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Sleep, Self-Regulation, Self-Control and Health

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Sleep, Self-Regulation, Self-Control and Health

There is considerable research examining the link between sleep and health-related outcomes. For example, insufficient sleep has been linked to increased psychological stress (Cruess et al., 2003) and lower self-rated health (Steptoe, Peacey, & Wardle, 2006). In addition, there is also a considerable body of research that has implicated insufficient sleep to poorer self-regulatory capacity (Altena, Van Der Werf, Strijers, & Van Someren, 2008) and cognitive functioning (Walker, 2008). This is important from a health perspective because self-regulation has been recognised as an important factor in the uptake and adherence to health-promoting behaviours such as physical activity and following a low-fat diet (Aarts, 2007; Andersson & Conley, 2008; De Ridder & De Wit, 2006; Hall & Fong, 2007) and resisting relapse in behaviours that have deleterious effects of health such as smoking and consuming alcohol above recommended limits (Hagger, Wood, Stiff, & Chatzisarantis, 2009, 2010).

Researchers have recognised the importance of sleep to these health related behaviours and have began to integrate sleep as a factor in theories and models that explain health behaviour and health outcome (Benham, 2010). For example, Benham's (2010) comprehensive review and empirical work appearing in the present issue highlights the importance of incorporating sleep as a mediator of the link between stress and health and demonstrates the value of its inclusion in a predictive model of self-rated health. As a consequence, the focal theme of sleep in the lead article and commentaries in present issue of *Stress and Health* is particularly timely and important in order to understand the role of sleep in the stress and health nexus. Specifically, the lead article by Barber, Munz, Bagsby, and Powell (2010b) and the associated commentaries by two leading theorists and researchers in the field of sleep (Anderson, 2010) and self-regulation (Wright, 2010) illustrate how sleep-related factors such as consistency and sufficiency can be incorporated into social psychological models of self-regulation and explain health-related outcomes such as psychological strain. The debate is one that is both healthy and lively and demonstrates the complexities in conducting such research,

its importance for theories of self-regulation in the fields of health psychology and behavioural medicine, and moves the field forward by identifying important avenues for future inquiry.

Limited Resource Account of Self-Control

Integral to the lead article, commentaries, and the authors' response (Barber, Munz, Bagsby, & Powell, 2010a) is the adoption of the limited resource account or 'strength' model of self-control, proposed by Baumeister and colleagues (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Vohs, & Tice, 2007; Muraven & Baumeister, 2000). In the model, self-control is conceptualized the ability or capacity to overcome or resist impulses and temptations and modify behaviour through active and conscious means. Self-control is viewed as a finite resource or 'energy' that is employed when engaging in behaviours or tasks that require overriding or inhibiting a response. However, the resource is finite in capacity and tends to be become depleted the longer an individual engages in tasks that require self-control. As a result of this 'depletion' of self-control capacity, it becomes increasingly difficult to exert self-control leading to lapses or failures in performance on subsequent tasks and behaviours requiring self-control. Baumeister et al. (1998) termed this state of reduced self-control capacity *ego depletion*. The model likens self-control resources to a muscle, just as a muscle becomes fatigued after a period of work so self-control capacity becomes depleted after a period of self-control exertion.

Research examining the 'strength model' has adopted a dual-task experimental paradigm in which participants assigned to an experimental group engage in an initial task that requires self-control, such as resisting the temptation to eat a desirable food or override their tendency to type spaces when copying a piece of text on a computer. Participants are allocated to a control groups engage in an easier version that does not require self-control. Participants then engage in a final task requiring self control. The extent to which experimental participants' performance on the second task is impaired relative to participants in the control condition provides confirmation of self-control resource depletion. There has been

considerable support for the ego-depletion effect across the literature (Baumeister, Gailliot, DeWall, & Oaten, 2006; Baumeister et al., 2007; Muraven & Baumeister, 2000) and a recent meta-analysis has shown the effect to be robust and of medium size ($d = 0.62$) across 198 tests from 83 studies (Hagger, Wood, Stiff, & Chatzisarantis, in press).

Conservation, Training, and Recovery of Self-Control

Conceptualizing self-control as a limited resource has given rise to a number of theoretically-consistent hypotheses. First, it has been proposed that people will conserve their self-control resources in anticipation of future demand. Research has demonstrated that people who anticipate an additional task requiring self-control in the dual-task paradigm perform worse on the second self-control task and exhibit greater levels of ego-depletion relative to controls who do not anticipate a third task (Muraven, Shmueli, & Burkley, 2006). This suggests that resources are not completely depleted. Rather, some reserves remain but will be conserved for times of need. Interestingly, incentives that increase task motivation have been shown to moderate the ego-depletion effect, suggesting that participants may be persuaded to expend their partially-depleted resources if they deem it worth their while (Muraven & Slessareva, 2003). Second, research has suggested that training on self-control tasks also reduces the deleterious effects of ego-depletion on task performance (Gailliot, Plant, Butz, & Baumeister, 2007; Muraven, Baumeister, & Tice, 1999; Oaten & Cheng, 2006a, 2006b). This is consistent with the muscle metaphor such that training increases the size or efficiency of self-control resources and moderates the ego-depletion effect. Third, and most relevant to the current issue, rest or recovery will result in the restoration of self-control resources. Two studies have shown that a rest period between the self-control tasks results in a replenishment of self-control resources (Oaten, Williams, Jones, & Zadro, 2008; Tyler & Burns, 2008, Study 1). Furthermore, inducing participants to relax using by listening to music may also allay the ego-depletion effect (Tyler & Burns, 2008, Study 2). A cursory meta-analytic synthesis of these effects for the purpose of this paper reveals a significant and large effect size ($d = 1.26$),

indicating that rested or relaxed participants exhibited significantly better task performance relative to depleted controls. These results are important as they substantiate that strength model as an explanation for self-regulatory failure. Most pertinent, the suggestion that recovery is necessary for the restoration of self-control capacity indicates the important of periods of rest or relaxation for individuals engaging in behaviours that require self-control such as dieting, exercise, quitting smoking, and reducing alcohol intake (Hagger et al., 2009). It is in the context of this hypothesis that sleep and its accompanying quality attributes may come in to effect in mitigating self-regulatory failure brought on by self-control resource depletion.

While the focus of many studies examining the strength model has been on the acute depletion of self-control resources by environmental stressors and self-control tasks, there is a considerable body of research that indicates that there are individual differences in self-control capacity. Such proposals come from capacity theories of self-control proposed by Mischel (Mischel, 1996) and others (e.g., Funder, Block, & Block, 1983; Tangney, Baumeister, & Boone, 2004; Wills & Dishion, 2004). These dispositional conceptualizations of self-control have been incorporated into the strength model, such that trait self-control serves to moderate the ego-depletion effect. From a strength model perspective, the trait self-control dictates the ‘size’ of an individual’s self-control reserves. Research has indicated that trait self-control does moderate the ego-depletion effect (Dvorak & Simons, 2009; Gailliot & Baumeister, 2007; Gailliot, Schmeichel, & Maner, 2007), as hypothesized, although there are some null effects (Hagger et al., in press). These results indicate the importance of consideration relating to both trait and state conceptualizations of self-control when it comes to understanding behavioural self-regulation.

Sleep and Self-Regulatory Capacity: The Commentaries

In the lead article of the commentary section of the present issue, Barber and coworkers (2010b) adopt the limited resource or ‘strength’ model of self control to propose some hypotheses relating sleep to self-regulation and stress. The authors adopt a standpoint

consistent with the recovery hypothesis proposed by the strength model, that is, sleep can assist in the recovery of self-control resources. Alone, this would provide useful evidence to corroborate and extend the previous short-term recovery studies (Oaten et al., 2008; Tyler & Burns, 2008) of the effects of rest on the replenishment of self-control resources. There is, however, preliminary evidence that sleep per se does not moderate short-term resource depletion (Vohs, Glass, Maddox, & Markman, 2010). In contrast, Barber et al. (2010b) introduce elements relating to sleep quality as important factors in this process and, rather than self-regulatory performance, focused on psychological strain as the dependent variable. The authors report that sleep sufficiency alone does not impact on psychological strain over the period of a week, rather it is the interaction between sleep sufficiency and consistency that results in significantly lower psychological strain. The authors report that consistency may have its effects on strain either as it has the effect of enhancing self-control capacity through a ‘training’ effect (i.e., consistent sleepers tend to have to resist temptations and impulses to sleep as and when they feel) or as a proxy for individual differences in self-regulatory capacity (i.e., individuals with high trait self-control are likely to be more effective in maintaining consistent sleep practices). The authors make some very interesting recommendations for future research including the need for more accurate evaluations of sleep practices, adopting a more diverse, representative sample, and a focus on long term effects of sleep sufficiency and consistency.

The commentators promote a lively and evidence-informed debate regarding the role of sleep in self-regulation from different perspectives. Anderson (2010), a sleep researcher, highlights the important factors likely to influence self-regulatory and cognitive capacity, including those not directly incorporated in the original Barber article such as diurnal preference. Diurnal preference, also known as ‘morning types and ‘evening types’) or morningness (Horne & Ostberg, 1976 see Barber, 2010b) is likely to be related to chronic depletion of self-control capacity because evening types demonstrate poorer self-regulation and

greater procrastination (Digdon & Howard, 2008). However, it is difficult to disentangle whether diurnal preference is causing the relatively lower levels of self-control among evening types or, whether morningness is merely indicative of greater individual differences in self-regulation as such individuals become 'trained' in resisting impulses to sleep longer. Wright (2010), a researcher on fatigue and self-regulation, focuses on the need for experimental evidence directly linking the sleep-related factors to self-control performance, perhaps using state measures of self-control used in ego-depletion experiments. He also suggests experimental means to establish whether consistent sleep practices are sufficiently demanding to lead to improvements in self-regulatory capacity. He cites a recent study that demonstrates that training on tasks that require minimal self-control only have a limited effect on ego-depletion, while tasks with higher self-control demands tend to be more effective in mitigating the ego-depletion effect (Hui et al., 2009). In their response, Barber et al. (2010a) acknowledge the limitations presented by the commentators and provide a reasoned and evidence-based defence of their 'naturalistic' approach. They also acknowledge the need to control for additional factors including control for sleep timing and light exposure (Duffy & Czeisler, 2009), the role of individual differences in self-control and other personality and trait-like moderators (Hagger, 2009), and the need for experimental evidence that sleep consistency has a training effect on self-regulatory resources or merely reflects individual differences in self-control. In fact, Barber et al. (2010a) present recent evidence indicating that the interaction between consistency and sufficiency has a significant effect on self-regulatory strength as indicated by a handgrip task, a task frequently used in ego-depletion paradigms as an index of self-control capacity (Barber & Munz, in submission).

In summary, there is a clear consensus among the authors and commentators in their call for more systematic and extended experimental research. Such research should manipulate sleep-related variables, adopt more 'objective' measures of sleep consistency and sufficiency rather than self-reports alone, control for the likely moderators of the effect of sleep on self-

regulatory capacity as well as psychological strain such as diurnal preference, and include measures of trait and state self-regulatory capacity using acknowledged individual difference instruments (e.g., Tangney et al., 2004) and tasks from the dual-task paradigm acknowledged for tapping self-control (for a taxonomy see Hagger et al., in press) respectively. I hope that the current commentaries highlight to the readership of *Stress and Health* a recent and innovative approach to self-regulation in the health domain and that it will stimulate further research in this field that will provide further insight into the mechanisms and processes that underpin health-related behaviour and stress responses.

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