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Investigating dosage frequency effects on therapy outcomes following self-managed telerehabilitation

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Introduction

Speech-language therapy is known to improve outcomes in post-stroke aphasia, particularly when it is high intensity (Brady et al., 2016). However, intensity is itself a multifactorial treatment parameter that is determined by several factors, including dosage amount, dosage frequency, session duration, and total intervention duration (Baker, 2012; Cherney, 2012; Warren et al., 2007). Understanding the effects of these sub-parameters on therapy outcomes is a critical first step towards optimizing treatment delivery for individuals with aphasia. The aim of the current study was to examine the association between one such intensity sub-parameter – dosage frequency – and change in performance on remotely delivered tasks during patients' first 10 weeks of self-managed therapy.

Methods

Anonymized data from post-stroke survivors who used the Constant Therapy application between late 2016 - 2019 were shared with Boston University. All patients consented to use of their data for research purposes. In the current study, we included only users who engaged with the app for at least one day in 10 of their first 15 calendar weeks of use, resulting in a study sample of 2,252 patients.

The current study includes therapy data for tasks spanning 13 skill domains: (1) auditory comprehension, (2) phonological processing, (3) production, (4) reading, (5) writing, (6) naming, (7) attention, (8) auditory memory, (9) visual memory, (10) analytical, (11) arithmetic, (12) quantitative, and (13) visuospatial. For each patient, the following variables were extracted: age, time since stroke, sex, baseline severity, and dosage frequency. Dosage frequency was defined as median days/week of app usage over the 10-week therapy period, binned into categories of 1, 2, 3, 4, or 5+ days/week. The outcome variable of interest was *domain score*, a composite performance measure that takes into account overall performance accuracy and task difficulty level.

Data were analyzed using linear mixed-effects models. Domain score was the dependent variable, with fixed effects of time (week number), age, time since stroke, sex, baseline severity, dosage frequency, and a time*dosage frequency interaction. Individual users and domain were modeled as random effects.

Results

Figure 1 shows performance trends over time across all skill domains, separated out by dosage frequency group. Model results revealed significant main effects of time, time since stroke, baseline severity, and dosage frequency on domain score in the 10-week treatment period. Crucial to our question of interest, the time*dosage frequency interaction was also significant, with greater change over time for higher versus lower dosage groups. Post-hoc comparisons revealed significantly greater performance change for users who practiced 4 or 5+ days/week compared with users who practiced 1, 2 or 3 days/week (Table 1). The result of greater improvement for higher versus lower dosage frequency groups was true not only across all domains, but also within a majority (i.e., 9 of 13) of individual subdomains.

Conclusions

Study results demonstrate that increased dosage frequency is associated with greater therapy gains over a 10-week treatment period of self-managed teletherapy. This result provides preliminary evidence to help guide clinicians in their recommendations to patients regarding optimal practice frequency for self-managed teletherapies.

References

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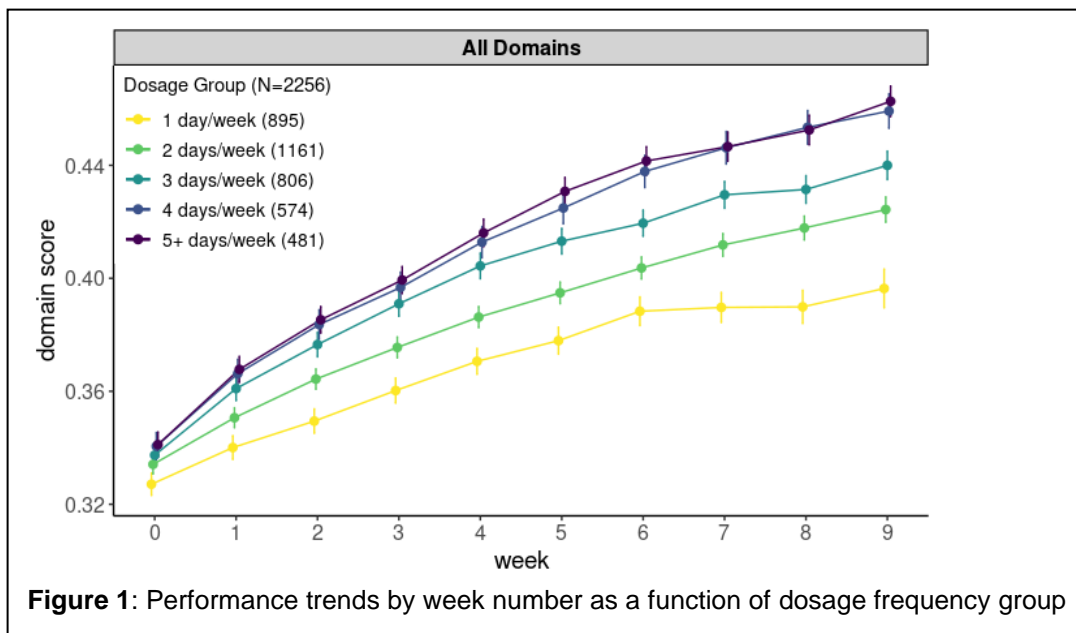


Table 1: Pairwise comparisons of model slopes (time*dosage group)

DOSAGE GROUP	CONTRAST	ESTIMATE	SE	P VALUE
1 day/wk	2 day/wk	-0.0014	0.00048	* 0.032
	3 day/wk	-0.0030	0.00054	*** <.001
	4 day/wk	-0.0049	0.00060	*** <.001
	5+ day/wk	-0.0051	0.00061	*** <.001
2 day/wk	3 day/wk	-0.0017	0.00045	** 0.002
	4 day/wk	-0.0035	0.00053	*** <.001
	5+ day/wk	-0.0037	0.00055	*** <.001
3 day/wk	4 day/wk	-0.0019	0.00052	** 0.003
	5+ day/wk	-0.0020	0.00055	** 0.002
4 day/wk	5+ day/wk	-0.0002	0.00057	0.999

p value adjustment: Tukey method for comparing a family of 5 estimates