Executive Function Training Intervention for Chronic Traumatic Brain Injury

October 8, 2018

Intervention

A. Description of the Interventions

The overall objective of the proposed study is to test the effectiveness of a rehabilitation training program (Expedition: Strategic Advantage) combining strategy-based coaching by a clinician with daily practice sessions conducted with game-based game based-simulations of tasks of daily living aimed at improving cognitive constructs embedded within functional tasks. This will be compared to a control arm of the intervention (Expedition: Informational Advantage). In Informational Advantage the game-based simulations will not be escalated fully in cognitive challenge. Informational Advantage is not a purely placebo control intervention, as it is matched for virtual interactions between the participant and a clinical intervention specialist, and may boost confidence, self-efficacy, and elevate mood. Critically, it will not include the escalating cognitive challenge element present in the Strategic Advantage intervention arm.

Expedition – Strategic Advantage

We will conduct the Strategic Advantage intervention over a four-week period using a remote telemedicine delivery method. Each participant will be issued a laptop computer loaded with both the game-based software, which will be used for each week of the intervention (both arms). Weeks 1-3 will focus on improving strategies and efficiency within separate cognitive domains. These intervention training modules are based tasks which focus on packing for a trip, selecting and remembering locations visited, transportation, and money management. During each week of the intervention the game-based simulation will escalate in difficulty, increasing the demands upon the participant. Accompanying the game based training will be virtually delivered personal coaching sessions related to each construct.

Phone Check-in:

The clinical impact of game-based simulation challenge tasks will be strongly enhanced by coaching sessions with a clinical interventionist, who can help to guide and support the participant.

At the start of each week there will be a phone meeting session, which will be a one-on-one participant meeting with a clinical interventionist for 30 minutes. The focus of this session will be to introduce the game-based simulation that will be practiced for the upcoming week. In Week 2, 3, and 4 emphases will also be placed on reviewing the performance from the prior week and working to identify places in which the skills and strategies used may be particularly relevant to real life.

There will be a second session of phone coaching at the midway point of the week. During this session, the coach will check in with the participant and encourage them to continue to work with the game-based simulation, discuss challenges, obstacles, and outcomes. The coach will be able to review game-based simulation adherence and performance metrics (errors, completion times, and total time playing the simulation) prior to this mid-week session. This mid-week session will also emphasize trying to meet the new demands of the game-based simulation at the end of the week.

Game-Based Simulation Sessions:

The clinical impact of game-based simulation challenge tasks will be accomplished through repetition, and engaging in "desirable difficulties", a term coined in the memory literature to describe a situation in which coping with challenges and overcoming them will lead to improved skills and abilities in the long run. Each week a participant will be tasked with playing the game-based simulation for a minimum of one hour Monday-Friday. The game-based simulation will incorporate an increasing level of challenge to the same module each day until the final module on Friday, which will be most difficult and present the most desirable difficulties.

Below are brief descriptions of the cognitive strategies and performance elements for the game-based simulations for each of the four weeks of the Strategic Advantage intervention.

- Week 1
    - *Game-based Simulation Module:* In a hotel room, participants are presented with a list of items that must be maintained while they search through the cabinets and drawers. Some items in the cabinets and drawers will be needed for the goal of the trip the player is taking, while others will be unnecessary. The task requires that participants focus on the available items, determine their relevance, and either place them in the correct repository (suitcase, briefcase, or backpack) or, if they are not needed for the trip, ignore them. As the week progresses the sessions will include more items to search for and more distracting items to contend with. Additional distractions will occur in the form of interruptions from text messages that must be either responded to or ignored depending on their relevance (travel-related vs. non-travel related).
- Week 2
    - *Game-based Simulation Module:* Participants are presented with a metro subway schedule that includes multiple transfers in order to navigate to different points of interest. At a VR train depot, participants view a series of trains, some are relevant and some are irrelevant. Participants are to catch the correct trains to complete their targeted route. In sessions 3-5 additional complications will arise involving late and canceled trains. Money for travel fare becomes more complex to manage, as well, with multiple routes possibly taxing management of money and time.
- Week 3
    - *Game-based Simulation Module:* In the simulation participants will be asked to navigate to different points of interest within a set timeframe. The task calls for the participant to focus on planning to virtually visit a manageable number of locations and learn facts about them. As the week progresses participants must focus on attending to text message distractions briefly, establishing their relevance, and either rapid blocking or immediate responding and resuming original task focus on the goal of visiting and learning about locations. At the end of each session there will be a delayed memory test. The test will be scored for both number of places visited and number of facts accurately reported.
- Week 4
    - *Game-based Simulation Module:* Participants play their way through the entire simulation beginning with the packing (working memory) task, followed by transit according to a metro train schedule (planning), and visiting locations to acquire information (attention and long term memory) with text message distractions present (selective attention). This will be repeated throughout week 4 with escalating levels of challenge for the participant to master.

Expedition – Informational Advantage

The Informational Advantage intervention will be carried out over a similarly scheduled four-week period in the same telemedicine delivery method. All aspects will be identical, except the game-based intervention will be capped at a lower challenge level (approximately ¼ of the difficulty level of the full-scale challenge level available in Strategic Advantage). Once this cap is reached, participants will be limited to that challenge level for the remainder of the week.