

The adaptation process following acute onset disability: an interactive two-dimensional approach applied to acquired brain injury

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Abstract

Objective: To describe a new model of the adaptation process following acquired brain injury, based on the patient's goals, the patient's abilities and the emotional response to the changes and the possible discrepancy between goals and achievements.

Background: The process of adaptation after acquired brain injury is characterized by a continuous interaction of two processes: achieving maximal restoration of function and adjusting to the alterations and losses that occur in the various domains of functioning. Consequently, adaptation requires a balanced mix of restoration-oriented coping and loss-oriented coping. The commonly used framework to explain adaptation and coping, 'The Theory of Stress and Coping' of Lazarus and Folkman, does not capture this interactive duality.

Relevant theories: This model additionally considers theories concerned with self-regulation of behaviour, self-awareness and self-efficacy, and with the setting and achievement of goals.

The two-dimensional model: Our model proposes the simultaneous and continuous interaction of two pathways; goal pursuit (short term and long term) or revision as a result of success and failure in reducing distance between current state and expected future state and an affective response that is generated by the experienced goal-performance discrepancies. This affective response, in turn, influences the goals set. This two-dimensional representation covers the processes mentioned above: restoration of function and consideration of long-term limitations. We propose that adaptation centres on readjustment of long-term goals to new achievable but desired and important goals, and that this adjustment underlies re-establishing emotional stability. We discuss how the proposed model is related to actual rehabilitation practice.

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Introduction

The process of adjustment to acquired brain injury is often divided into a biomedical process and a psychosocial adaptation process.^{1–3} The biomedical pathway focuses on medical diagnosis, treatment and functional outcome. The psychosocial or emotional pathway concerns the way people perceive their circumstances and how others perceive them² and how they deal with, overcome and manage the emotional consequences of brain injury.

Although this dual approach is widely used, it is based on two isolated linear models of the processes involved. In practice the physical, psychosocial and emotional aspects of the adaptation process to injury are obviously interlinked. The general adjustment process usually starts with the (re-)learning of skills to manage the wide array of physical, cognitive and communication impairments. Then, when the patient begins to realize that the premorbid level of functioning is not going to be completely regained despite hard work, the process of building an entirely new perspective on life starts, which includes making adjustments of expectations about the future to restore and/or rebuild self-concept or self-image.

So, the global process of adaptation is characterized by a continuous and complex interaction between two processes: achieving maximal restoration of function and adjusting to the alterations and losses that occur in the various domains of physical and psychosocial functioning.

Although clinicians and researchers regularly use the term ‘coping’ in this context, the content of coping is ill-defined. The recent literature suggests it is used to cover several different aspects of adaptation. Some authors use ‘coping’ to describe the way people with brain injury deal with any problem or stressor they encounter.^{4–7} Others conceptualize coping as the way of managing all symptoms and problems related to brain injury (considering brain

injury as a unitary stressor).^{1,8–11} Yet other authors use a situation-specific approach and focus on particular problems due to brain injury to identify specific coping efforts.^{12–14}

We think there is a need to reconsider the classical view on coping and adaptation. In this article we will therefore present a new model for explaining the adaptation process after acquired brain injury based on theories developed out of the field of rehabilitation, concerning behavioural change and self-regulation and self-efficacy. We will briefly explain these theories first. We will discuss how our model can help to solve the knowledge gaps in the existing literature although the purpose of this article is not to undertake a full review on coping. Finally, we discuss how this new model is related to actual clinical practice in rehabilitation.

The stress-coping model and critique

Despite the diversity in the conceptualization of coping, almost all authors rely on ‘The Transactional Theory of Stress and Coping’ of Lazarus and Folkman as the theoretical foundation for explaining ‘problem management’.^{15–17} An essential theme in this theory is the ‘transactional’ perspective, which means that there is a continuous interplay between the individual and the environment.

The basic assumption is that an event is defined as stressful by the individual’s subjective appraisal of the event rather than by its objective characteristics. Through primary appraisal the person evaluates what is at stake for him or her. This concerns emotions such as threat, harm, loss or challenge. In the secondary appraisal process the person evaluates what can or cannot be done to overcome or prevent harm or to improve the prospects for benefit; this concerns the controllability of the event.

In this theory, the process of appraisal results in 'coping', which are the cognitive and behavioural efforts used to deal with the event and with one's emotional reactions to the event. The process of appraisal and coping is influenced by a range of personal (e.g. self-esteem) and environmental (e.g. social support) resources.

Within this theoretical model, coping has been classified in many ways. One very common division concerns the 'style' of coping, separating problem-focused coping processes (i.e. resolving the problem by altering the situation itself) from emotion-focused coping (i.e. regulating and managing the emotional response associated with the situation).^{15,18-21}

The Lazarus and Folkman model is a serial model where the result of one stress-coping cycle is the possible starting point of a new cycle. This model incorporates the possibility that different stressors coexist but it does not describe a process of concurrent appraisal and coping with different stressors²² nor a description of the interaction that takes place when coping with different stressors occurs simultaneously, which is always the case in patients with recent brain damage.

The published research into coping can be summarized as showing that certain kinds of escapist strategies (which simply do not try to resolve either the practical or the emotional problems generated) are consistently associated with poor mental health outcomes, while other kinds of coping – such as the seeking of social support or instrumental, problem-focused forms of coping – are sometimes associated with negative outcomes, sometimes with positive ones and sometimes with neither, usually depending on characteristics of the appraised stressful encounter.¹⁷

A similar conclusion can be drawn from the literature concerning acquired brain injury. A few specific coping styles such as passive emotion-focused coping and coping characterized by wishful thinking, avoidance, worry, self-blame and using drugs and alcohol are consistently associated with poor quality of life.^{5,23} In contrast, the relation between outcome and other styles of coping, both problem-oriented and emotion-oriented, are diverse and complex.^{5,6,12,24-28}

We cannot infer from the existing literature what determines the adaptive quality of a coping style and why one coping strategy should be (or is) used in favour of another.

Within their theory on stress and coping, Lazarus and Folkman formulated the goodness-of-fit hypothesis. This hypothesis suggests that the nature and success of coping strategies will be associated with the controllability of the event.¹⁷ If an event is relatively uncontrollable, then emotion-focused or perception-focused (reappraising the meaning of a situation) coping may be more effective than problem-focused coping. In contrast, a controllable event may be best managed through problem-focused coping. In the normal population, there is only mixed support for this hypothesis.¹⁷ Kendall found no support for the goodness-of-fit hypothesis in a traumatic brain injury population.⁹

Furthermore, very few researchers have tried to develop a model to explain adaptation after recent brain injury.^{1,24,29} The work of Kendall and Terry⁸ and Rutterford and Wood⁴ has shown that the theory of Lazarus and Folkman only partially fits as a framework for explaining adaptation both in the early and late stage after acute brain damage.

In summary, the model of Lazarus and Folkman is a widely used and valuable model but it has weaknesses when applied to the adaptation process after brain injury. The theory offers a description and a classification of how people cope with stress but it does not provide a complete explanation, or a framework to elucidate why people cope as they do, what determines the choices people make and what makes coping adaptive. Lastly, the available evidence only partially supports the validity or utility of this model to explain the adaptation process after recent brain damage.

As we stated earlier, the process of adaptation to brain injury is better considered as having at least two contemporaneous tracks: an interaction of striving towards maximal restoration of function while also adjusting to the alterations and losses that occur in the domains of physical and psychosocial functioning. Thus, adaptation requires a balanced mix of restoration-oriented coping and loss-oriented coping²² and the commonly used division of coping styles in the model of Lazarus and Folkman into emotion-focused

Table 1. Explanation of the coping terminology used in this article

Coping style	Explanation
Emotion-focused	Regulating and managing the emotional response associated with the situation
Problem-focused	Resolving the problem by altering the situation itself
Perception-focused	Reappraising the meaning of a situation
Escapist	Turning away from problems
Avoidant	Keeping oneself busy with other things to avoid thinking about the problem
Restoration-oriented	Applying all kinds of necessary strategies to rebuild one's situation
Loss-oriented	Applying all kinds of necessary strategies to deal with aspects of the loss experience itself
Adaptive	Actively working on the problem and using humour and enjoyable activities to manage stress (subscale of the Coping Scale for Adults)
Non-productive	Avoidance, worry, wishful thinking, self-blame, and using drugs and alcohol (subscale of the Coping Scale for Adults)
Accommodative	Attempting to accept the consequences by adjusting personal goals and preferences
Assimilative	Actively adjusting circumstances to personal preferences, striving to maintain life as it was before

and problem-focused styles does not fit this model very well. Both emotion-focused and problem-focused styles are in play simultaneously.

We think that the reality of adapting to brain injury is better represented by a model that allows parallel and interactive processing; people deal with different problems or stressors simultaneously and these parallel processes influence and interact with each other.

Definitions of adaptation and coping

When introducing a new model it is important to start with clear definitions of the core concepts. The words 'coping' and 'adaptation' are regularly used in the literature, sometimes as unique concepts, sometimes as interchangeable notions, but for the most part their meaning is open to many interpretations. To avoid confusion and for a clear reading of this article, we propose the following distinction between coping and adaptation.

- Adaptation, in our definition, refers to the general and overall process of change in emotions, actions and thoughts that arise from the changes and limitations imposed by the injury in any and all domains. Adaptation is a process, an evolution that takes place over time in response to ongoing challenges.

- Coping, in our definition, is a more restricted concept and refers to the way people respond to the problems and emotional turmoil associated with brain injury. It is a description of the adaptation process in relation to a specified problem at a certain moment in time.

The contrast between the two is illustrated by 'Mr Jones is adapting poorly to his brain injury' and 'Mrs Smith is coping well with her poor communication'.

Table 1 gives an overview and explanation of the terminology concerning coping used in this article.

Additional theories used

Before introducing our model we will first explain two influential behavioural theories – the theory on self-regulation of behaviour from Carver and Scheier³⁰ and the concept of self-efficacy from Bandura³¹ – that served as a general theoretical basis for our model of adaptation after brain injury.

Self-regulation of behaviour

Goals are central to some very influential theories developed to explain human behaviour.^{30,32,33} The common principle is that achieving goals generates

feedback processes that are involved in creating and adapting our behaviour through affecting thoughts, actions and emotions. These theories have been the subject of extensive research and are also used in rehabilitation to develop interventions directed towards self-regulation and self-management in brain injury.³⁴⁻³⁸

We will focus on the theory on self-regulation of behaviour from Carver and Scheier.³⁰ Described in brief, the core construct in this theory is the 'discrepancy feedback loop'. The theory argues that the normal adaptive self-regulation constitutes of the following cycle:

- The perception of the current condition (input) is compared to a reference value, which is equivalent to a goal.
- If the comparison yields 'discrepancy', a process of creating conformity between input and reference starts, attempting to attain valued or desired goals. This output is behaviour.
- At some late point the comparison is made again, and the cycle continues until the goal is met, or until the goal is changed or abandoned.

Furthermore this theory suggests that, parallel to this behaviour-guiding loop, an affect-loop operates. The affect-loop has the following cycle:

- It checks how well the behaviour-loop is doing in terms of discrepancy reduction over time, the rate of progress.
- This rate of progress is compared to an internally generated expected rate of change, a reference standard.
- The result of this comparison is affect, a sense of positiveness or negativeness, which in turn has an influence on subsequent behaviour. Negative feelings may lead to efforts to catch up or, alternatively, to a sense of hopelessness and giving up. Positive feelings lead to coasting.
- The normal effect of this adjustment is to return affect to neutral but constant failure may lead to frustration, or hopelessness.

In this theory, when people encounter adversity in trying to move towards their goals, they monitor

their efforts to assess the likelihood of success. Their outcome expectancy depends on memories of prior outcomes, the availability of additional resources or alternative approaches and influences subsequent behaviour. If expectancies are favourable, the result is renewed goal-directed effort. If doubts are strong enough, the result is reduced effort or even complete disengagement. Research shows that confident people take a goal-engaged approach to coping, whereas doubtful people respond in ways that imply disengagement.^{39,40} Goals that people engage in are derived from core aspects of the self, a system of beliefs and values with a hierarchical structure.

Furthermore, in this theory, when one is confronted with continuing adversity (as is the case in brain injury) an additional mechanism can occur. As mentioned before, the first response to discrepancy is to change the present conditions. One tries very hard to correct things. If, for a long enough period, all these efforts fail, feelings of distress increase. In this perspective, one has to acknowledge that persistence is a very important quality but the ability to give up at an appropriate time is an equally important quality.

One way that both cycles can respond is to alter (usually to scale back) the reference point against which current conditions are compared.⁴¹ In the context of goals, this slower acting feedback mechanism has the effect of recalibrating the person's subjective reality (behavioural aspirations), which may alter the affective response and the choice of goals to pursue. This shift in reference point, if appropriate in size, may enable the person to experience the same range of positive and negative feelings again instead of an overwhelming amount of negative emotions associated with the original reference point.

In this way the person's quality of life is maintained. As some goals become unattainable, others are substituted but not indiscriminately; new wanted goals are set. The substitute goals typically represent alternative paths to core values of the self. This scaling back of aspirations prevents people from complete disengagement. Consequently purpose in life is sustained, although it is different from before, which is crucial to well-being.

In quality of life research, this is termed 'response shift' and it is an important methodological issue, dealing with discrimination between 'true' changes in quality of life scores and changes based upon the recalibration of internal standards, reprioritization of values and reconceptualization.⁴²⁻⁴⁴ Conceptually, though, these three types of change fit into the theory of Carver and Scheier.⁴¹

Self-efficacy

The theory of 'self-efficacy' from Albert Bandura³¹ can also shed some light on the process of adaptation. Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to achieve goals; it is not a measure of the skills one has. Self-efficacy is not an omnibus trait but a differentiated set of self-beliefs linked to distinct realms of functioning. Efficacy beliefs are concerned not only with the exercise of control over action but also with the self-regulation of thought processes, motivation and affective and physiological states.

Self-efficacy beliefs are constructed from four principal sources of information:

- *mastery experiences*, which serve as indicators of capability (e.g. success in specific activity performance);
- *vicarious experiences*, which alter efficacy beliefs through transmission of competencies and comparison with the attainment of others (e.g. the performance of a sports teammate);
- *verbal persuasions* that one possesses certain capabilities (e.g. constructive feedback);
- *physiological and affective states*, from which people partly judge their capabilities, strength and vulnerability to dysfunction (e.g. stress, fatigue).

Efficacy beliefs vary on several dimensions. They differ in level or magnitude (the level of a task demand from easy to taxing), strength (the stronger, the more resistant to disconfirming evidence) and generality (specific to one task or more general). Efficacy beliefs influence the type of activity people choose to engage in, the level of effort they spend

and their perseverance in the face of difficulties. Among other factors, cognitive processes are an important mediator through which efficacy beliefs produce their effects. Both the conception of ability (as either an acquirable skill or an inherent aptitude) and people's beliefs about the extent to which their environment can be influenced and controlled are strong belief systems that affect how efficacy information is cognitively processed.

People with a strong sense of self-efficacy are less burdened by negative thoughts, they set themselves challenging goals and maintain strong commitment to them, and they are more resilient in the face of failure and setbacks.

Looking at coping and adjustment from the self-efficacy perspective, one could hypothesize again that the widely used dichotomization into problem-focused and emotion-focused coping becomes less important because these concepts are simply different means by which one exerts self-control. Of importance is to develop a strong sense of self-efficacy in one's coping abilities, whatever processes are used.

In the medical field self-efficacy is widely studied in relation to interventions and disease self-management. High self-efficacy predicts better psychological functioning, improved functional status and improved health behaviour and disease management.⁴⁵⁻⁴⁹ Also in numerous other fields (e.g. sports, organizational decision making) the role of self-efficacy is acknowledged.³¹

Our proposed model

We propose an alternative approach to adaptation in brain injury, based on an interactive model with two dimensions or axes. The model, which is shown schematically in Figure 1, will now be explained. It has been developed in response to the limitations of the current theory on stress and coping already discussed, and it specifically incorporates the self-regulation and self-efficacy theories just reviewed.

After brain injury the person has to deal with various problems or stressors, many being long term. As a result, problems must be considered both

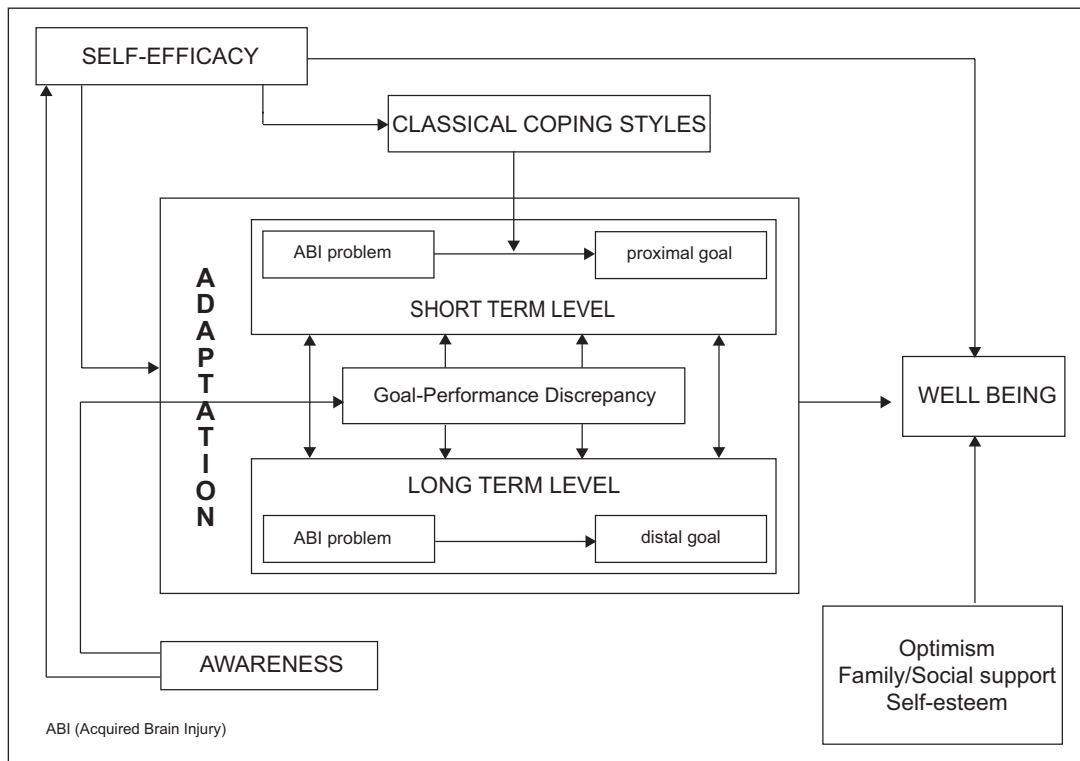


Figure 1. Schematic of the model.

in a short-term perspective and in a long-term perspective. This time perspective is inevitably closely related to the goals that are set in relation to the problems because goal-setting is highly influenced by future expectations. What seems impossible in the short term may be judged as achievable in the long term. When setting goals to manage problems with a long-term character, it is usual to set short- and long-term goals simultaneously.^{50,51}

Consequently, coping with or adjusting to a chronic problem reflects the simultaneous interaction of two levels. On the one hand, there is the short-term level, representing the day-to-day adjustment and application of strategies to manage the various problems associated with brain injury. In this perspective proximal goals are set. For example, Mr Peters wants to walk around the house and in the garden and learn to use a notebook to overcome memory problems.

On the other hand, there is the long-term level, where the same problems/stressors are related and integrated into a broader perspective and oriented towards the long term. This level concerns the process of building a new perspective about life and altering expectations about the future. In this perspective, distal goals are set. In our example: Mr Peters wants to regain his former job as an engineer and he wants to make a long, low-budget trip around the world on his own.

Both levels interact continuously and simultaneously. With the passage of time, one learns if one's short-term goals can be attained. This is an important indicator for possible success in attaining one's long-term goals. This process of judging and evaluating what one has reached and what one wishes to achieve in the future is continuous. In our example, eight months post injury, Mr Peters still experiences poor walking ability and problems to manage his

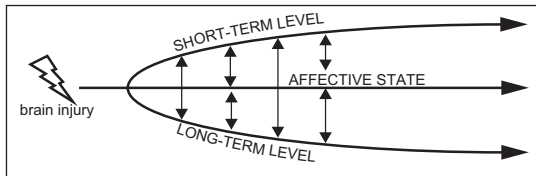


Figure 2. Influence of the emotional state on the adaptation process following brain injury.

memory problems. He no longer is planning a world trip but wants to take a hotel vacation at the seaside together with his family.

Everyone, not only people with brain injury, has to answer questions such as: do I stick to my original goal of regaining full-time employment or do I switch towards voluntary work? Both the short-term and the long-term level mutually influence each other in this process of appraisal of possibilities and difficulties. This continuous interplay, described here for the more behavioural oriented aspects, operates analogously for the emotional aspects (Figure 2). So, finally the process of adaptation will be influenced by the emotional state that the process itself engenders.

A major determinant of goal revision is the size of the discrepancy between one's performance and goal. These goal-performance discrepancies are powerful motivational forces towards action. When people recognize goal-performance discrepancies, they make adjustments to either their goal or their behaviour or both when they are attempting to reduce the discrepancy.^{30,32,52} At the same time, there is an effect on the emotional state. The experienced discrepancy is compared to an expected rate of progress (an internally generated standard, see self-regulation theory), which engenders positive or negative emotions (affect). Achieving goals create feelings of satisfaction. Negative emotions arise when the actual performance is far from what one is striving for. This in turn can lead to re-engagement and efforts to catch up but also to frustration when the wanted goal cannot be reached.

Thus, a balance must be found between persistence – important in preventing people from giving up too quickly – and partial disengagement when goals are unattainable. The proper balance between

tenacious goal pursuit and flexible goal adjustment³³ reflects the ability to sustain effort or to disengage based on the size of experienced goal-performance discrepancies.

Finding this balance is crucial in regaining emotional stability and preventing striving towards the unattainable, ending up in frustration.

Research shows that individuals often respond to large negative goal-performance discrepancy feedback (performance < goal) by revising their goals in such a way that they become easier.^{53,54} Individuals who come close to their goals or even exceed their goals have been found to increase their goals.⁵³ Donovan showed in athletes that distal goals were revised continuously on the basis of the outcome of proximal goals.⁵⁰

Outside the field of rehabilitation, investigators have shown that goal disengagement and goal re-engagement are important factors when people face challenging and normatively less-expected life circumstances that might require them to adjust important life goals. Disengagement from unattainable goals shows beneficial effects on subjective well-being.^{55,56} Also, re-engaging in new pursuits predicts well-being above and beyond a person's ease of abandoning unachievable goals.⁵⁵

In brain injury, it is not only the importance of life goals that has been shown to influence subjective well-being; both attainability and success of life goals are also found to play important intermediate roles.³⁸

We suggest that optimal adjustment is reached if an individual is able, based on the accomplishments and failures experienced in the day-to-day struggle with the different problems associated with the injury, to adapt the long-term perspective by choosing a set of realistic goals, which will create feelings of well-being and satisfaction with life when attained. Finding a balance and adjusting previously set goals towards a more achievable level of goals is a process that takes time.^{30,41}

A range of personal and environmental resources will enable individuals to resist the deleterious effects of stress and adjust with less effort to a range of situations. Self-esteem, optimism and perceived family and social support are shown to be important.^{1,4,5,8,19,57–64}

In summary, as we stated in the introduction, the process of adaptation is an interplay between achieving maximal restoration of function; and adjusting to the alterations and losses that occur in the various domains of physical and psychosocial functioning. Both components are represented and incorporated in the proposed model.

Adaptation is an iterative process. This iterative character fits well into the proposed model because of its time independency. The model is applicable independent of time since injury. Either being confronted with problems in the acute stage after brain injury or facing a stressful major life event in the chronic phase starts the same kind of adaptation process.

The role of self-efficacy in the new model

Little research into the role of self-efficacy in the process of coping and the prediction of adjustment has been published.^{4,8,9,65} Most authors consider self-efficacy only in relation to the secondary appraisal process (i.e. the aspect of controllability of the stressful situation). However, Cicerone showed that self-efficacy, conceptualized in a multidimensional way and linked to specific domains of functioning, is an important contributor to life satisfaction. More specifically, participants' self-efficacy for the management of cognitive symptoms made the single greatest contribution to prediction of quality of life.^{66,67}

In our opinion, self-efficacy is an important contributor to successful adaptation.⁶⁸ Perceived self-efficacy will act directly upon well-being.⁶⁶ We hypothesize that the better one's perceived self-efficacy is in several domains, the greater the range of available response strategies and the better the selection of strategies in relation to the demands of the situation. A higher self-efficacy will influence both restoration-oriented behaviours, because it determines the level of effort people spend and their perseverance in the face of difficulties, and also loss-oriented coping and goal changing because it influences emotional resilience and the ability to overcome and manage emotional distress.

The role of awareness in the new model

Impaired awareness will interfere with problem perception and the ability to assess goal-performance discrepancies. We hypothesize that impaired awareness will inflate perceived self-efficacy. The assumption is that in the presence of impaired awareness, the person feels little urge to adapt because relatively few problems and small goal-performance discrepancies are perceived. Satisfaction with life and quality of life could be fairly good as a direct consequence of the absence of problem perception and goal-performance discrepancy and a high-perceived self-efficacy.

Little is known about the relation between awareness of deficits and coping or adaptation. Anson and Ponsford did not find an association between the level of adaptive coping and self-awareness, but did find that greater use of non-productive coping strategies (coping characterized by avoidance, worry, wishful thinking, self-blame and using drugs and alcohol) was significantly associated with greater awareness of deficits.⁵ Kortte et al. showed that lower levels of awareness were associated with an increased reliance on avoidance strategies.⁶⁹ Interestingly they found that psychological denial was a stronger predictor of an avoidant coping style than organic awareness deficits.⁶⁹ Medley et al. found that patients with impaired awareness showed a relatively lower reliance on wishful thinking and emotion-focused coping. The group with better awareness reported a greater overall use of a variety of coping strategies.⁷⁰

In the long term, Ownsworth et al. did not find differences in emotional adjustment between groups with good and poor awareness. However, the poor awareness group scored significantly lower on independent living skills.⁷¹

The role of coping styles in the new model

In our model coping styles, defined and described in the classical way using the dichotomization into problem- and emotion-oriented styles, are only relevant to the day-to-day, short-term adjustment to

the problems (short-term level). They reflect which strategies people are using at that time to attain the short-term goals that are related to the daily problems they have to overcome.

The description of coping styles in terms of accommodation (attempting to accept the consequences by adjusting personal goals and preferences) versus assimilation (actively adjusting circumstances to personal preferences, striving to maintain life as it was before)³³ is more appropriate to reflect aspects of the general process of adaptation (see definition) which is characterized by the simultaneous interaction of achieving maximal restoration of function and adjusting to losses in the various domains of functioning.

What is new in this model?

This model differs from existing models in several ways:

- There is an emphasis on the importance of goal-setting, which is crucial in understanding behavioural change and adaptation.
- It has three theoretical bases that are integrated:
 - the transactional perspective, which is present in the theory of stress and coping of Lazarus and Folkman, implies the continuous interplay between individual and environment,
 - elements central to the theory of Carver and Scheier on self-regulation, and
 - the self-efficacy theory of Bandura.
- It integrates two processes that are occurring and interacting simultaneously: attempts to recover lost skills and abilities and consideration of (perceived) long-term limitations, by the interaction of:
 - goal revision as a result of success and failure in reducing distance between current state and expected future state; and
 - the affective responses that are generated as a result of the experienced goal-performance discrepancies.

These affective responses, in turn, may influence both functional performances and the goals set.

- It proposes that adaptation centres on readjustment of long-term goals to new achievable but desired and important goals, and that this adjustment underlies re-establishing emotional stability.

Discussion

The basic principle in the proposed model is the parallel processing and simultaneous interaction of two processes: attempts to recover lost skills and abilities and adjusting long-term goals in response to (perceived) long-term limitations. The model suggests that the patient's emotional state arises from the search for equilibrium between persistence, which is necessary to progress successfully towards long-term goals, and partial disengagement, which is necessary to prevent frustration when goals turn out to be unattainable.

Although research using the classical approach on coping shows that coping styles and appraisals contribute in the prediction of well-being and functional outcome,^{8,27,72–74} it remains very difficult to determine what distinguishes the adaptive quality of coping. The classical theory of stress and coping does not provide a framework of the motivational patterns and belief systems that guides the process of appraisal and coping, especially in long-term illness.

Furthermore the theory of stress and coping of Lazarus and Folkman is a mediated model; resources (predictors) influence adjustment through their impact on appraisal and coping (mediators). In the early stage after brain injury, partial evidence was found for mediated relationships⁸ but in the late stage no mediated effects occurred.⁴

We have developed this interactive two-dimensional model because we think it reflects the iterative character of the adaptation process. It is applicable both in the acute and chronic stage after brain injury. In our opinion, this model helps to solve the existing knowledge gaps concerning the effectiveness of coping and adaptation by adding elements such as success in goal pursuit and goal revision and self-efficacy.

We suggest that goals play a central role in guiding and adapting behaviour^{30,32} and our model is

based on this premise. We believe that describing adaptation in the proposed two-dimensional goal-oriented way provides a link to the general rehabilitation practice where systems of goal-setting and goal-planning are considered to be essential and are widely implemented in therapy schemes. Moreover, there is a trend to develop interventions directed towards self-regulation and self-management in people with adult onset brain damage. In these interventions short-term goal-setting, self-evaluation and use of feedback from proximal goal-setting are core concepts.^{75–77}

As the goal-oriented approach is already common practice in rehabilitation, describing the adaptation process in a similar way facilitates the integration and evaluation of adaptation processes into the whole process of rehabilitation.

This model is entirely consistent with the biopsychosocial model of illness that underlies the World Health Organization's International Classification of Functioning (WHO ICF).^{78,79} All the concepts described in the model (see Figure 1) can be classified following the ICF terminology as body functions, activities and participation, personal or environmental factors.^{80,81}

Data are now being collected to test this model of adjustment after brain injury. We hope to increase our understanding of this complex but intriguing topic and we hope to contribute to a more solid theoretical background from which predictions about the adaptation process can be made and interventions can be designed to facilitate this process.

Clinical messages

- Adaptation to brain injury is an interactive and iterative process.
- A serial model does not illustrate the complex process of adaptation in brain injury well.
- Focusing on goals, their pursuit and their revision, helps in understanding adaptation.
- Considering adaptation in terms of goals facilitates its integration into the whole rehabilitation process.

Conflict of interest

The authors declare that there is no conflict of interest.

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