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## Injured Brains 'Work Harder' To Perform At Same Level As Healthy People

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Now brain imaging experts with Baycrest's Rotman Research Institute in Toronto have found a distinct "brain signature" in patients who have recovered from head injuries that shows their brains may have to work harder than the brains of healthy people to perform at the same level.

The patients in the study had diffuse axonal injury (DAI), the most common consequence of head injuries resulting from motor vehicle accidents, falls, combat-related blast injuries, and other situations where the brain is rattled violently inside the skull causing widespread disconnection of brain cells.

"Our imaging data revealed that the DAI patient brains had to work harder to perform at the same level as healthy, non-injured brains. Specifically, the brain injury patients showed a greater recruitment of regions of the prefrontal cortex and posterior cortices compared to healthy controls," said Dr. Gary Turner, who led the study as a part of his doctoral studies at Baycrest and the University of Toronto with senior author and Rotman scientist Dr. Brian Levine. The study is published in the Sept. 9th issue of *Neurology*, the medical journal of the American Academy of Neurology.

Even though the head injury patients performed as well as the healthy controls on a series of working memory tests that measured their ability to organize, plan and problem solve, the fact their brains had to work harder is an indication of "reduced cognitive efficiency", explained Dr. Turner, who is now completing a post-doctoral fellowship with the Helen Wills Neuroscience Institute at the University of California, Berkeley, where he is working to develop assessments and programs to enhance cognitive skills in people with head injury and normal aging patients.

Using standard techniques for imaging resting brain function, doctors typically look for reduced blood flow in certain regions to indicate neural damage. The Baycrest study used functional magnetic resonance imaging (fMRI) to assess brain activity during performance of a mentally challenging task involving the control and manipulation of information held in mind. This "executive" or high level cognitive operation is important to many daily tasks, such as problem solving and organization.

"Our study adds to an emerging line of evidence that increased blood flow to areas not normally recruited during challenging mental tasks is related to reduced cognitive efficiency in patients with head injury," added Dr. Levine, who is internationally-recognized for his research on recovery and reorganization of brain function after traumatic brain injury.

The eight patients in the Baycrest study had been in motor vehicle accidents several years prior, sustaining significant brain injuries that left them comatose for various lengths of time; yet all patients made good recoveries as evidenced by a return to pre-injury employment or school. Their fMRI scans were compared to 12 healthy adults, matched to the patients for age and education.

The Baycrest study is the first to recruit patients and healthy controls that were evenly matched in cognitive performance from the outset. The study included only head injury patients with DAI and not other large brain lesions

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