numerator and denominator for rehabilitation intensity is needed. Operationalising and then auditing compliance with the NICE recommendation [6] to 'offer initially at least 45 minutes of each relevant stroke rehabilitation therapy for a minimum of 5 days per week for people who have the ability to participate and where functional goals can be achieved' (our emphases) will be problematic. Each of the underlined phrases requires interpretation. We have chosen to assume that all patients transferred to our SRU will have the ability to participate and be able to achieve functional goals but this may not apply to every SRU. We have also assumed that the rehabilitation 'dose' should apply throughout the admission, otherwise discharge to community rehabilitation may be more appropriate and generally less costly. We excluded a proportion of days when calculating rehabilitation 'dose' for the guideline comparison: weekends, admission and

transfer days, and days when the patient was deemed 'medically unwell'. This represented almost 30% of all days. Managers might consider that the cost of these 'lost' days is substantial. Patients and their families may wonder why they are not receiving an appropriate level of rehabilitation contact on more than 70% of all possible days. Our inclusion of self-care activities, face-to-face education sessions, group therapy activities, including those supervised by a therapy assistant, can all be questioned – we consider these integral to our current practice. We have also chosen to interpret the standards in terms of patient minutes rather than therapist minutes: thus a joint OT and PT 45 minute session would not meet the standard of '45 minutes of each relevant therapy' – this would require a joint 90 minute session or combination of sessions.

Table 2. Activities and time of day.

Activities: total min (% of all minutes)	All n=51	ASU n=51	SRU n = 24
Assessment vs treatment			
Assessment	3295 (10)	1965 (21)	1330 (5)
Treatment	34,980 (90)	7595 (79)	24090 (95)
Type of activity			
Mobility	13015 (37.1)	2735 (28.6)	10280 (40.2)
Upper limb	5490 (15.6)	770 (8.1)	4720 (18.5)
Self-care	10720 (30.5)	3165 (33.1)	7555 (29.6)
Communication	2080 (5.9)	870 (9.1)	1210 (4.7)
Swallow	830 (2.4)	525 (5.5)	305 (1.2)
Psychological/cognitive	480 (1.4)	35 (0.4)	445 (1.7)
Education	1770 (5.0)	1340 (14.0)	430 (1.7)
Home visit	740 (2.1)	120 (1.3)	620 (2.4)
Contact time of day (% all minutes)			
8am-12pm	70	64	71
12pm-4pm	25	26	25
4pm-8am	4	9	3

ASU = acute stroke unit, SRU = stroke rehabilitation unit,

Surprisingly, the amount of face-to-face rehabilitation contact was somewhat higher on the ASU than on the SRU. Some of the explanation for this is the greater contribution of nurses, particularly the stroke nurse specialist, to the totals on the acute ward compared with the SRU where nursing time may not have been consistently captured to the same extent. One of the positive outcomes of the study was an acknowledgement from the SRU team that better integration of rehabilitation nursing into

the rehabilitation team environment was required. In a similar way, the ASU team received acknowledgement of the significant rehabilitation inputs they provide for acute stroke patients right from the time of admission. Almost half the stroke patients go directly home from the ASU and some require considerable input from allied health staff to do so successfully. Almost all patients are seen by allied health staff in the first 24 hours of first admission to hospital. Daily multidisciplinary meetings on the ASU allows a tailored rehabilitation plan to be delivered over the usual 2-7 days of admission. Although not captured in the summary statistics presented in the tables, many of the PT and OT sessions in the first few days on the ASU were short – 10-20 minutes – sometimes repeated during the day, allowing all patients to be seen most days.

Table 3. Clinicians involved in rehabilitation activities.

Clinician: total min, (% all minutes)	All n=51	ASU n=51	SRU n = 24
PT (including student)	9628 (27)	1775 (19)	7853 (31)
OT (including student)	7275 (21)	2275 (24)	5000 (20)
Therapy assistant	6205 (18)	345 (4)	5860 (23)
Nurse (including student)	8140 (23)	3120 (33)	5020 (20)
Health care assistant	757 (2)	505 (5)	252 (1)
SLT	2855 (8)	1410 (15)	1445 (6)
Doctor	120 (0)	120 (1)	0
Social worker	10 (0)	10 (0)	0
Music therapist	50 (0)	0	50 (0)

ASU = acute stroke unit, SRU = stroke rehabilitation unit, PT = physiotherapist, OT = occupational therapist, SLT = speech and language therapist

The reason for the significantly lower number of sessions in the afternoon (overall 26% vs 70% in the morning) is not clear although feedback sessions from the teams suggested a general view that 'patients must rest' in the afternoon. The ASU, as part of the combined Neurosurgery/Neurology wards, closes to visitors for two hours in the afternoon for 'patient rest', a time-honoured tradition in Neurosurgical nursing.

The process of measuring rehabilitation intensity in this project was seen as worthwhile by members of both rehabilitation teams despite the small inconvenience of filling in the forms. We are developing a simple system of real-time documentation that will facilitate ongoing audit at much less human resource cost.

The current study was not powered to measure change in outcome with regard to rehabilitation intensity. We think that a large cohort study, with robust casemix-adjusted outcome, in-

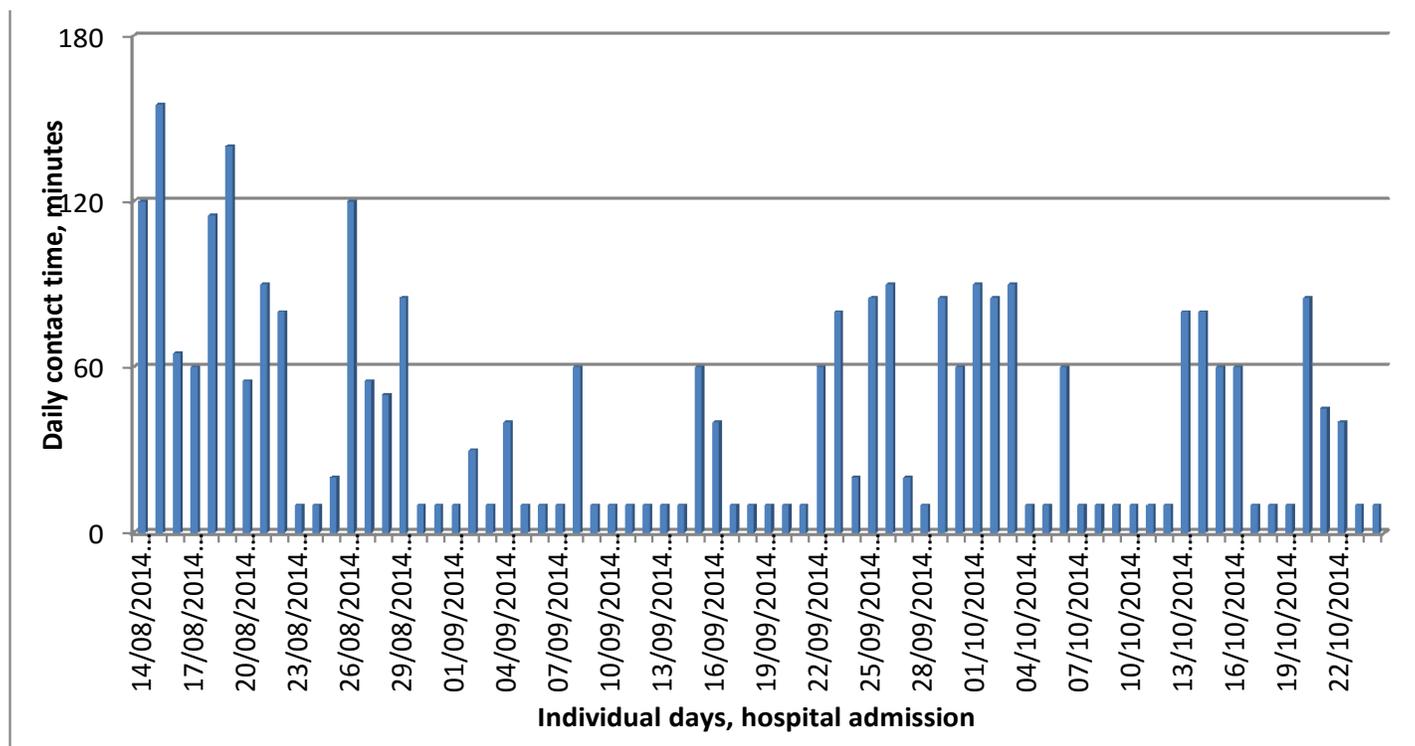
vestigating rehabilitation 'dose', type and timing of intervention in several thousand patients in many centres may be the best way to establish future targets for randomised controlled trials and to refine the delivery of optimum rehabilitation for every patient with stroke.

We don't think it is currently possible to say with any certainty what rehabilitation intensity should be delivered to most inpatients following stroke. One clear lesson from the CIRCIT randomised trial of two methods for increasing therapy time (circuit training and seven day per week therapy) [17] was that more therapy time alone does not lead to better outcomes. A meta-analysis of 'more therapy after stroke' trials [18] confirms the amount of active task practice may be more important than time alone. There is compelling evidence from animal models of early stroke rehabilitation and brain plasticity, that significant improvements can be made in functional abilities, but that the 'doses' used in animal trials are significantly greater than those usually delivered to human patients with stroke [19]. Better stroke outcomes for US patients compared to New Zealand patients in a large cohort study may have been because a much larger 'dose' of rehabilitation was delivered – generally a minimum of three hours per day [8]. For our part, within a year we hope to deliver at least 60 minutes per day of contact time on 90% of inpatient days (excluding weekends, transfer and admission days) and believe that it is both desirable, and possible, to deliver at least 90 minutes per day of contact time on 50% of inpatient days in the SRU with relatively straightforward changes to current practice patterns. However we think it is critical to combine this with strategies to maximise active engagement of the patient in their rehabilitation. Personalised rehabilitation plans, with prescribed activities and doses and agreed targets, owned (and kept) by the patient and their family to allow them to 'Take Charge' [20] of the rehabilitation process, plus more opportunities for practice outside of therapy sessions including weekends may be good starting points. We plan to use regional stroke networks as forums to discuss ways of improving performance with regard to rehabilitation intensity and use an already established framework of prospective casemix-adjusted community outcomes to measure progress with important outcomes over time.

Clinical Messages

- Quality improvement in stroke rehabilitation should be based on rigorous review of current practice
- Total time of rehabilitation contact may not be the most appropriate target for rehabilitation services that wish to improve outcomes for stroke patients

Figure 1. Daily rehabilitation contact time in minutes for consecutive days of hospital admission for a single patient. The first 7 days were on the acute stroke unit and subsequent days were on the stroke rehabilitation unit.



Competing interests

None of the authors have any competing interests to declare.

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