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Physiotherapists systematically overestimate the amount of time stroke survivors spend engaged in active therapy rehabilitation: an observational study

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Questions: How accurately do physiotherapists estimate how long stroke survivors spend in physiotherapy sessions and the amount of time stroke survivors are engaged in physical activity during physiotherapy sessions? Does the mode of therapy (individual sessions or group circuit classes) affect the accuracy of therapists' estimates? **Design**: Observational study embedded within a randomised trial. **Participants**: People who participated in the CIRCIT trial after having a stroke. **Intervention**: 47 therapy sessions scheduled and supervised by physiotherapists (n = 8) and physiotherapy assistants (n = 4) for trial participants were video-recorded. **Outcome measures**: Therapists' estimations of therapy time were compared to the video-recorded times. **Results**: The agreement between therapist-estimated and video-recorded data for total therapy time and active time was excellent, with intraclass correlation coefficients (ICC) of 0.90 (95% CI 0.83 to 0.95) and 0.83 (95% CI 0.73 to 0.93) respectively. Agreement between therapist-estimated and video-recorded data for inactive time was good (ICC score 0.62, 95% CI 0.40 to 0.77). The mean (SD) difference between therapist-estimated and video-recorded total therapy time, active time, and inactive time for all sessions was 7.7 (10.5), 14.1 (10.3) and –6.9 (9.5) minutes respectively. Bland-Altman analyses revealed a systematic bias of overestimation of total therapy time and total active time, and underestimation of inactive time by therapists. Compared to individual therapy sessions, therapists estimated total circuit class therapy duration more accurately, but estimated active time within circuit classes less accurately. **Conclusion**: Therapists are inaccurate in their estimation of the amount of time stroke survivors are active during therapy sessions. When accurate therapy data are required, use of objective measures is recommended. **[Kaur G, English C, Hillier S (2013) Physiotherapists systematically overestimate the amount of time stroke survivors spend engaged in active therapy during inpatient rehabilitation: an observational study. *Journal of Physiotherapy* 59: 45–51]**

Key words: Stroke, Rehabilitation, Motor activity, Physical therapy (Specialty)

Introduction

The dose-response relationship between intensity of therapy and increased recovery of motor function after stroke is well supported by evidence (Kwakkel et al 2004, Galvin et al 2008, Cooke et al 2010), and is reflected in clinical guidelines for stroke rehabilitation (National Stroke Foundation 2010), although the effect size of this benefit varies between individual studies (Kwakkel et al 2004, Galvin et al 2008). Despite this evidence, many observational studies have shown that people with stroke spend very little time engaged in physical activity during the course of a day in rehabilitation, with therapy sessions being the most active part of the day (Ada et al 1999, Bernhardt et al 2004). Therefore, physiotherapists working in stroke rehabilitation are constantly challenged to maximise the amount of active therapy stroke survivors are engaged in each day. In order to change clinical behavior it is important to be able to assess the existing behaviour or practice accurately.

Only two studies have specifically examined the accuracy of therapists in reporting therapy time (Wittwer et al 2000, Bagley et al 2009), both of which used video-recordings of therapy sessions as the criterion standard. In an observational study embedded in a clinical trial of stroke rehabilitation, Bagley et al (2009) found that physiotherapists systematically overestimated the duration of therapy sessions by more than 20 per cent. In an earlier study, Wittwer et al (2000) found moderate to high correlations (Spearman rank order correlation coefficient 0.49 to 0.83) between therapist estimates and video-recorded time for subcategories of physical activity (upper limb, bed mobility, sitting, sit to stand, standing, and early gait activities), but the presence of systematic over- or under-estimations was not examined. Both of these studies investigated the accuracy of individual therapy sessions. The accuracy of therapists in estimating therapy duration for group circuit class therapy sessions has not been examined.

The Circuit Class Therapy for Increasing Rehabilitation Intensity of Therapy after Stroke (CIRCIT) trial is a multicentre randomised trial currently investigating alternative models of physiotherapy service provision (Hillier et al 2011). Participants in this trial receive 7-day week therapy (up to 90 minutes of therapy per day, 7 days

What is already known on this topic: The amount of rehabilitation people receive after stroke affects motor recovery but many people with stroke spend little time engaged in physical activity while in rehabilitation.

What this study adds: Therapists over-estimated the amount of time stroke survivors spent in physiotherapy sessions and how much of the session was active task practice. Over-estimation of the duration of therapy was greater in individual therapy sessions than in group circuit class therapy sessions. However, estimation of the amount of active task practice was less accurate during group classes than in individual therapy sessions.

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a week), group circuit class therapy (up to 180 minutes of group therapy per day, 5 days a week), or usual therapy (up to 90 minutes of therapy per day, 5 days a week). As with other similar dosage studies (Partridge et al 2000, Slade et al 2002, Peurala et al 2007), this trial relies upon therapist estimates of therapy time and content to describe the interventions and to monitor adherence to the trial protocol.

The specific research questions of this study were:

1. How accurately do physiotherapists and physiotherapy assistants working in stroke rehabilitation facilities estimate the duration of each therapy session (total therapy time), the time people with stroke spend physically active within each therapy session (active time), the time people with stroke spend at rest (inactive time), and the time people with stroke spend engaged in different subcategories of activity during therapy sessions (activities in lying, active sitting, standing, walking, treadmill, upper limb activities, and other therapeutic activities)?
2. Is there a difference in the accuracy of physiotherapists' estimations of therapy time (total therapy time, active time, and inactive time) in circuit class therapy sessions as compared to individual therapy sessions?

Method

Design

An observational study embedded within a randomised trial was conducted. Full details of the CIRCIT trial protocol have been published (Hillier et al 2011). Recruitment for the CIRCIT trial commenced in July 2010 and is expected to finish in December 2012. Data collection for the current study occurred during three time periods in September and October 2010 (3 weeks), in December 2010 and January 2011 (2 weeks), and in February 2011 (1 week).

Participants and therapists

Participants in the CIRCIT trial were people who had survived a stroke of moderate severity who were admitted to an inpatient rehabilitation facility and who were able to walk independently (with or without a walking aid) prior to their stroke (Hillier et al 2011). Moderate stroke severity was defined as either a total Functional Independence Measure (FIM) score of between 40 and 80 points or a motor subscale score of 38 to 62 points at the time of recruitment to the trial. Participants who consented to the additional data collection were eligible to participate in this observational study.

The therapists were those involved in scheduling and supervising physiotherapy sessions for the CIRCIT trial participants. They included both physiotherapists and physiotherapy assistants. The therapists recorded the duration and content of all the participants' therapy sessions using the standardised CIRCIT Trial Therapy Data Form (see Appendix 1 on the eAddenda). Therapists were asked to complete this form as soon as possible after each therapy session.

Outcome measures

During each day of the data collection period, all therapy sessions of every consenting CIRCIT trial participant were video-taped. If more than one CIRCIT trial participant was receiving therapy at the same time, the person to be videotaped was selected at random (using coin toss).

As part of the CIRCIT trial, the duration and content of each therapy session of every trial participant was recorded at the conclusion of the session by the participating physiotherapists using the CIRCIT trial therapy data form (see Appendix 1). This form was an adaptation of the form developed by Wittwer et al (2000) and used in other stroke rehabilitation trials (Bernhardt et al 2007). It was not possible to blind the treating therapists to which therapy sessions were video-taped, but in an attempt to minimise bias, the exact purpose of the study was concealed from the therapists and CIRCIT trial participants. They were told only that the data from the videos would be used to evaluate adherence to the CIRCIT trial protocol. The researcher (GK) was blinded to the CIRCIT trial therapy data forms when analysing the video recordings.

The researcher viewed the videos and used the onscreen time display to determine the total duration of the therapy sessions and the time spent engaged in each physical activity category (rounded to the nearest minute). Standard operational definitions were used to determine the beginning and end of a therapy session. Definitions of various physical activity sub-categories were on the CIRCIT trial therapy data form (Appendix 1). This method of video analysis has been shown to have acceptable intra-rater reliability (Elson et al 2009). Total active time was determined as the sum of time spent in each category of physical activity. Total inactive time was determined as total therapy time minus total active time.

Data analysis

The level of agreement between video-recorded and therapist estimated times for total therapy duration, total active time, and total inactive time were examined using intraclass correlation coefficients (ICC), and by examining Bland and Altman plots for evidence of systematic bias. It is important to determine not only whether systematic bias is present, but also whether the magnitude of any bias is clinically relevant. In the absence of published data, we consulted a group of senior physiotherapists experienced in stroke rehabilitation and decided that the percentage mean difference (or percentage error between the therapist estimations and video recordings of the therapy time) would need to be greater than 15 per cent (equivalent to 9 minutes of a 60-minute therapy session) to be clinically relevant. This judgment was based on how accurate we could expect clinicians to be in judging therapy time, rather than the impact this inaccuracy may have on clinical outcomes.

A priori sample size calculations were based on being able to detect a minimum correlation of 0.8 between video-recorded and therapist-estimated total therapy duration. A sample size of 40 pairs of therapy sessions provides over 99% power at $\alpha = 0.05$ to detect a correlation of 0.8 (Portney and Watkins 2009) with a 95% CI of 0.65 to 0.89 (based on Fisher's z transformation).

Results

Flow of participants and therapists through the study

Forty-seven therapy sessions (19 individual therapy sessions and 28 circuit class therapy sessions) of 14 CIRCIT participants were video recorded in three different inpatient rehabilitation centres in South Australia. Eight physiotherapists and four physiotherapy assistants

Table 1. Mean values and mean differences in minutes, relative differences, and agreement between the therapist-estimated and video-recorded therapy time for all therapy sessions.

	Therapist-estimated time	Video-recorded time	Absolute difference therapist minus video	Relative difference	Agreement
	mean ± SD (range)	mean ± SD (range)	mean ± SD (95% CI)	%	ICC (95% CI)
Total session	63.4 ± 24.5 (20 to 90)	55.6 ± 23.4 (19 to 90)	7.7 ± 10.5 (4.6 to 10.8)	12	0.90 (0.83 to 0.95)
Active therapy time	50.2 ± 18.9 (20 to 80)	36.1 ± 16.4 (10 to 78)	14.1 ± 10.3 (11.1 to 17.1)	28	0.83 (0.72 to 0.93)
Inactive therapy time	12.5 ± 8.0 (0 to 32)	19.4 ± 13.1 (2 to 53)	−6.9 ± 9.5 (−9.7 to −4.1)	36	0.62 (0.40 to 0.77)

ICC = Intraclass correlation coefficient

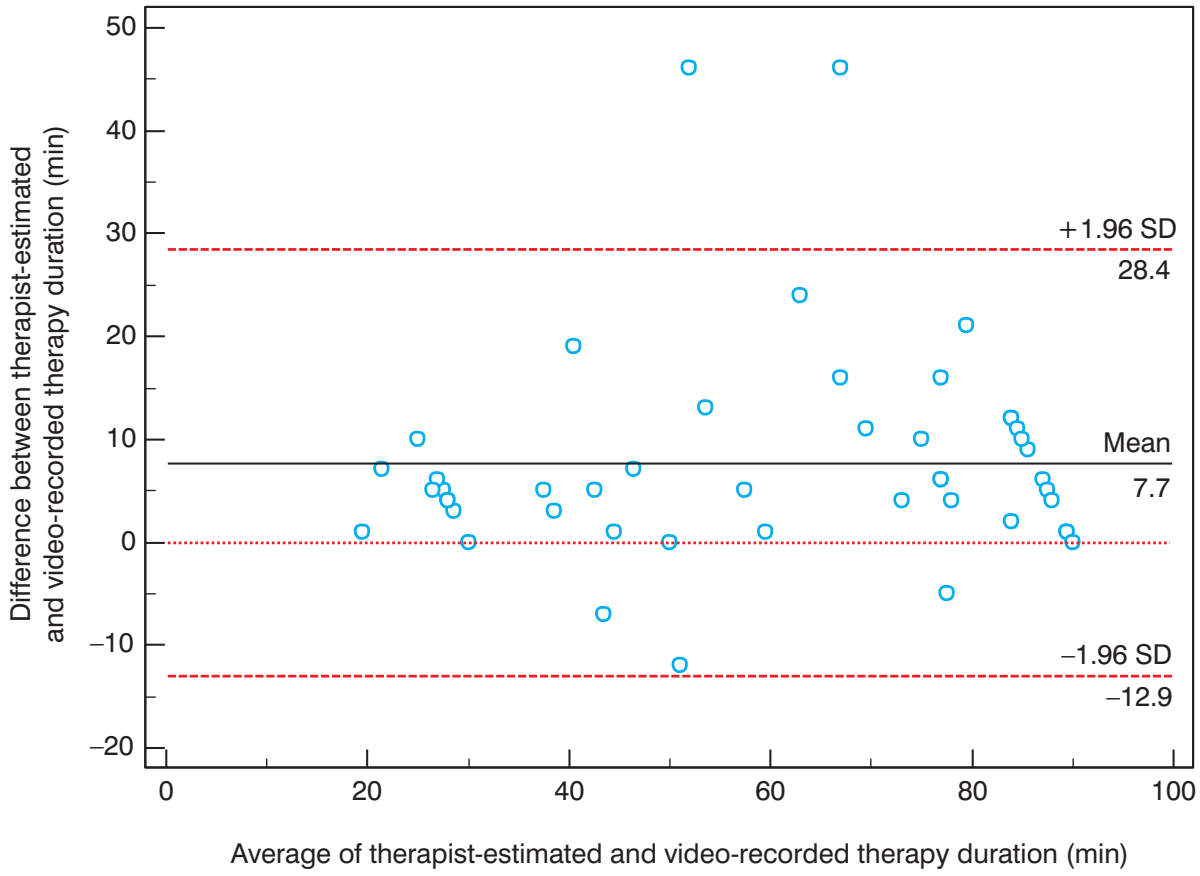

Figure 1. Bland-Altman plot for difference between therapist-estimated and video-recorded total therapy duration.

participated in the study. The physiotherapists ranged in experience from one to 14 years post-graduation and the physiotherapy assistants had between two and 10 years of experience. Physiotherapists were managing caseloads of a mean of 8 patients (SD 2). The participants had a mean (SD) age of 68 (13) years, 9 (64%) were male, 7 (50%) had a right-sided stroke lesion, 6 (43%) had a left-sided lesion and 1 (7%) had a bilateral stroke. The average duration of physiotherapy sessions was 55.6 (23.4) minutes (range 19 to 90) (Table 1).

Agreement between therapist estimations and video recordings

There was strong agreement between therapist-estimated and video-recorded total therapy times (ICC = 0.90, see Table 1), however there was a systematic overestimation of total therapy time by the therapists, mean difference 7.7 (SD 10.5) minutes (95% CI 4.6 to 10.8). The Bland-Altman plot (Figure 1) for total therapy time presents this systematic overestimation.

Similarly, there was strong agreement between therapist-estimated and video-recorded time for total *active* time in therapy sessions (ICC = 0.83, see Table 1) with a systematic overestimation of total active time by the therapists, mean difference 14.1 (SD 10.3) minutes, 95% CI 11.1 to 17.1 (Figure 2). However, there was less agreement between therapist-estimated and video-recorded inactive time (ICC = 0.62, see Table 1), and therapists systematically underestimated the amount of time patients were inactive during therapy sessions, mean difference −6.9 (SD 9.5) minutes, 95% CI −9.7 to −4.1 (Figure 3).

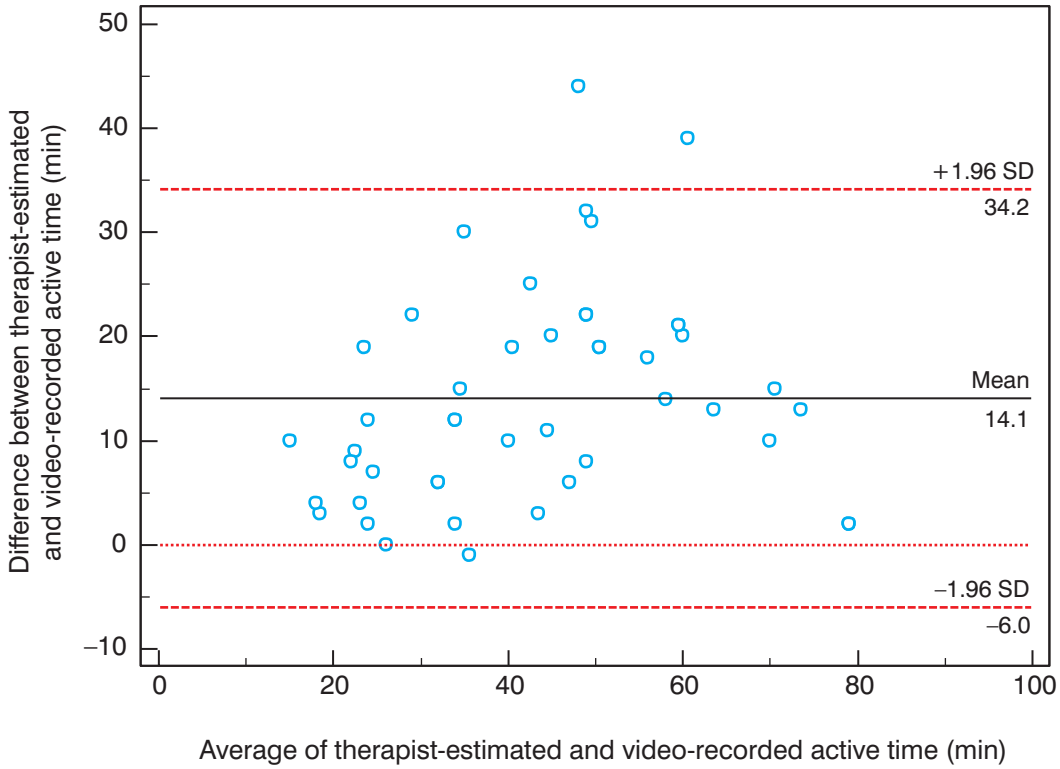

Figure 2. Bland-Altman plot for difference between therapist-estimated and video-recorded active time.

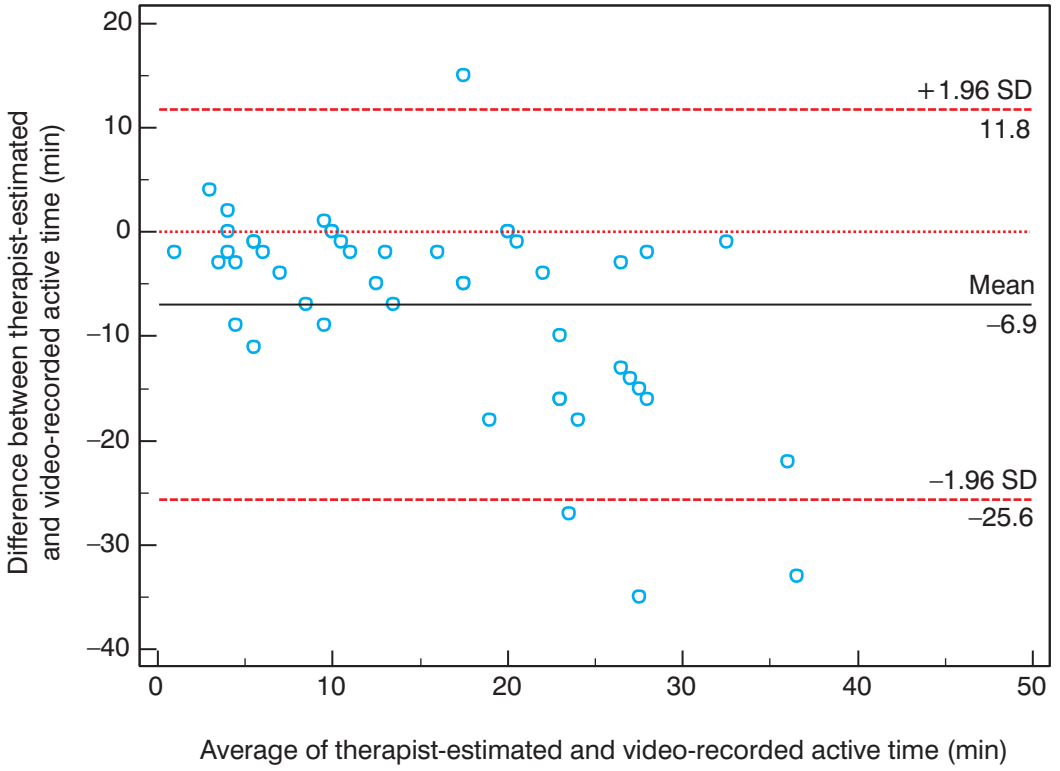

Figure 3. Bland-Altman plot for difference between therapist-estimated and video-recorded inactive time.

Table 2. Mean differences in minutes and relative differences between the therapist-estimated and video-recorded therapy times for individual therapy sessions and group circuit class therapy sessions.

	Difference between therapist-estimated and video-recorded time		Relative difference	
	mean ± SD (95% CI)		%	
	Individual	Group	Individual	Group
Total session	6.2 ± 11.7 (0.6 to 11.8)	8.8 ± 9.8 (4.9 to 12.6)	16	11
Total active time	9.2 ± 7.8 (5.4 to 12.9)	17.4 ± 10.5 (13.3 to 21.5)	28	28
Total inactive time	−2.6 ± 6.3 (−5.7 to −0.4)	−9.8 ± 10.3 (−13.8 to −5.8)	29	37

Individual = individual therapy sessions, Group = group circuit class therapy sessions

Table 3. Mean values and mean differences in minutes, relative differences, and agreement between the therapist-estimated and video-recorded therapy time for different physical activity subcategories.

Activity subcategory	Therapist-estimated time	Video-recorded time	Absolute difference therapist minus video	Relative difference	Agreement
	mean ± SD	mean ± SD	mean ± SD (95% CI)	%	ICC (95% CI)
Activities in lying	5.3 ± 9.7	3.9 ± 7.8	1.5 ± 3.7 (0.4 to 2.5)	28	0.91 (0.85 to 0.95)
Active sitting	6.9 ± 7.8	4.3 ± 6.0	2.5 ± 4.9 (1.1 to 4.0)	36	0.75 (0.59 to 0.85)
Transfers and sit-to-stand practice	4.6 ± 6.4	1.8 ± 2.3	2.9 ± 5.4 (1.3 to 4.4)	63	0.37 (0.10 to 0.60)
Standing	11.0 ± 10.5	7.9 ± 8.7	3.1 ± 5.0 (1.6 to 4.5)	28	0.87 (0.78 to 0.92)
Walking practice	11.7 ± 8.2	9.9 ± 6.8	1.9 ± 5.5 (0.2 to 3.5)	16	0.73 (0.56 to 0.84)
Treadmill	0.8 ± 3.9	0.7 ± 3.9	0.1 ± 0.6 (-0.1 to 0.2)	13	0.99 (0.98 to 0.99)
Upper limb activities	5.5 ± 8.0	4.1 ± 6.8	1.4 ± 4.5 (0.1 to 2.8)	27	0.82 (0.69 to 0.89)
Other therapeutic activities	5.1 ± 8.9	3.6 ± 6.2	1.6 ± 5.2 (0.0 to 3.1)	31	0.77 (0.62 to 0.87)

ICC = Intraclass correlation coefficient

Comparing the influence of session type (individual versus group) using percentage mean difference, there was no difference in the accuracy of estimations of total active time between individual (28%) and circuit class therapy (28%) sessions, but therapists tended to underestimate inactive time in circuit class therapy sessions (37%) to a greater extent than in individual therapy sessions (29%) (Table 2).

In terms of the various subcategories of activity, ICC scores ranged from 0.73 to 0.99 for all of the categories except for 'transfers and sit-to-stand practice', which had a low ICC score of 0.37, indicating only a fair agreement between therapists' estimations and video recordings (Table 3). As with the total active time, therapists tended to overestimate the time patients spent engaged in the various physical activity categories. The magnitude of this overestimation varied, but in some cases was as high as 63%.

Discussion

This is the largest study to date to investigate the accuracy of therapists in recording therapy time, and the only such study to involve multiple data collection centres and to include group therapy as well as individual therapy sessions. Therapists were found to be inaccurate in their estimations of the time stroke survivors spent in physiotherapy sessions, and particularly inaccurate in estimating the time stroke survivors were engaged in active task practice during therapy sessions. Contrary to expectations, total therapy duration was found to be overestimated more in individual therapy sessions than in circuit class therapy sessions.

There are two main implications of these findings. First, in terms of clinical practice, accurate quantification of therapy dose is important to allow for reflection on current

practice and to measure changes in practice accurately. The National Stroke Foundation Clinical Guidelines for Stroke Management (2010) recommend that stroke survivors should be provided with as much opportunity as possible to engage in active task practice during the first six months after stroke. The results of this study showed that, on average, therapists overestimated active time by 28%, and underestimated rest time by 36%. This means, that in an hour-long therapy session, therapists believe their patients are active for 17 minutes more than they actually are. Conversely, patients are resting for 22 minutes longer than estimated. This finding is in line with other studies examining therapists' accuracy of estimating therapy time (Bagley et al 2009).

These findings suggest that when accurate data for therapy dose are required, such as for research or to monitor adherence to clinical guidelines, more objective methods of measurement should be employed. For example, simple counting of repetitions of tasks or exercises has been used to describe therapy dosage in clinical trials (Birkenmeier et al 2010), and many stroke survivors in rehabilitation are able to accurately count repetitions of their own practice (Scrivener et al 2011). More detailed information about physical activity both in therapy and across the day can be collected using activity monitors such as accelerometers. To date, the majority of studies using activity monitors have been conducted with ambulatory, community dwelling stroke survivors (Alzahrani et al 2011, Manns and Baldwin 2009, Rand et al 2009). Less is known about the accuracy of these monitors to detect activity in people early after stroke who may move very slowly, and activity monitors cannot provide information about the context and purpose of activity.

Second, in light of these findings, one of the reasons therapy dosage studies have shown small effect sizes may be that many have relied on therapist estimations of therapy time. It is possible that if dose of therapy were more accurately quantified in these studies, a larger effect may have been detected. This is of course speculative, but serves to highlight the need for accurate quantification of therapy dosage in clinical trials.

This study has several strengths: it involved multiple rehabilitation centres, examined both individual and circuit class therapy sessions, and involved clinicians with a range of experience. There was no difference in the degree of accuracy related to years of experience or whether clinicians were qualified physiotherapists or therapy assistants. A limitation of the study is that the magnitude of difference considered clinically relevant was based on expert opinion only. The overestimation of total therapy time of 12% is less than the 15% difference we considered clinically meaningful *a priori*. This represents an overestimation of 6 minutes in individual therapy sessions (of average 33 minute duration) and 9 minutes of circuit class therapy sessions (of average 71 minutes duration). It may not be reasonable to expect a greater degree of accuracy when reliant on human recall. While we know that increased dosage of active task practice improves clinical outcomes, we don't yet know exactly how much is enough (Kwakkel et al 2004, Galvin et al 2008), so it is unclear whether a 15% overestimation of therapy time would have an impact on rehabilitation outcomes for stroke survivors.

This study was embedded within an ongoing randomised trial. Some, but not all, of the circuit class therapy sessions within this trial were mandated in terms of duration which may have made it easier for the therapists to estimate therapy duration. Furthermore, despite efforts to conceal the exact purpose of the study from participating therapists, it is likely that they paid particular attention to the accuracy of recording the duration and content of therapy sessions during the study. Therefore it is possible that the accuracy of therapist-estimates were overstated.

The take home message of this study is that patients are likely to be doing a lot less active therapy than we believe them to be. A recent systematic review (Kaur et al 2012) of the activity levels of patients within physiotherapy sessions found, on average, around 65% of therapy time or 32.2 minutes per session was spent in active task practice. If we assume this was the only therapy session provided per day, this seems alarmingly low. It is even more alarming when we consider that these therapy times were based on therapist estimates, which, as we have shown, are likely to be overestimations. While no clear guidelines exist on the optimal amount of time stroke survivors should be engaged in active task practice, current evidence (Carey et al 2002, Cooke et al 2010, Galvin et al 2008, Kwakkel et al 2004, Liepert et al 1998, Liepert et al 2000) and clinical guidelines (National Stroke Foundation 2010) recommend active task practice be maximised. Further research is needed to clarify the nature of the active practice, the quality of the practice, and its relationship to non-physically active therapy such as mental imagery, relaxation, and education. The challenge for therapists is to reflect upon and objectively measure their own practice, and look for ways of increasing active practice time in rehabilitation centres. ■

eAddenda: Appendix 1 available at jop.physiotherapy.asn.au

Ethics: The University of South Australia Human Research Ethics Committee, the Royal Adelaide Hospital Research Ethics Committee, the Flinders Medical Centre Clinical Research Ethics Committee, and the Queen Elizabeth Hospital Ethics of Human Research Committee approved this study. Participants gave separate written informed consent for both trial participation and video-recording before data collection began.

Competing interests: Nil.

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