Finding lost emotions after brain injury

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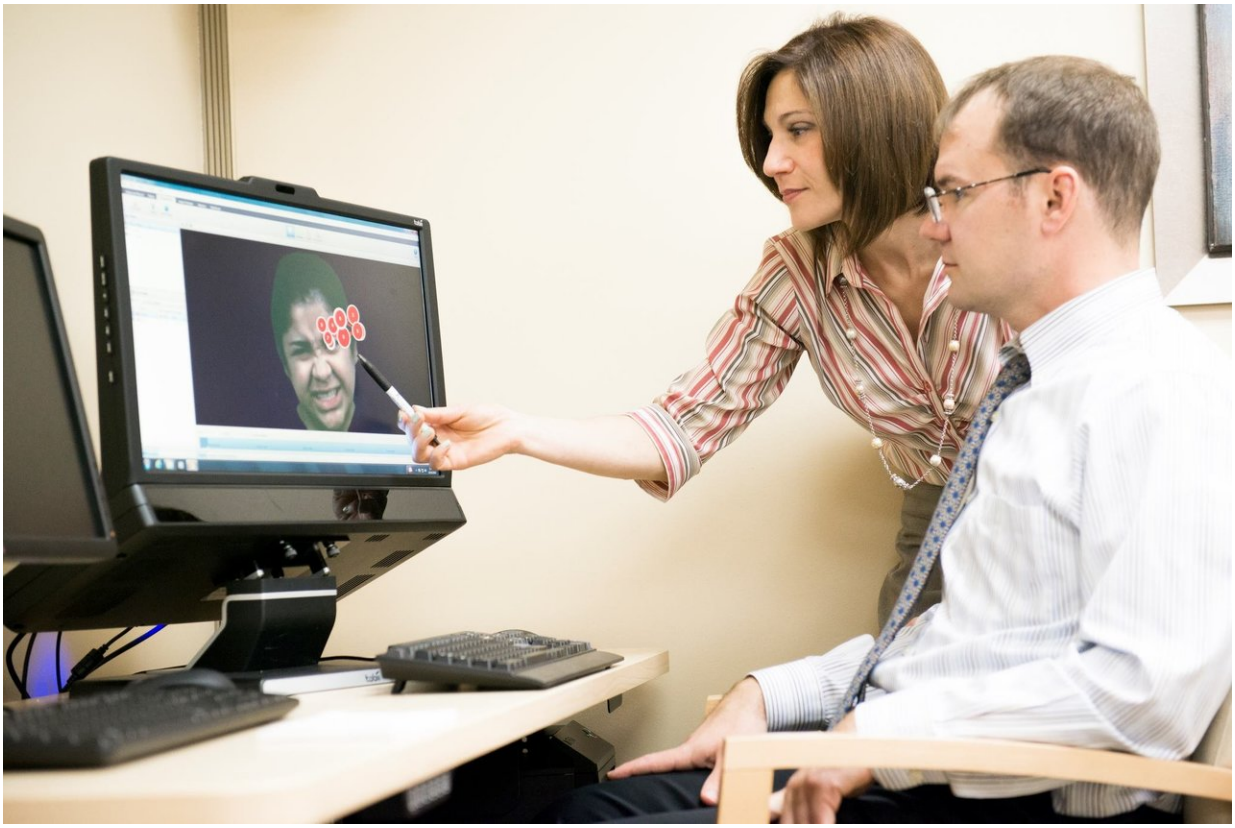

Credit: Dawn Neumann

This week, a study published by scientists at the University of Rochester indicates that a new blood test may make it easier to more quickly diagnose traumatic brain injury (TBI). This is great news, given that TBI factors into about one-third of all injury-related deaths. Although modern medicine has succeeded in lowering the number of deaths

directly caused by TBI, the long-term effects that this type of injury has on survivors is still poorly understood. In this piece, we highlight the research of Dr. Dawn Neumann, whose work is aimed at creating interventions to improve the long-term quality of life and emotional health of traumatic brain injury patients.

Traumatic injury to the brain can leave a person emotionless. What happens if we stop feeling emotions? An individual's inability to understand and express their own emotions can be detrimental not only to themselves, but also to their loved ones. Our ability to empathize and gauge feelings of our friends and families, is what defines our interpersonal relationships and shapes our personalities. Apart from the physiological and neuropsychological damages caused by severe traumatic brain injury (TBI), these emotional deficits make it very difficult for a patient to return to their normal lifestyle. Social cognition researcher, Dawn Neumann, PhD, helps patients with TBI to reconnect with their emotions, build a capacity for relationship maintenance, and develop interpersonal skills in order to improve their quality of life.

Dr. Neumann is an Associate Professor and Research Director at Indiana University School of Medicine in the Department of Physical Medicine and Rehabilitation, with a focus on issues related to emotional deficits in patients of brain injury. Before even starting graduate school, Dr. Neumann observed that patients of TBI found it difficult to perceive and respond to emotional cues, which affects their ability to interact with other people. This echos the research published in a 2013 *PLOS One* study which indicates a lack of ability to perceive emotions can lead to increased sadness and anger in TBI patients. As Dr. Neumann explains, "There was a huge gap in this area, which was an important problem, so I kept going with it." Early on in her career, Dr. Neumann decided to address this issue by developing an intervention that would help patients with TBI recognize how other people are feeling, also known as affect recognition (e.g. through facial expressions). Interestingly, Dr. Neumann

has also found that patients who tend to avoid thinking about their emotions are often the ones who face difficulty understanding emotions or the perspectives of others. This phenomenon is explained by the fact that TBI can also cause difficulty interpreting and recognizing one's own feelings and emotions (alexithymia), thereby impairing an individual's empathy for another's emotions. Her study, Relationships Between Alexithymia, Affect Recognition, and Empathy After Traumatic *Brain Injury*, looked at 60 such adults with TBI and explained the clinical implications of this finding.

Understanding and studying something as abstract as emotion requires innovative research tools, which can be challenging. "How do you study interpersonal relationships, and can you really do that in a sterile laboratory setting to get a good understanding?," probes Dr. Neumann. With this impetus, Dr. Neumann helped to establish the Indiana University Interactive and Functional Assessment of Communication and Emotion (InterFACE) Center at Rehabilitation Hospital of Indiana (RHI). At InterFACE, patients, along with their spouses, children, or parents, are brought together in an observational laboratory, designed to look like a living room to make it seem more natural. As the chair of the InterFACE Center, Dr. Neumann is currently studying patients with TBI to build a profile of their emotions to different cues. With the technology at InterFACE, researchers can also monitor physiological changes such as heart rate, breathing pattern, muscle tension, and eye tracking, which allows the cataloging of non-verbal emotional responses. Immersive virtual reality is another feature of InterFACE, to help researchers create different virtual situations for participants. All these strategies can be synchronized together to closely monitor, identify, and link an individual's emotional deficits and customize their therapy program.

As Dr. Neumann elaborates, "We have high definition cameras that can do video recordings, and we have equipment to measure people's heart

rate, sweating, muscle tension, breathing rate, and pattern – as these things will change when you're starting to get upset or feeling different emotions. All of these separate components in the lab are designed to work together. We can go back to those videos and can see exactly what's going on."

Recently, Dr. Neumann has partnered with a software company to develop a mobile app, My Emotional Compass, designed to help people navigate their emotions and find the right words to describe their feelings. The app is available for download for Apple and Android platforms, and user-friendly guides and tutorials are also made available online. With the app and future research, Dr. Neumann is interested in understanding one important emotion after brain injury: anger. Uncontrolled anger and aggression is seen very commonly after TBI and can impact the patient's general functioning. Dr. Neumann is trying to understand what might contribute to this issue and come up with treatment programs to address these problems. She adds, "My research includes clinical trials for these interventions, and we have been fortunate enough to get promising results. Some of them are being used clinically and others are still under investigation." Treatment programs formulated by Dr. Neumann have helped train TBI patients to recognize emotions in others and have shown successful results in a Phase I trial.

Dr. Neumann's work stretches far outside the InterFACE lab, to other clinicians and even caregivers. She frequently facilitates workshops to educate the medical community about problems in social cognition and behavior changes after trauma. More than half of patients with TBI report having impairment with social cognition; however, more than two-thirds of their physicians reported not making use of any formal tools to assess these problems (McDonald, 2013). She conducts research that involves contacting the caregivers of patients and collecting their inputs to get their perceptions on the patient's progress. By collaborating with caregivers, she hopes to understand their frustrations and learn how to

help them.

It is the patients and families, themselves, that keep Dr. Neumann motivated to continue her work. A recent donor to the Rehabilitation Hospital of Indiana (RHI) Foundation visited Dr. Neumann's lab for the first time, and was moved to tears remembering the pain her mother, a TBI patient, felt. In another account, Dr. Neumann helped build the vocabulary of a patient who was struggling to find the right words to explain her feelings. After completing the treatment program, the patient thanked Neumann for "giving her speech back." Dr. Neumann has found her patients frequently maintain contact with her long after leaving her facility: "I don't know how, but somehow, I connect with them."

More information: Dawn Neumann et al. Relationships Between Alexithymia, Affect Recognition, and Empathy After Traumatic Brain Injury, *Journal of Head Trauma Rehabilitation* (2013). DOI: 10.1097/HTR.0b013e31827fb0b5