Schizophrenia patients' ability to monitor reality may be helped by computerized training

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People with schizophrenia who completed 80 hours of intensive, computerized cognitive training exercises were better able to perform complex tasks that required them to distinguish their internal thoughts from reality.

As described in the journal *Neuron* (2/22/12), a small clinical study conducted at the San Francisco VA Medical Center (SFVAMC) and the University of California, San Francisco (UCSF), tested the digital exercises as a new therapy for schizophrenia.

"We predicted that in order to improve complex cognitive functions in neuropsychiatric illness, we must target impairments in lower-level perceptual processes, as well as higher-order working-memory and social cognitive processes," said Srikantan Nagarajan, PhD, a professor of radiology and biomedical imaging at UCSF and a senior author of the study.

When compared with their assessments before the training, schizophrenia patients who received 80 hours of computerized training over the course of 16 weeks became better at monitoring reality. This improvement coincided with increased activation in a key part of the brain: the medial prefrontal cortex.

"The medial prefrontal cortex is a critical higher-order brain region that

supports successful reality-monitoring processes," said Karuna Subramaniam, the study's first author, who worked directly with the patients in the study and analyzed their data.

How the Study Works

Schizophrenia strikes about 1 percent of all Americans and about 51 million people worldwide. It is one of the most intractable and difficult to treat psychiatric illnesses, with prognosis becoming progressively poorer the longer a patient has the disease, according to the study's senior author, Sophia Vinogradov, MD, professor and interim associate chief of staff for mental Health at SFVAMC and interim vice chair of psychiatry at UCSF.

One of the core impairments of the disease is losing a grip on what is real, she said. "Reality-monitoring is the ability to separate the inner world from outer reality," she explained. "It is a complex cognitive function that is impaired in schizophrenia."

In the study, the brains of 31 patients with schizophrenia and 15 healthy people used for comparison were scanned using functional magnetic resonance imaging (fMRI) while they performed a reality-monitoring task.

Then, 16 of the 31 patients with schizophrenia were randomly assigned to complete 80 hours of computerized training composed of auditory, visual and social cognitive exercises that included programs designed by the Posit Science Corporation. The other 15 patients with schizophrenia were assigned to play computer games for the same amount of time.

After 80 hours, all of the subjects repeated the original reality-monitoring task in the MRI scanner, to monitor brain activity associated with their ability to discern words they made up in their head (internally-

generated information) from words the experimenter showed them (externally-presented information).

The reality-monitoring test consisted of a study phase and a retrieval phase. During the study phase, subjects read sentences with noun-verb-noun structures outside the scanner. These were simple sentences like: "The chicken crossed the road." During this study phase, the final word of each sentence was either presented by the scientists or it was left blank for subjects to make up and fill in themselves (e.g., "The rabbit ate the ___" to which the subject might write down, "carrot").

Then, 45 minutes later, the subjects performed the retrieval phase in the MRI scanner where their brain activity was monitored while they were shown pairs of nouns from the sentence list. They had to identify whether the second word in the noun pair was a word that they had previously generated themselves during the study phase ("rabbit-carrot") or was one that the experimenter had presented to them ("chicken-road").

Compared to their pre-training assessments, people who had received the computerized cognitive training were better able to distinguish between the words they had made up themselves and those that had been presented to them. Furthermore, analyses of the MRI data revealed they also had increased activity in the part of the brain (the medial prefrontal cortex) that governs these decisions.

“Interestingly, greater activation within the medial prefrontal cortex was also linked with better social functioning six months after training,” Subramaniam said. "In contrast, patients in the computer games control condition did not show any improvements, demonstrating that the behavioral and neural changes were specific to the computerized training patient group.”

What this suggests, said Vinogradov, is that “the neural impairments in schizophrenia are not immutably fixed but may be amenable to well-designed interventions that target restoration of neural system functioning.”

The study “sets the groundwork for what could be a new treatment approach in psychiatric illness – a new tool we could use in addition to medication, psychotherapeutic approaches or cognitive behavioral approaches,” she said.

The article, "Computerized Cognitive Training Restores Neural Activity within the Reality Monitoring Network in Schizophrenia" by Karuna Subramaniam, Tracy L. Luks, Melissa Fisher, Gregory V. Simpson, Srikantan Nagarajan, and Sophia Vinogradov appears in the Feb. 23 issue of Neuron.

This work was funded by the National Institute of Mental Health. Gregory Simpson, an author of the study, is a senior scientist at Brain Plasticity Institute, Inc. Sophia Vinogradov, also a study author, is a consultant to Brain Plasticity Institute, Inc., which has a financial interest in computerized cognitive training programs.

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