Constant Therapy Health's Research Bibliography

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Home-based electronic cognitive therapy in patients with Alzheimer's disease dementia: A feasibility study





Themes: Dementia, Mild Cognitive Impairment, Cognitive Health, Feasibility

Study Pl/Institution: Center for Translational Cognitive Neuroscience at the Veterans Affairs Boston Healthcare System & the Alzheimer's Disease Research Center and Department of Behavioral Neuroscience at Boston University School of Medicine

Over 5.8 million people in the United States alone have Alzheimer's dementia, and yet many treatment options are minimally effective. A home-based, self-directed computerized cognitive training program is ideal for patients as risk is extremely minimal relative to pharmacological risks, and patients can complete such a program independently in the comfort of their own homes. In this randomized control trial, patients' cognitive and language skills were monitored over a six-month period. Patients in the control group completed commonly recommended brain games such as Sudoku, crossword puzzles, etc., whereas patients in the experimental group utilized Constant Therapy to complete targeted, individualized, evidence-based therapy tasks. The control group had extensive drop off despite weekly check-in phone calls, whereas the vast majority of the experimental group stuck with their therapy practice, demonstrating that a self-directed home program has strong retention potential and is feasible for these patients, even across a lengthy period of time. Additionally, promising trends were noted in the experimental group maintaining their cognitive and language skills better than the control group, supporting further research and a larger trial to further determine the efficacy of Constant Therapy for this patient population.

Marin, A., DeCaro, R., Schiloski, K., Elshaar, A., Dwyer, B., Vives-Rodriguez, A., Palumbo, R., Turk, K., Budson, A. Home-based electronic cognitive therapy in patients with Alzheimer's disease dementia: A feasibility study. Journal of Medical Internet Research, 2022 Sep 12;6(9):e34450. doi: 10.2196/34450.

Dosage frequency effects on treatment outcomes following self-managed digital therapy: Retrospective cohort study

BOSTON UNIVERSITY

Themes: Stroke, Aphasia, Equitable Access, Dosage

Collaborators: Aphasia Research Laboratory @ Boston University

Bridging the gap between carefully constructed research studies and real-world applications for patients can be a challenge. Digital solutions like Constant Therapy can help to bridge that gap by providing patients with flexible, self-directed access to life-changing therapy exercises. Prior studies have demonstrated that there is a significant dosage gap between how much therapy patients are actually receiving and how much therapy the research tells us is optimal for these patients. In this study, researchers looked at a large data set of over 2,000 patients' anonymized data to determine the optimal amount of self-directed, home-based therapy for post-stroke patients with speech, language, and cognitive deficits. This was the first study of its kind to look at optimal dosage for a home exercise program (HEP). While improvements were seen with even just 1 day of practice per week, optimal improvements were seen at 4 days per week of practice. This optimal dosage is made possible by providing patients with Constant Therapy's self-directed, home-based program.

<u>Cordella, C., Munsell, M., Godlove, J., Anantha, V., Advani, M., Kiran, S. Dosage frequency effects on</u> <u>treatment outcomes following self-managed digital therapy: Retrospective cohort study.</u> <u>J Med Internet</u> <u>Res 2022;24(7):e36135. URL: https://www.jmir.org/2022/7/e36135. DOI: 10.2196/36135</u>

Constant Therapy Health

Coupling hearing health with community-based group therapy for cognitive health in low-income African American Elders



Themes: Dementia, Equitable Access, Hearing Health, Cognitive Health, Aural Rehabilitation

Study PI/Institution: Saint Louis University

One of Constant Therapy's most essential missions is ensuring equal access to therapy. Breaking down socioeconomic and racial disparities in healthcare is one of the most meaningful ways to provide equal access, and this study conducted in St. Louis demonstrated the power of access to therapy. Patients participated in a cognitive stimulation therapy group, where they participated in activities and discussions to stimulate social interaction and cognition. Health topics were introduced, and free hearing health services were provided. An aural rehabilitation pilot case study was also included, with one participant utilizing Constant Therapy in conjunction with using her hearing aids to address auditory comprehension, verbal auditory memory, and phonological processing. Linking these various interventions reduced barriers to care for this group of low-income African American elders with cognitive-communicative impairments.

Postman, W.A., Fischer, M., Dalton, K., Leisure, K., Thompson, S., Sankey, L., Watkins, H. Coupling Hearing Health with Community-Based Group Therapy for Cognitive Health in Low-Income African American Elders. Perspectives of the ASHA Special Interest Groups. 2022; (SIG8):1-13. doi:10.1044/2021 PERSP-21-00110.

2021

Clinical study of the effectiveness of Constant Therapy in the treatment of clients with dementia: Implications for telepractice



Themes: Dementia, Efficacy, Telemedicine

Study Pl/Institution: College of Health Professions and Sciences, University of Central Florida, Orlando

Particularly while coping with the impacts of the COVID-19 pandemic, patients with dementia struggle to receive therapy within the comfort and safety of their own homes. Teletherapy reduces the barriers for dementia patients receiving skills services from speech-language pathologists, allowing patients to have access to therapy at home as well as individualized home practice routines. This study examined two case studies of persons living with dementia utilizing Constant Therapy at home. Relative to baseline, both patients demonstrated an increase in accuracy on their Constant Therapy exercises. Both patients also completed substantially more exercises when they were enabled with Constant Therapy at home compared to what they completed when only completing exercises in the clinic. This study highlights the importance of not only providing patients with individualized therapy that includes the flexibility of telepractice options, but also the power of providing a home practice program for patients to carryover their therapy outside traditional therapy sessions.

Edgar, D. & Bargmann, P. Clinical Study of the Effectiveness of Constant Therapy in the Treatment of Clients with Dementia: Implications for Telepractice. Perspectives of the ASHA Special Interest Groups. 2021; 6(SIG18):691-703. doi:10.1044/2021_PERSP-20-00123

A virtual, randomized, control trial of a digital therapeutic for speech, language, and cognitive intervention in post-stroke persons with aphasia



Themes: Stroke, Aphasia, Efficacy, Telemedicine

Study Pl/Institution: Michelle Braley, The Learning Corp

In the face of healthcare access challenges, particularly for patients with chronic disorders, virtual and self-managed therapies are essential to enable patients to receive the therapy that they require. In this study, patients were randomized into a control group that utilized traditional, self-managed speech-language pathology workbooks, while the experimental group utilized Constant Therapy tasks within the Constant Therapy-Research application. The study was conducted completely virtually, with pre- and post-assessments along with biweekly check-ins for all participants taking place via video-conferencing software. Patients were instructed to complete their self-managed therapy activities for approximately 30 minutes, 5 times per week. At the end of 10 weeks of intervention, patients in the experimental group made statistically and clinically significant progress on their speech, language, and cognitive skills relative to their severity-matched counterparts in the control group. This study demonstrates the power of self-managed therapy that adjusts to fit patients' ever-changing needs, and also demonstrates the feasibility of a fully virtual study for patients with post-stroke aphasia.

Braley, M., Sims Pierce, J., Saxena, S., De Oliveira, E., Tarabonata, L., Anantha, V., Lakhan, S., Kiran, S. <u>A Virtual, Randomized Control Trial of a Digital Therapeutic for Speech, Language, and Cognitive</u> <u>Intervention in Post-stroke Persons with Aphasia. Frontiers in Neurology, 2021; 2:12. doi:</u> <u>10.3389/fneur.2021.626780.</u>

Closing the digital divide in speech, language, and cognitive therapy: Cohort study of the factors associated with technology usage for rehabilitation



Themes: Stroke, Aphasia, Traumatic Brain Injury, Self-Managed Therapy, Equitable Access

Study PI/Institution: Aphasia Research Laboratory @ Boston University

Patients face persistent barriers to accessing the ongoing care that they need following a stroke, traumatic brain injury, or diagnosis of other neurologic conditions associated with speech-language disorders. Self-managed therapy programs like Constant Therapy are key for expanding access to therapy in the face of barriers such as limited clinician availability and variable insurance reimbursement. In this study, researchers examined clinical and demographic characteristics that impact a patient's engagement with Constant Therapy's technology-based therapy program. They found that older patients were actually more active than younger patients, and that patients who lived in rural areas and had more difficulty accessing traditional therapy were more digitally engaged than their urban counterparts. While many might assume that age would be a barrier to utilizing technology-based programs like Constant Therapy, this demonstrates that patients of all ages are able to use digital therapeutics, and are especially motivated to do so when their access to other modalities of therapy is limited.

Munsell, M., De Oliveira, E., Saxena, S., Godlove, J., Kiran, S. Closing the Digital Divide in Speech, Language, and Cognitive Therapy: Cohort Study of the Factors Associated with Technology Usage for Rehabilitation. Journal of Medical Internet Research, 2020; 22:2. doi: 10.2196/16286.

Constant Therapy Health

Comparison of therapy practice at home and in the clinic: A retrospective analysis of the Constant Therapy platform data set



Themes: Stroke, Aphasia, Efficacy

Collaborators: Aphasia Research Laboratory @ Boston University

Patients who suffer from speech deficits after a stroke benefit from speech and language therapy. Computer-based tools like Constant Therapy can be used by a healthcare professional when the patient comes to the clinic, or the patient can participate remotely at home, or both. Usage trends from 3,686 patients over four years were studied and researchers found that patients who did therapy at home (about every two days) were able to master cognitive tasks twice as quickly as those that only did therapy during clinic visits (about every five days). Patients were still making improvements to their functioning as much as two years after their stroke, and nearly a third of users were aged 71 or over.

<u>Godlove J, Anantha V, Advani M, Des Roches C, Kiran S. Comparison of therapy practice at home and in</u> <u>the clinic: A retrospective analysis of the Constant Therapy platform data set. Frontiers in Neurology.</u> <u>2019;10:140. doi: 10.3389/fneur.2019.00140</u>

2017

Relationship between self-administered cues and rehabilitation outcomes in individuals with aphasia: understanding individual responsiveness to a technology-based rehabilitation program



Themes: Stroke, Traumatic Brain Injury, Aphasia, Efficacy

Study Pl/Institution: Aphasia Research Laboratory @ Boston University & Massachusetts General Hospital Institute of Health Professions

When patients receiving speech and language therapy for aphasia struggle to understand instructions or to complete an exercise, their therapist might prompt them with "cues" such as repeating the instructions, sounding out the first letter, or saying the category of object. In this study we looked at how often patients with aphasia used prompts and cues in Constant Therapy. As expected, more severely affected patients relied on prompts more often and continued to use them throughout therapy. Less severely affected patients used fewer cues and were able to reduce their use of them over time. Self-administered cues are an important part of delivering effective therapy without a human therapist to support patients on their path to recovery.

<u>Des Roches CA, Mitko A, Kiran S. Relationship between Self-Administered Cues and Rehabilitation</u> <u>Outcomes in Individuals with Aphasia: Understanding Individual Responsiveness to a Technology-Based</u> <u>Rehabilitation Program. Frontiers in Human Neuroscience. 20</u>

RecoverNow: Feasibility of a mobile tablet-based rehabilitation intervention to treat post-stroke communication deficits in the acute care setting.

UNIVERSITY OF TORONTO

Themes: Stroke, Aphasia, Efficacy

Study PI/Institution: Ottawa Hospital, University of Toronto

While guidelines suggest that stroke patients should receive at least 3 hours of therapy per day five times a week, the reality is that access to speech-language therapists is often delayed and restricted. During inpatient care, post-stroke patients spend more than half their time in hospital resting alone in bed. During this rest time, there is an opportunity for digital therapy programs to be utilized by patients. This study tested the feasibility of offering digital therapy to patients in the first two weeks after their stroke. Over the course of six months, 30 patients with aphasia were given an iPad and a suite of therapist-selected apps including Constant Therapy. After a 15-minute training session, patients used the tablet on average for 2.5 hours a day, found digital therapy to be convenient, and the authors report that perceived barriers such as infection control were easily overcome. The authors conclude mobile tablet technologies could be a useful frontline tool to augment therapy sessions in the first weeks after a stroke.

Mallet KH, Shamloul RM, et al. RecoverNow: Feasibility of a Mobile Tablet-Based Rehabilitation Intervention to Treat Post-Stroke Communication Deficits in the Acute Care Setting. PLOS ONE. 2016;11(12): e0167950. https://doi.org/10.1371/journal.pone.016795

Feasibility of a mobile cognitive intervention in childhood absence epilepsy

Northwestern Medicine® Feinberg School of Medicine

Themes: Epilepsy, Pediatrics, Efficacy

Study Pl/Institution: Feinberg School of Medicine @ Northwestern University

Children with childhood absence epilepsy (CAE) experience brief, momentary lapses in consciousness that can interfere with their cognitive development and academic performance. While these children could benefit from cognitive rehabilitation, there is little evidence and few resources to support them. In this study the authors tested the feasibility of an iPad-based approach that encouraged eight children with CAE to use Constant Therapy tasks for 20 minutes a day, four times a week. The children enjoyed using the app and believed it helped their cognitive abilities, and their parents agreed. Although statistical power was limited in such a small study, the authors found improvements in the cognition fluid composite and pattern comparison processing speed on the NIH Toolbox's cognitive domains. They conclude that mobile cognitive interventions like Constant Therapy have the "potential to be utilized as a component of a comprehensive treatment program for children with CAE."

<u>Glynn P, Eom S, Zelko F, Koh S. Feasibility of a mobile cognitive intervention in childhood absence</u> epilepsy. Frontiers in Human Neuroscience. 2016;10:575. doi: 10.3389/fnhum.2016.00575



Themes: Dementia, Aging, Efficacy

Study Pl/Institution: St. Louis University

Digital therapy tools are now used across the human lifespan, including in the geriatric population. In this case study, an 83-year-old woman with moderate dementia living in a locked, special care memory unit was referred for speech-language therapy due to a decline in activities of daily living, safety, and communication. Over a 6-week period, 12 therapy sessions were administered with Constant Therapy to support attention, visual memory, mental flexibility, and visuospatial processing. The patient got better at completing the tasks and required less support to participate across sessions, with real-world benefits such as ignoring distractions in a busy environment and requiring less cues from caregivers. Remarkably, shortly afterwards, she was deemed safe to be discharged to a non-secure unit that facilitated greater independence. This study shows how people living with dementia can benefit from digital therapy programs.

Postman WA. Computer-mediated cognitive-communicative intervention for residents with dementia in a special care unit: an exploratory investigation. Perspectives of the ASHA Special Interest Groups. 2016;1(15):68-78. doi: 10.1044/persp1.SIG15.68

How does severity of aphasia influence individual responsiveness to rehabilitation? Using big data to understand theories of aphasia rehabilitation



Themes: Stroke, Aphasia, Prognostic Factors

Study Pl/Institution: Aphasia Research Laboratory @ Boston University

Which patients are most likely to benefit from speech-language rehabilitation after a stroke? And how much of which type of rehabilitation will produce the best outcomes? While many factors influence patient outcomes such as demographic characteristics, lifestyle, and the nature of the stroke experienced, few studies have explored the nature of the rehabilitation therapy offered, in part because traditional therapy is analogue, face-to-face, and goes unrecorded. Digitally delivered rehabilitation has the potential to offer up "big data" that might allow us to answer these questions and offer personalized therapy to patients. The author discusses that when digital therapy is tailored to the individual, both mild and severe patients show improvement. In fact, more severe patients showed more gains on standardized tests, suggesting that severity is not a negative prognostic indicator for successful outcomes. Additionally, digital therapy helps us understand how varying severity levels benefit from cues. Digital tracking of how often patients used "hints" during their tasks pointed toward clusters of paths to improved functioning that could help build personally-tailored programs for patients in a much more scalable way than today's practice.

Kiran S. How does severity of aphasia influence individual responsiveness to rehabilitation? Using big data to understand theories of aphasia rehabilitation. Seminars in Speech and Language. 2016;37:48-60. doi: 10.1055/s-0036-1571358. (Open access pending)

Effectiveness of an impairment-based individualized rehabilitation program using an iPad-based software platform



Themes: Stroke, Aphasia, Efficacy

Study PI/Institution: Aphasia Research Laboratory @ Boston University

While some 200,000 Americans are diagnosed with aphasia each year and recovery is measured in years, most patients only receive the recommended intensive speech-language rehabilitation therapy for a matter of weeks. Digital therapy delivered via tablet computer offers the potential to fill this gap, but rigorous studies are needed to establish efficacy. In this preliminary study, 51 people with aphasia were divided into experimental (N=42) and control (N=9) groups to test the effectiveness of Constant Therapy compared to usual clinic-based care. The control group received 1 in-clinic visit per week while the experimental group received the weekly in-clinic visit plus use of Constant Therapy at home. While both groups showed improvement on language and cognitive tasks over the 10-week therapy program, the experimental home-based digital therapy group practiced more (around 4 hours a week) than clinic-based therapy (around 40 minutes) and showed greater changes in task accuracy and response latency.

Des Roches CA, Balachandran I, Ascenso E, Tripodis Y, Kiran S. Effectiveness of an impairment-based individualized rehabilitation program using an iPad-based software platform. Frontiers in Human Neuroscience. 2015;8:1015. doi: 10.3389/fnhum.2014.01015

2014

Development of an impairment-based individualized treatment workflow using an iPad-based software platform

BOSTON UNIVERSITY

Themes: Stroke, Aphasia, Efficacy

Study Pl/Institution: Aphasia Research Laboratory @ Boston University

While a number of technological advances have been deployed in speech and language therapy, these have tended to focus on expanding the reach of the clinician, employing remote therapy or "telemedicine" to link patient and clinician by videoconferencing. While clearly an improvement on clinic-based therapy, this still presents a bottleneck around the time and resources of highly-trained clinicians. An alternative approach, described in this paper, concerns the development of purely software-guided rehabilitation programs to provide a scalable platform to offer therapy to an unlimited number of patients. The authors describe the technical development of Constant Therapy's automated assessment, task generation, and progression tracking, alongside four case studies of people with aphasia as they test the system. Across a range of impairment and language function, participants produced significant improvements and adopted the technology with ease. In the future clinicians may act more as "orchestrators of the rehabilitation process" and unblock the bottlenecks that limit patient recovery today.

Kiran S, Des Roches CA, Balachandran I, Ascenso E. Development of an impairment-based individualized treatment workflow using an iPad-based software platform. Seminars in Speech and Language. 2014;35(1):38-50. DOI: 10.1055/s-0033-1362995 (Open access pending)

Constant Therapy Health



Themes: Stroke, Aphasia, Efficacy

Study PI/Institution: Aphasia Research Laboratory @ Boston University

This case study describes the interesting case of a person with aphasia who used the Constant Therapy rehabilitation tool after experiencing a stroke. With Constant Therapy, this individual was able to continue to target language skills after discharge from speech-language therapy. Over the course of four months, he completed his therapy tasks on a daily basis, but when his performance suddenly deteriorated, it alerted his family that something might be wrong. Subsequent testing by his doctor revealed a second stroke that would otherwise have potentially gone undetected. After discharge from hospital for the second stroke, digital therapy was resumed, and the patient continued to work on maintaining and improving his skills at home. The authors suggest that digital therapy platforms not only help people access therapy more easily, but also it could act as "early warning systems" for follow-on strokes, which are particularly common in this population and a significant source of disability.

Kiran S. Detecting small- and large-scale fluctuations in language and cognitive performance: a longitudinal rehabilitation case study. International Journal of Physical Medicine & Rehabilitation. 2014 2:3. DOI: 10.4172/2329-9096.1000203