

Hypnosis and brain injury: four cases and three predictions

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Abstract

Recent studies have found large effects of hypnotic suggestion on cognitive impairment following acquired brain injury. Four illustrative cases are presented to discuss potential mechanisms underlying the treatment effects. First, mental imagery of brain recovery may be effective in ameliorating cognitive impairment even if it does not correspond to the "real" physical brain injury. Second, some patients do not subjectively experience improvements despite large measurable improvements. Third, ongoing litigation can inhibit improvement in contexts where this is incentivized, but not in other contexts. Fourth, pre-injury autobiographical memories may be an important resource in for ameliorating the negative effects of brain injury using hypnotherapy. Potential mechanisms underlying these and other observations are discussed. I argue that that the physical characteristics of the brain injury may be of lesser importance for the experienced cognitive impairments than the subjective metaphors each patient has about his/her brain injury and its causes. Hypnosis may enable the patient to adopt the role of his/her own pre-injury autobiographical self when such a role is available and desirable. I present three testable predictions, which may serve to optimize the use of hypnotic suggestion for patients with acquired brain injury.

Keywords: hypnosis, brain injury, concussion, rehabilitation, cognition

Introduction

Hypnosis has been successfully applied in rehabilitation of a wide range of sequelae following acquired brain injury, including motor disorders (Irawan, Mardiyono, Suharto, & Santjaka, 2018; Spankus & Freeman, 1962), aphasia (Thompson, Hall, & Sison, 1986), pain, vertigo, and many more (Appel, 2003; Cedercreutz, Lähteenmäki, & Tulikoura, 1976).

Recent studies have found large effects of hypnosis on cognitive and affective domains for patients with acquired brain injury (Cui-Ping, 2011; Lindeløv, in review; Lindeløv, Overgaard, & Overgaard, in review, 2017), though this literature also has a few shortcomings (Lindeløv et al., in review). A randomized controlled study found very large and long-lasting improvements on working memory (Lindeløv et al., 2017), and a further analysis of interview data from this study found a one-hour reduction in the median need for daily sleep as well as progress on 75% of patient-reported outcome measures (Lindeløv et al., in review). A single-group study on patients suffering from long-term deficits following mild traumatic brain injury found large improvements on fatigue ($d = 0.8$) and medium-sized improvements on depression and anxiety (Lindeløv, in review). The available evidence indicates that hypnosis is more cost-effective than other methods for this patient group (Lindeløv, in review, 2015). However, the literature consists exclusively of studies of efficacy and effectiveness. The present article is a first step towards identifying the underlying mechanisms of recovery.

Working memory, concentration, attention, and fatigue are prevalently impaired following acquired brain injury irrespective of the type of injury - from Mild Traumatic Brain Injury (sometimes called concussion) to severe strokes (Carroll et al., 2004; Cumming, Marshall, & Lazar, 2013; Dunning, Westgate, & Adlam, 2016; Serino et al., 2006). For this reason, my colleagues and I have focused on improving these aspects using hypnosis. Patients will often complain that thinking itself has become a strenuous and unreliable activity. In everyday life, they experience difficulties understanding written and verbal language, they forget important appointments, and feel overloaded with information in public and social situations. Usually, this leads to elevated anxiety and the eventual retraction from many activities.

The hypnotic procedures used in our studies have centered on suggestions that thinking will become effortless and reliable after the hypnotherapy (Lindeløv et al., 2017). Techniques towards this end include regression to the premorbid state (i.e., the experience of being oneself prior to the injury), imagery of neuroplasticity, and posthypnotic suggestions about the future. We also specifically included suggestions about trusting the ability to improve, no matter the patient's preconceptions or what he/she has been told by others. I present some illustrative excerpts from our manuscripts below. The square brackets mark sections which are excluded here for brevity. Each script was read slowly and with frequent brief pauses.

Regression to the premorbid autobiographical self:

And while you continue relaxing, please imagine your life as a timeline. Notice that you can float above yourself, so now you can look down on yourself and your timeline. It stretches far into the future and far into the past. Now, begin sliding back towards your past [More sliding] to a time when your brain was functioning perfectly, and where you could take for granted that you could do the things which you now find difficult to do. [Find specific situations and experience them vividly] And take this re-found knowledge and move forward, along your timeline, to the present moment. Let this knowledge be a seed inside you, which begins to grow and sprout. Brains are like roads: if something is blocked or closed, you can find another way, and the new route can be just as good – or even better - than the old one.

Countering the ideas that a brain injury is static:

Throughout life, your body has repeatedly repaired itself. If you had a scratch on your skin, the bleeding automatically stopped. If you had a virus infection, your immune system defeated it. Actually, everyone has tiny brain hemorrhages throughout their life, so small repairs and restructuring is happening all the time. In a moment, I will ask you to use this capability, which is in your unconscious mind, to repair the things you need to repair. [The brain is a computer that can be reprogrammed] So begin... continue... and finish the changes or restructuring, necessary to regain what you lost. You are regaining the ability to concentrate, be with others as before the injury, you can rely on your memory, and in all other respects you regain the functions that were affected.

Implausible theories

Since publishing the RCT (Lindeløv et al., 2017), I have been continually pressed to provide a mechanistic explanation for the large treatment effects of hypnotic suggestion in neurological populations. Until now, I have been hesitant to theorize based on the relative scarcity of available evidence. However, I also recognize that theorizing structures research agendas and inspires action.

As a first step towards this goal, some explanations can easily be ruled out a priori. For example, the idea that hypnosis physically heals the brain injury or otherwise restores a perfect blueprint of premorbid thinking skills is implausible since memory hardly stores such “meta-cognitive blueprints” (Klatzky & Erdelyi, 1985; Nisbett & Wilson, 1977; Zell & Krizan, 2014).

Somewhat more plausible, early research on hypnotic suggestion and brain injury has mostly focused on anxiety as a potential cause of the symptoms (Fromm, Sawyer, & Rosenthal, 1964; Sullivan, Johnson, & Bratkovitch, 1974). However, these studies did not assess anxiety, so that hypothesis was not empirically substantiated. We have indirect evidence to the contrary: we observed relatively small effects on the European Brain Injury Questionnaire – a self-report

questionnaire which should be sensitive to anxiety (Teasdale et al., 1997). While anxiety-reduction is plausible, it seems that something else is driving the effect.

The following four cases serve to home in on such potential mechanisms. In addition, they also serve to give a human face to the treatment effects behind the statistics reported in previous publications. I have selected the cases which most vividly illustrate phenomena which we observed generally though they were less pronounced in the other participants.

Case #1: Mental imagery need not correspond to the physical brain injury to be effective

Patient

A middle-aged woman was diagnosed with idiopathic normal pressure hydrocephalus (iNPH) 13 years prior to undergoing hypnosis. NPH is a condition where the brain's cavities are expanding, thus displacing neural tissue. iNPH is usually associated with a significant reduction in cognitive functioning (Miyoshi et al., 2005; Thomas et al., 2005).

In the present case, the iNPH had stabilized, and no medical procedures were undertaken to correct it. Her primary symptoms were strong fatigue, which she coped with by sleeping for four hours every afternoon in addition to seven hours of nightly sleep. She attended a support group with concussed patients as part of a vocational re-evaluation program. She felt unable to work in her present condition. Her aim was to (at least) regain the ability to take on a part-time job, e.g., in a thrift shop.

Results

During hypnosis, she found one imaginative experience particularly effective. She visualized walking along her cerebral cortex, noticing whether there were any abnormalities. As she was walking from the prefrontal cortex towards the parietal cortex, she "discovered" a large section of scarred, inflamed, and "disgusting" tissue. She described it in great detail, pointing to her superior parietal lobe. She immediately felt an insight that this was the cause of her problem. The hypnotist invited her to apply a healing ointment to the area, and she did. She reported seeing it heal up completely, becoming "smooth and tidy." This was a very strong emotional experience for her, and she was in tears during the session and several hours afterward. Following this session, she needed only sleep one hour each afternoon. In other words, she had a three-hour reduction in daily sleep. In her waking hours, she reported that she was ready to seek work again but mused that until she got a job, her main challenge was now finding activities to fill in her extra wake-hours.

Discussion

Needless to say, hydrocephalus does not cause focal scarring of the cerebral cortex. Case #1 indicates that, at least for some patients, the characteristics of the actual brain injury is of lesser importance for functioning (or perceived functioning) than the “perceived brain injury.”

Several other metaphors used in Lindeløv (2017) are physically implausible, including returning the brain to the premorbid state and undergoing extensive neuroplasticity in the order of minutes. Yet, only a few patients noted that these suggestions were nonsense. Indeed this comes as no surprise given that we generally have little introspective access to our cognitive functioning (Nisbett & Wilson, 1977; Zell & Krizan, 2014), much less to our brain structure. This disconnection between subjective experience and objective functioning is particularly pronounced in patient populations (Knight, Harnett, & Titov, 2005; Schiehser et al., 2011). Supporting this, objective characteristics of the brain injury, such as lesion size and post-acute Glasgow Coma Scale Scores explain only around 10% of the variance in long-term outcomes (Carroll et al., 2004; Grafman, Salazar, Weingartner, Vance, & Amin, 1986; Zafonte et al., 1996). The physical characterization of the brain injury seems to be of lesser importance to the patient’s functioning than his/her perception of this brain injury.

The “perceived brain injury” consists of the stories, metaphors, and imageries the patient has about the injury and its consequences, and they are known to predict long-term outcomes of traumatic brain injury (Hou et al., 2012). If this perception is formed in the post-acute phase while the temporary effect of the ischemic cascade (or other imbalances) are in effect, they may not be representative of the long-term brain functioning. This would constitute a cognitive version of learned non-use, a well-known phenomenon in motor- and aphasia rehabilitation (Meinzer, Elbert, Djundja, Taub, & Rockstroh, 2007; Wolf, Lecraw, Barton, & Jann, 1989). Hypnotic suggestion may therefore be effective in unlearning learned non-use, just as it is effective in unlearning other long-term habits (Anbar & Hall, 2004; Hall & Crasilneck, 1970).

Methods directly targeting metaphors and roles/identities have previously been applied in neurorehabilitation (Lorenz, 2010; Ylvisaker, Mcpherson, Kayes, & Pellett, 2008). Compared to these quite deliberate methods, I believe that the above hypnotic procedures take a few shortcuts that increase the likelihood of success.

First, we simply use the patient’s premorbid self as a possible future self rather than some fictional or animal character, as is conventionally done. When case 1 metaphorically repaired her brain, this may have caused her to adopt the premorbid state, knowing that the brain would automatically (or “subconsciously”) function much better. As the autobiographical memory of the premorbid self is often idealized (Lange, Iverson, & Rose, 2010), this may still more accurately be thought of as a metaphor. Second, compared to e.g. being Superwoman, explicit and implicit memories of the premorbid self include well-rehearsed action schemas, so little deliberation is needed to transform the role/metaphor into action. Consistent with this, implementation suggestions enhance responsiveness in and out of hypnosis – especially for low-hypnotizables (Barnier & McConkey, 2001; Bayer, Achtziger, Gollwitzer, & Moskowitz, 2009; Gallo, Pfau, & Gollwitzer, 2012), perhaps exploiting the fact that learning is most effective when it closely resembles the target situation (Lindeløv et al., 2016; Perkins & Salomon, 1989; Thorndike & Woodworth, 1901). Third, the patient’s relatives “knows” his/her premorbid self so they can readily adjust to accommodate and sustain this change.

In conclusion, the hypnotherapist should provide suggestions so that they are logically consistent with the patient's imagery – not the physical reality. However, attention to details of the autobiographical memories or the actual premorbid condition may aid in ensuring transfer to the present state.

Case #2: No subjective experience of objective improvement

Background

Continuing on the same theme as case #1, we have been puzzled that a substantial proportion of the participants lacked subjective experience of improvement despite large objective treatment effects. We analyzed this extensively elsewhere (Lindeløv et al., in review) where an exploratory factor analysis showed that only changes on objective outcomes (neuropsychological tests and relatives' evaluation) co-varied while subjective reports were independent. Here, we present one illustrative case of this phenomenon and its potential implications for theory.

Patient

A 58-year-old woman had suffered a stroke five years prior to enrollment. Her baseline SHSS:C score was 2, i.e., low suggestibility. She received procedure B in Lindeløv et al., (2017), which consisted of four sessions of hypnosis based on mindfulness suggestions, followed by four sessions of targeted suggestion (see the excerpts above). As with many low-hypnotizables, she reported no experience of trance, worrying that she was unfit for the treatment. The therapist assured her that hypnosis need not feel in a particular way to be effective (when blinding was lifted, we later learned that low SHSS:C scores did not reduce treatment effects).

She had major improvements in the cognitive tests. Her Working Memory Index improved from index 56 to 81, i.e., 1.67 standard deviations. Similarly, she more than halved the completion time on the Trail Making Test from 39 to 19 seconds on form A and from 109 seconds to 39 on form B. However, she did not experience these improvements when asked.

By chance, I met her at a party two years later. She reported that although her friends and relatives had noted a large improvement in her energy, communication, and planning, she did not experience any change herself. It was only after a few months when her husband pointed out to her that she did not have bruises anymore that she realized that something had changed. She had stopped walking into doorframes, tables, etc. without noticing it! At this point, she learned not to trust her subjective self-evaluations, and this led her to notice other tangible evidence of improvements, e.g., that since hypnosis, she had not left a party early like she often used to do. She stayed for the full party where I met her, being very engaged and talkative.

Discussion

We have received similar reports from around a third of the participants in Lindeløv et al. (2017), though most did subjectively experience some immediate improvement followed by a delayed realization that the improvement was much larger than initially felt.

As such, this is the awareness-problem of reduced insight in reverse. Some patients with acquired brain injury do not feel impaired in the days and weeks following the injury, but come to understand their own abilities through hard evidence from experiences of failing (Schmidt, Lannin, Fleming, & Ownsworth, 2011). Mirroring this, our participants did not *feel* an improvement in the days and weeks following therapy, but come to understand their own abilities through experiences of succeeding, including experiences of not failing when they used to. In both cases, external observers are sometimes needed to bring about this awareness.

I think that two factors provide a substantial contribution towards this experience of automaticity.

First, most suggestions were furnished with instructions to let the “conscious” or “controlled” parts of the mind relax while the “subconscious” or “automatic” parts make the desired changes during therapy and post-hypnotically. In other words, the patient is directly asked to experience nothing, and this, of course, increases the likelihood that he/she reports no experience (Spanos & Gorassini, 1984). As a side effect, this “amnesia” may have reduced or avoided any dissonance between expectancy and ongoing experiences, thus allowing the effect of strategic self-deception to continue (Dienes et al., 2015).

Second, I speculate that if they adopt the role of a better-functioning individual, e.g., like their premorbid self or an idealized non-injured version of themselves, the accompanying better functional level is less salient or “surprising”, thus attracting less attention so that it goes unnoticed. Such mechanisms underlie adaption effects in the affective domain (Lyubomirsky, 2010; Wilson & Gilbert, 2008) and may apply to self-evaluations of behavior as well.

This phenomenon could have implications for therapists, who often use the client’s own report of progress (or lacking progress) to guide the therapy. Therapists should be aware of the potential low validity of such reports as an index of objective functioning if they are not accompanied by measurable facts (Knight et al., 2005; Schiehser et al., 2011). The next case speaks to this point, though in the context of litigation.

Case #3: On litigation and role-playing

Background

Ongoing litigation sometimes incentivizes the patient to remain ill. Therefore, litigation for compensation or pension is detrimental to treatment outcomes in neurorehabilitation in general, with the largest detrimental effects for milder injuries (Belanger, Curtiss, Demery, Lebowitz, & Vanderploeg, 2005; Binder & Rohling, 1996). Indeed, we found strong effects of litigation (up to a $d = 0.9$ difference) on the treatment effect of hypnotic suggestion in a sample of patients with mild traumatic brain injury (Lindeløv, in review). Here, we report on one of these cases.

Patient

A 23-year-old male fell from a ladder at work, due to an electric shock. He suffered a head trauma upon hitting the ground. At the time of hypnotherapy onset, this work-related accident was five years old, and he had been out of work since the accident. He sought to get monetary compensation from his previous workplace, and the trial was ongoing. In addition, he sought permanent monetary support from the municipality so that he could work part-time.

He was referred to a support group. Symptom-wise, he walked and talked slowly, was easily fatigued in the support group, and often left early. Overall, the symptoms were consistent with that of the post-concussion syndrome (Hou et al., 2012; Sayegh, Sandford, & Carson, 2010).

He was offered individualized hypnotherapy to which he agreed. The procedure was similar to the excerpts in the beginning of this article, though later hypnosis sessions also addressed pain, anxiety, and depressive thoughts.

Results

After a few sessions of therapy, multiple observers noted that he had gained an upright posture, brisk walking style, and talked fluently upon arriving and leaving the support group. He also now stayed for the full duration of the sessions and had taken up new projects in his free time. However, while in the support group, he assumed the same behavior as prior to hypnotherapy onset, both physiologically and verbally. He was the only participant with ongoing litigation in the group, and the only one who did not experience large improvement from the hypnotherapy. To the contrary, he reported feeling more fatigued. His score on the Mental Fatigue Scale and the Hospital Anxiety and Depression Scale was unchanged (self-scoring questionnaires), and he did not improve his performance on the Digit Span test and the Trail Making Test. He continued expressing his desire to succeed in the litigations.

Discussion

Case #1 and #2 served to establish that the metaphor of being the premorbid self could work subliminally/automatically to bring about cognitive improvement. Case #3, however, indicate that while this improvement may be manifest, there is no compulsion to show it in all situations. Rather,

case #3 was able to adopt the role of a sufferer when the social system affords or incentivizes it, and the role of a higher-functioning individual at other times.

Healthy participants who are hypnotized to "be" brain-injured patients succeed in manifesting the most overt signs of a true brain injury, e.g., body posture, speech, and performance on neuropsychological testing (Fromm et al., 1964). However, they fail malingering tests, indicating that they are not true "brain injury models" but rather playing the role to the best of their knowledge (Gruenewald & Fromm, 1967; Wagstaff, Parkes, & Hanley, 2001). After hypnotherapy, case #3 was similar in this respect. His behavior lends itself to the idea proposed by Theodore Sarbin that individuals can strategically adopt different roles in different "miniature social systems", e.g., in and out of hypnosis (Sarbin, 1950).

In this case, and in recent literature, the hypnotist used age-regression to empower the participants with a new "role": the high-functioning role of being their premorbid selves. Case #3 indicates that, rather than compulsory adoption of the premorbid role, it may be more accurate to say that hypnosis makes it available and that motivational factors determine whether it is adopted.

But what happens when there is no autobiographical memory of a premorbid self?

Case #4: Premorbid autobiographical memories may be important

Introduction

Autobiographical memories elicited through age-regression in Lindeløv et al. (2017) served as a template to which the patient could refer when given suggestions for improvement. It is important to note here that it is ambiguous whether the vividness of hypnotic age-regression reflects a truly accurate recollection, or whether it reflects a larger degree of constructive filling-in (Dywan & Bowers, 1983; Geiselman, Fisher, MacKinnon, & Holland, 1985; Klatzky & Erdelyi, 1985). Accurate or not, the participants find their "re-experiencing" of past events believable.

Patient

Only one patient from Lindeløv et al. (2017) had no autobiographical memory prior to her brain injury. At the age of nearly seven years old, she was riding her bike when a car hit her. She fell and suffered a head trauma. No other physical injuries were sustained. She was immediately hospitalized and unconscious for around an hour. In the following week, her language was impaired and several weeks passed before she attended school again. As she grew up, she completed a short education. When enrolled in the study, she reported barely being able to work all her life and that she had no energy left for family or leisure. By the age of 47 years, she went on a sickness leave due to stress. She was 48 years old when enrolled in the study and out of work.

Her SHSS:C score at baseline was 10, i.e., highly suggestible (Weitzenhoffer & Hilgard, 1962). The hypnotic script was read to the patient according to protocol even though she complained that she

did not remember any premorbid state and thus could not follow the instruction. However, she felt able to follow the other suggestions using imagery and metaphors.

Results

Of all 49 patients in the treatment arms, she was a negative outlier on most of the outcomes. She had the smallest improvement on the WAIS Working Memory Index of only two points from start to finish compared with a sample mean of 24.8 points. Following hypnosis, her need for nightly sleep increased from 8.0 to 8.5 hours, returning to 8.0 hours after a 7-week break. The median improvement in the rest of the sample was a 1-hour reduction. Like the rest of the sample, she reported a small improvement of 0.19 points in symptoms using the European Brain Injury Questionnaire (Teasdale et al., 1997). However, whereas relatives generally reported improvements of 0.2 points (on a scale from 1 to 3), her relative (a close friend) observed a slight deterioration of 0.15 points. On the Trail Making Test, she experienced little improvement during the first four hypnosis sessions, which relied heavily on regression, but a larger improvement during the last four hypnoses, which relied less on regression.

Discussion

This case suggests that hypnotic regression to the premorbid state could be an important driver of the effect compared to the other techniques. Indeed, in case #1-#3, I have entertained the possibility that the (perhaps idealized) memory of the premorbid self may serve to make that “role” available. Case #4 had no such premorbid role to refer to, and this seems to have reduced the effect of hypnotic suggestion, although there were isolated improvements when other hypnotic techniques were used.

I receive similar reports from practicing hypnotists who report a low success rate for congenital brain injury and pediatric cases though this has lower evidential weight. One may object that duration since injury confounds this phenomenon, but the treatment effect was statistically independent of duration since treatment (Lindeløv et al., 2017).

I currently entertain two mechanisms explaining how age-regression to the premorbid state may facilitate a positive effect on cognition. This autobiographical memory may act as

- (1) *a backward-looking retrieval cue*: Hypnotic regression could act as a strong retrieval cue, which activates important parts of the functional connectivity that characterized the premorbid brain, strengthening it in the process. The minimal version of this type of explanation is that hypnosis unlearns a learned non-use of relatively intact cognitive abilities (Lindeløv et al., 2017; Meinzer et al., 2007).
- (2) *a forward-looking suggestion*: Re-experiencing a premorbid state, whether truthful or not, could act as a strong suggestion that such a state can be obtained in the future, and induce a strong motivation to obtain it. The accuracy of autobiographical memories are inversely proportional to the time passed (Barclay & Wellman, 1986), so this idea is supported by the finding that neither the time since injury nor the age of injury moderated the treatment effects (Lindeløv et al., 2017).

Most likely, both of these mechanisms work in concert. They are both supported by the empirical finding that mental imagery activates the very neural networks that would process the imagined, if it was actual (Miller et al., 2010). Hypnosis is known to enhance imagery (Derbyshire, Whalley, Stenger, & Oakley, 2004), thus potentially strengthening the neural underpinnings that would actualize a better-functioning state. This may explain why hypnotic suggestion often achieve larger treatment effects than conventional methods in and out of rehabilitation (Cedercreutz et al., 1976; Kirsch, Montgomery, & Sapirstein, 1995; Lindeløv, in review; Lindeløv et al., in review, 2017).

Discussion

I have presented and discussed four cases. The first three cases exemplify broader patterns in our observations while case #4 was the only patient without a premorbid autobiographical memory. These cases served to present some theoretical reflections about the mechanisms underlying the effect.

To summarize, case #1 indicates that the perception of the injury may be a strong causal factor for the symptoms following acquired brain injury over and above the physical injury. Case #2 demonstrates that this perception can change latently so that the concomitant improvement is not always noticed subjectively at the time of improvement. Case #3 indicates that hypnosis merely makes this altered (or re-gained) perception of the brain injury available as part of a broader “premorbid role”, but that it is not compulsory adopted. Case #4 shows that autobiographical experience of a premorbid role may be necessary adopt that role during- and after treatment.

This framework also accounts for many other observations, which were not elaborated in the interest of brevity. Briefly, they include (a) the effect seems smaller for patients who are averse/unable to metaphorical or abstract thinking. (b) The effect is independent of suggestibility – a finding which has been seen before when the hypnotic intervention is clinically relevant (Montgomery, David, Winkel, Silverstein, & Bovbjerg, 2002). This indicates that, in these cases, hypnosis facilitates or enhances normal processes in a way that is not bottlenecked by individual differences in suggestibility. (c) The type and extent of the brain injury did not moderate the effect, suggesting that a psychological level of explanation may give a higher yield than a biological one (see also Case #1). And (d), as in case #1, many patients reported a stronger sense of change in their thinking after the age-regression than to other techniques employed during hypnosis.

I believe that the theorizing above is more descriptive than predictive at this stage. However, it does allow for making a few non-trivial and testable predictions:

- Hypnotherapy based on the “perceived brain injury” and matching metaphors will yield larger treatment effects than hypnotherapy based on characteristics of the physical brain injury and matching biological science.

- Hypnotherapy based on regression to premorbid experiences will yield larger effects than hypnotherapy based on any other single technique. Similarly, patients with congenital brain injury or complete retrograde amnesia (no premorbid autobiographical memory) will show smaller improvements.
- Patients will underestimate their objective performance after receiving hypnotherapy – at least if the script emphasizes automatic or unconscious processes.

Stroke and traumatic brain injury combined currently constitutes the second-largest health-related expense in the U.S. (Ma, Chan, & Carruthers, 2014) affecting around 1.5 million new citizens each year. Hypnosis presents itself as a cost-effective treatment modality for the cognitive sequelae experienced by these patients. It is my hope that the considerations in this article contribute towards the further optimization of hypnotic suggestion in neurorehabilitation.

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