Tired of pain or painfully tired?

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Central to the motivational framework is the balance between (expected) costs and benefits of ongoing goal-directed behavior. When the costs start to exceed the benefits, this signal is perceived as fatigue, urging goal adjustment. The authors propose that this cost–benefit trade-off is affected by chronic pain. For instance, pain may hinder goal progress, requiring increased top-down effortful control to maintain goal-directed behavior, which adds to the costs inducing fatigue. Thus, in their model, a sensation that is perceived as painful increases effortful control during goal-pursuit, thereby inducing fatigue. Interestingly, pain perception itself may be influenced by fatigue. Research has shown that individuals suffering from chronic fatigue have lower pain thresholds to pressure and electrical stimulation than healthy controls (which has been ascribed to sensitization of the central nervous system) (21, 14, 18, 21). Moreover, although exercise usually increases pain thresholds in healthy individuals, it has the opposite effect in individuals with chronic fatigue. Animal research has also shown that healthy mice demonstrate hyperalgesia after fatigue induction. These results indicate that, besides pain increasing fatigue during ongoing activity, fatigue during ongoing activity may also exacerbate pain. Therefore, we argue that pain and fatigue may mutually reinforce and perpetuate each other in chronic pain. Future longitudinal and experimental studies should scrutinize this reciprocal relationship.

Finally, the authors seem to equate reduced motivation to fatigue in some instances. We argue that although fatigue may be captured as reduced motivation, not each occurrence of motivational reduction is (or leads to) fatigue. For instance, the authors propose that chronic pain may impair reward processing, which may reduce the weight of the benefits associated with current goal-directed behavior, thereby inducing fatigue. This conclusion builds on experimental work showing that when the consequences of our actions embody a mixture of reward and (anticipated) pain, this cost–benefit integration leads to attenuated predictive reward signaling in the brain. To use a real-life example: If a person goes to the dentist to maintain dental health (reward), the anticipation of pain may reduce the weight of the benefits associated with consulting a dentist. However, referring to this attenuated reward processing as fatigue or fatigue inducing may not be warranted. Indeed, although fatigue may manifest itself as reduced motivation, not each occurrence of fatigue in some instances. We argue that although fatigue may be conceptualized as fatigue.

The framework presented by Van Damme et al. opens a new research agenda for fatigue in chronic pain. We propose that expanding their model by integrating reciprocal relationships will allow for a better representation of the complexity of real-life symptom interactions.

**Conflict of interest statement**

The authors have no conflict of interest to declare.

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indicating that the presence of fatigue increases the


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