

Know thyself

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The studies in this thesis concern a problem that is encountered in clinical practice during rehabilitation after acquired brain injury (ABI). Namely, after sustaining an ABI, it is common for people to have impairments in a variety of cognitive functions, such as memory, attention, or decision-making. However, some people have difficulties recognizing that, or how, their behavior has changed due to the ABI. This is called impaired self-awareness and can hinder rehabilitation. People with impaired self-awareness might not understand or see the need for treatment and are less motivated to participate in treatment. This can cause frustration for the patient, who does not understand why they should change, but also for the therapists and significant others, who want to help but feel they are not being heard. This can lead to conflict between these parties. The aim of this thesis was to investigate what self-awareness is conceptually, what the underlying causes of impaired self-awareness are, and how it can be treated.

Main findings

The studies described in this thesis, combining studies in patients and healthy subjects, confirm that self-awareness of cognitive functioning, also known as metacognition, consists of different distinguishable elements which makes it hard to grasp as a whole. The elements can be measured in different ways. For example, questionnaires can be used to get a more general overview of someone's beliefs about their cognition, while confidence judgments related to one's specific answers on a cognitive task measure a more specific and dynamic element of metacognition. The studies in this thesis also indicate that there are different brain networks that are involved in the different elements of metacognition and that brain injuries in these different networks are associated with impairments in different elements of self-awareness. After ABI, impaired self-awareness can arise in several ways. Damage to the brain can disrupt brain networks that are necessary for self-awareness, but impaired self-awareness can also arise through a coping mechanism associated with the traumatic event of having an ABI, such as denial. In our studies we found evidence for this distinction. Namely, performance on cognitive tasks and injury-related factors, such as severity of the injury, were associated with neurocognitive impaired self-awareness, while denial of disability

was associated with anxiety. A new intervention, Socratic Guided Feedback therapy, was investigated as a possible treatment for impaired self-awareness and compared to care as usual. We found that the new treatment was just as effective as the standard practices in rehabilitation centers. Through these studies, we have gained a lot of information on how future research and treatments should be set up and conducted.

Scientific impact

The studies in this thesis have been published, or have been submitted to be published, in open access international peer-reviewed journals. Results have also been presented at national and international conferences. Our findings contribute to scientific research by adding knowledge on theoretical models and treatment of self-awareness. This thesis provides a thorough investigation of self-awareness with a focus on self-awareness of cognition. Having investigated this in people with and without ABI, our findings can help scientists understand metacognition and how impairments can occur after ABI. This thesis provides a theoretical overview of the different elements metacognition consists of and how these can be measured. We emphasize the need to be specific when studying this topic. This implies that scientists should be clear on which element of metacognition they are studying. This can help us compare studies and understand metacognition even better. With the studies in this thesis we provide tools on how metacognition can be further investigated in a structured way. For example, the imaging study in chapter 2 has proven to be a feasible set-up in healthy people that can now be used in people with ABI to investigate neural correlates of metacognition in that population. This is not only relevant for scientists in the ABI rehabilitation field but could also be translated to studies concerning metacognition in any other population or field, such as in patients with dementia, or in the field of educational psychology.

Societal impact

People with ABI as well as clinicians and therapists working in rehabilitation centers were directly involved in some of the studies in this thesis. Therefore, the findings in this thesis have direct implications for anyone involved in health care practice and, more specifically, neuropsychological rehabilitation after ABI. Firstly, through creating better theoretical foundations of self-awareness and how this can be impaired, we offer better understanding for therapists, patients, as

well as significant others and caregivers. This could clarify some of the questions these individuals might have, which could already relieve some burden for them. Secondly, the Socratic Guided Feedback protocol can help therapists feel more secure when treating a patient with impaired self-awareness which can, in turn, improve the outcomes of the therapy. In a similar way it can offer significant others and caregivers grip on how to communicate with their loved ones. At the same time, Socratic Guided Feedback therapy can help patients feel more understood. Taken together, this can decrease friction and conflict, relieve burden, and improve quality of life for everyone involved. Additionally, this thesis has implications for students in the neuropsychological field. Through lectures and tutorials they can learn about theoretical and neurobehavioral factors related to self-awareness.

Dissemination activities

The findings in this thesis have been disseminated in different ways. They have been shared with the scientific community through publication in open access international peer-reviewed journals and are accessible to read for scientists or anyone interested. The papers that are not published yet have been submitted for publication in such journals. Moreover, the datasets are, or will be, accessible on request for use in future research. The results have been presented at international conferences such as the International Neuropsychological Society (INS), Special Interest Group of the World Federation for NeuroRehabilitation (NR-SIG-WFNR), and International Brain Injury Association (IBIA). Additionally, the findings have been shared with the professional community through symposia and webinars organized by the Brain Injury Center Limburg. We have shared the findings in this thesis with the general public too. This was achieved through presentations at informal public meetings organized for people with ABI and their partners such as Brain Cafes. The findings have also been spread in a podcast episode of the Stroke Knowledge Network in the Netherlands. For the chapters that remain to be published, we will share the findings with the participants through newsletters. Finally, we have updated the general public about the findings through social media such as our website www.hersenletsellimburg.nl, LinkedIn, and Twitter.