

Faculty of Human Sciences
Doctoral Thesis in Psychology



Intervening Stress Recovery Behaviors in Everyday Life

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Intervening Stress Recovery Behaviors in Everyday Life

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Abstract

Background. High levels of perceived stress and stress-related ill health, such as burnout, are common in many countries. Several theories postulate that stress behaviors promote adaption to environmental changes and if sustained they are potentially harmful for the body. In accordance, impaired stress recovery behaviors, i.e., psychophysiological deactivation after periods of stress behaviors, have been suggested to be a critical factor in explaining stress-related ill health. Whereas research shows that interventions targeting stress reactivity can have beneficial effects on stress-related variables, studies on interventions targeting stress recovery are surprisingly few. Also, the number of validated instruments for measuring behaviors important for stress recovery are few, in particular easily used self-rating scales.

Aims. The primary aim of the thesis was to evaluate stress and health-related effects of an intervention targeting stress recovery behaviors in everyday life among people perceiving high levels of stress in life. A secondary aim was to validate a self-report scale measuring behaviors important for stress recovery in everyday life.

Method. Three empirical studies were conducted to evaluate effects of the behavioral stress recovery intervention “balance in everyday life”, which solely aims at strengthening stress recovery behaviors in everyday life. First, a brief version of the intervention was investigated through a small pilot study in which a single-subject experimental design was used (study 1). After that, the intervention was exploratively tested in a group format in which a quasi-experimental design was used (study 2). Due to the positive results of these two studies, a larger scale study using a randomized controlled design was conducted in order to further investigate the effects of the intervention when delivered in a group format (study 3). To fulfill the secondary aim of the thesis, the Recovery Experience Questionnaire was translated into Swedish and analyzed using exploratory factor analysis and confirmatory factor analysis (study 4).

Results. In study 1, data demonstrated immediate reduction of stress symptoms as a function of the intervention. The improvements were maintained at 1-year and 5-year follow-up assessments. In study 2, in comparison with a waiting-list-control group, the intervention yielded statistically significant improvements between pre- and postintervention assessment on eleven out of twelve stress and health-related variables.

Medium to large between-groups effect sizes were demonstrated for the primary outcome measures covering (potential) recovery behaviors, perceived stress and rest and experiences of being recovered. In the third study, statistically significant improvements for all outcome measures at postintervention assessment and at the 3-month follow-up were demonstrated. The between-groups effect sizes for the primary measures - perceived stress, tension, and burnout - were medium-to-high at postintervention assessment and at follow-up. In addition, in all studies the intervention was associated with beneficial changes in levels of anxiety and depression. In the last study, support was found for the proposed four-factor structure of the Swedish version of the Recovery Experience Questionnaire.

Conclusions. The results clearly indicate that the intervention “balance in everyday life” improves stress and health-related factors in a relatively satisfactory way among people perceiving high levels of stress in life. The empirical support is strongest for the reduction in tension, perceived stress, burnout, anxiety and depression, and to deliver the intervention in a group format. The studies demonstrated results that warrant further investigation of the effects of “balance in everyday life”, for example in different contexts, and to study other behavioral recovery interventions. To test (potential) recovery facilitating behaviors as mediators of intervention effects, such as reduction in burnout, the Swedish version of the Recovery Experience Questionnaire could be used.

Summary in Swedish

Bakgrund. Höga nivåer av upplevd stress och stressrelaterad ohälsa, såsom utbrändhet, är vanliga i många länder. Flera teorier postulerar att stressbeteenden främjar anpassning till miljöförändringar och att ihållande stressbeteenden är potentiellt skadligt för kroppen. I enlighet med detta har bristfälliga nivåer av stress-återhämningsbeteenden, d.v.s. psykofysiologisk avaktivering efter perioder av stressbeteenden, föreslagits vara en kritisk faktor för att förklara stressrelaterad ohälsa. Medan forskning visar att interventioner som riktar sig mot stressreaktivitet kan ha positiva effekter på stressrelaterade variabler är studier om interventioner som inriktar sig på stress-återhämtning förvånansvärt få. Dessutom är antalet validerade instrument som mäter beteenden av betydelse för återhämtning från stress få, särskilt lättanvända självskattningsskalor.

Syften. Det primära syftet med avhandlingen var att utvärdera stress- och hälsorelaterade effekter av en intervention inriktad på stress-återhämningsbeteenden i vardagen bland människor som upplever höga nivåer av stress i livet. Ett sekundärt syfte var att validera en självskattningsskala som mäter beteenden som är betydelsefulla för stress-återhämtning i vardagen.

Metod. Tre empiriska studier genomfördes för att utvärdera effekter av den beteendeorienterade stresshanteringsinterventionen "balans i vardagen", som enbart syftar till att stärka stress-återhämningsbeteenden i vardagen. Först undersöktes en kort version av interventionen genom en liten pilotstudie där experimentell design för enstaka individer användes (studie 1). Därefter testades interventionen explorativt i ett gruppformat där kvasi-experimentell design användes (studie 2). På grund av de positiva resultaten från dessa två studier genomfördes en större studie med randomiserad kontrollerad design i syfte att ytterligare studera effekter av interventionen förmedlad i gruppformat (studie 3). För att uppfylla det sekundära syftet med avhandlingen översattes självskattningsskalan Recovery Experience Questionnaire till svenska och analyserades med explorativ faktoranalys och konfirmatorisk faktoranalys (studie 4).

Resultat. I studie 1 påvisades omedelbar minskning av stressymtom som en funktion av interventionen. Förbättringarna var vidmakthållna vid de uppföljande mätningarna 1 respektive 5 år efter interventionsavslut. I studie 2 frambringade interventionen, i jämförelse med en kontrollgrupp på väntelista, statistiskt signifikanta förbättringar mellan för- och

eftermätningen avseende elva av tolv stress- och hälsorelaterade variabler. Medelstora till stora effekter påvisades för de primära utfallsmåtten vilka omfattade (potentiella) återhämtningsbeteenden, upplevd stress samt vila och upplevelser av att ha återhämtat sig. I den tredje studien påvisades statistiskt signifikanta förbättringar för alla utfallsmått direkt efter samt tre månader efter avslutad behandling. Mellangrupps effekterna för de primära måtten - upplevd stress, anspänning och utbrändhet - var vid de två mätillfällena medelstora till stora. Vidare var interventionen i alla studier associerad med positiva förändringar avseende ångest och depression. I den sista studien fann vi stöd för den föreslagna fyrfaktorstrukturen i den svenska versionen av Recovery Experience Questionnaire.

Slutsatser. Resultaten indikerar tydligt att interventionen "balans i vardagen" förbättrar stress- och hälsorelaterade faktorer på ett relativt tillfredsställande sätt bland personer som upplever höga nivåer av stress i livet. Det empiriska stödet är starkast för minskning av anspänning, upplevd stress, utbrändhet, ångest och depression, och för att genomföra interventionen i gruppformat. Studiernas resultat motiverar att ytterligare undersöka effekter av "balans i vardagen", till exempel i olika sammanhang, och att studera andra beteendeinriktade stress-återhämtningsinterventioner. För att testa (potentiella) återhämtningsbeteenden som mediatorer av interventionseffekter, såsom minskning av utbrändhet, skulle den svenska versionen av Recovery Experience Questionnaire kunna användas.

List of Papers

The thesis is based on the following empirical studies:

1. Almén, N., Lisspers, J., & Öst, L.-G. (2020). Stress recovery management: A pilot study using a single-subject experimental design. *Behavior Modification, 44*(3), 449-466.
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2. Lisspers, J., Almén, N., & Sundin, Ö. (2014). The effects of a recovery-focused program for stress management in women – An exploratory study. *Health, 6*, 2825-2836.
<http://dx.doi.org/10.4236/health.2014.620321>
3. Almén, N., Lisspers, J., Öst, L.-G., & Sundin, Ö. (2020). Behavioral stress recovery management intervention for people with high levels of perceived stress – A randomized controlled trial. *International Journal of Stress Management, 27*(2), 183-194.
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4. Almén, N., Lundberg, H., Sundin, Ö., & Jansson, B. (2018). The reliability and factorial validity of the Swedish version of the Recovery Experience Questionnaire. *Nordic Psychology, 70*(4), 324–333.
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Abbreviations

ANOVA	Repeated measures analysis of variance
ANCOVA	One-way analysis of covariance
ASV	Average shared squared variance
ATR	Applied tension release
AVE	Average shared squared variance
BEL	The intervention balance in everyday life
CBT	Cognitive behavior therapy
CCSRx	Combined clinical stress and recovery index
CFI	Comparative fit index
CR	Composite reliability
CRBFx	Combined recovery behavior frequency index
CSI	Clinically significant improvement
ELSS	Everyday Life Stress Scale
HAD	Hospital Anxiety and Depression Scale
HAD-a	The Anxiety subscale of the Hospital Anxiety and Depression Scale
HAD-d	The Depression subscale of the Hospital Anxiety and Depression Scale
HPA	Hypothalamic-pituitary-adrenal
INT	Intervention control group
KSQ	Karolinska Sleep Questionnaire
MSV	Maximum shared squared variance
OCW	Overcommitment to Work
PSWQ	Penn State Worry Questionnaire
PSS	Perceived Stress Scale
RWQ	Recovery at Work Questionnaire
RBS	Recovery Behavior Scale
REQ	Recovery Experience Questionnaire
RCT	Randomized controlled trial
RMSEA	Root mean square error of approximation
RRW	Rest and Recovery From Work

SMBQ	Shirom-Melamed Burnout Questionnaire
SRMR	Standardized root mean square residual
STR	Short tension release
TES	Tension Scale
WLC	Waiting list control group

Preface

On 21 February 1923, the rehabilitation center Årekliniken in the northern part of Sweden, at that time called Åre Fjällkuranstalt, received its first patient. His name was Oskar Karlsson, and he was a stonemason who suffered from melancholy - a commonly used diagnosis at the time, at least in Sweden - and was not able to work due to the problem. The rehabilitation was successful and notes from a follow-up interview on October 7 the same year mention that he was back at work. For almost twenty years, Årekliniken helped people who suffered from melancholia, and the associated diagnosis neurasthenia. In 1942, the doctor Viktor Hedström started to work at the clinic. The clinical focus changed and people with asthma and allergy problems were offered treatment instead. In 1952, the activities were expanded and children with severe asthma lived at the clinic on a term basis and went to school in the Åre village.

At the end of the 1990s there was a large increase in long-term sick leave due to clinical burnout in Sweden (Åsberg & Nygren, 2012). The increase during that period was not unique to Sweden. For example, Maslach and Leiter (1999) stated that burnout had reached epidemic levels in the United States. Burnout problems were reported to be highly prevalent in many other countries besides Sweden and the United States, such as Australia, Canada, the UK, Germany, the Netherlands, Japan, India, and Brazil (Schaufeli & Enzman, 1998). In Sweden, clinical burnout has been of such an importance in society that a psychiatric diagnosis for the condition called *exhaustion disorder* (in the 10th revision of WHO's *International Classification of Diseases*, ICD-10, code F43.8) was suggested in 2003 (Socialstyrelsen, 2003) and established in 2005 by the Swedish National Board of Health and Welfare.

Several decades passed at the Årekliniken, and in the end of 2000, the asthma rehabilitation was still going on (but now only for adults), and a new rehabilitation program was started; a program for people having a problem highly associated with melancholia and neurasthenia: burnout. As my first job after graduating as a psychologist, I was given the opportunity and the great challenge to be responsible for the development and application of the intervention. Fortunately, I had the privilege to work with highly experienced rehabilitation staff. Unfortunately, evidence-based clinical interventions for clinical burnout were lacking. Therefore, it was unclear what the intervention should be based upon. At the time, burnout

treatments in Sweden were seemingly often based on common-sensical ideas, such as to stay away from work and stressful situations. Also, myths could be communicated to clients, for example “recovery from burnout will take as long as it took for the burnout to develop”, which could potentially contribute to patience, but also worry (i.e., stress) for people who believed that this involved a great number of years, perhaps several decades, of stress that had led to the syndrome. In addition, there was probably more skepticism regarding the burnout syndrome than there is today, which risked leading to the person not receiving any help at all. This may partly explain why so many people were ashamed of their symptomatology and accompanied reduced ability to work. Although we know more now than we did around the millennium in terms of clinical burnout, the lack of knowledge, for example how to prevent and treat it, is still large (Lindsäter et al., 2022). Since cognitive behavior therapy (CBT) had been demonstrated to be effective for many psychological clinical problems, for example unipolar depression, generalized anxiety disorder, panic disorder with or without agoraphobia, social phobia, and posttraumatic stress disorder (Butler et al., 2006), I considered it reasonable to analyze clinical burnout based on the theories used in CBT. This led to the development of a cognitive-behavioral analysis of the syndrome (Almén, 2002, 2021), which primarily was used for psycho-educative purposes. In addition, we used evidence-based interventions for associated problems, such as relaxation (Hayes-Skelton et al., 2013), behavioral activation (Kanter et al., 2010), exposure (Craske et al., 2014), behavioral experiments and cognitive restructuring (Clark et al., 2006). Also, general health behavior changes (exercise and diet) often addressed in behavioral medicine-oriented rehabilitation were used (Almén, 2002; Lisspers et al., 2005). The clinical experiences were good, and (uncontrolled) evaluations demonstrated positive effects (Almén, 2002). This, and the lack of literature on CBT for clinical burnout, motivated me to write the book *Stress- och utmattningsproblem—Kognitiva och beteendeterapeutiska metoder* [Stress and exhaustion problems—Cognitive and behavioral therapy methods] (Almén, 2007, 2017). In the book (and in an article [Almén, 2021]), based on research and clinical experiences, I have formulated several hypotheses regarding the development and maintenance of clinical burnout, as well as for prevention and rehabilitation of the problem. One of the hypotheses is that intervening recovery-facilitating behaviors, and normalizing effort and stress, in everyday life is an effective way to reduce stress- and exhaustion problems. This hypothesis is what this doctoral project is mainly testing.

1 Introduction

The Problem

There are good and bad sides of our ability to respond to stressful events (McEwen, 2002). In particular, work stress has been shown to be associated with ill health, such as burnout (van der Molen et al., 2020). It has been estimated that approximately 25% of workers in Europe experience work-related stress for all or most of their working time and that work has a negative impact on their health. (Eurofound & EU-OSHA, 2014). Regardless of the source of stress, it is primarily the many stress events of daily life rather than dramatic events that lead to negative health outcomes (McEwen, 2006). A large group of ill health whose risk increases as a function of stress is mental ill-health (Chen et al., 2009; Gallagher et al., 2021; Kendler et al., 1999; Lee et al., 2013; van der Molen et al., 2020).

Mental disorders are a major public health problem with significant consequences for societies in the world (Trautmann et al., 2016). Apart from the cost in terms of suffering, low levels of wellbeing and functional impairment, the monetary cost is very high. Mental disorders have become responsible for a higher economic cost than chronic somatic diseases (Bloom et al., 2012).

In Sweden, mental disorders are the most common reason for long-term sick leave (Lidwall & Olsson-Bohlin, 2016; SBU, 2018) and within the group of mental disorders, stress-related disorders account for half of the number of incidences (Lidwall & Olsson-Bohlin, 2017). Among stress-related disorders, clinical burnout/exhaustion syndrome¹ is a particularly serious problem in our society since the syndrome is highly prevalent (16% according to self-reports among employees in Sweden; Glise et al., 2010), may maintain itself (Almén, 2002, 2021), and often lasts for many years (Glise et al., 2012). Some symptoms that are important for daily function even appear to be permanent among many individuals (Ellbin et al., 2021).

Burnout is not a syndrome operating in isolation of other symptoms, but rather the opposite: It has been associated with 132 different symptoms (Schaufeli & Enzman, 1998), and patients with high levels of burnout

¹ Hereinafter exhaustion and exhaustion syndrome will mostly be referred to as burnout and clinical burnout respectively since exhaustion disorder is a term rarely used internationally.

usually have multidimensional symptoms/problems (Weber & Jaekel-Reinhard, 2000), particularly anxiety and depression (Glise et al., 2012; Glise, et al., 2010). Roughly half of the severely “burned-out” persons have been shown to be clinically depressed (Ahola et al., 2005; Wurm et al., 2016). Other factors that usually have significant negative consequences for a person scoring high levels of burnout are cognitive impairments, in particular regarding attention, memory and executive functions (Deligkaris et al., 2014; Gavelin et al., 2021) and insomnia (Söderström et al., 2012). Moreover, burnout is associated with somatic discomfort and dysfunctions such as digestive problems, skin problems, and headaches (Chakravorty & Singh, 2022), as well as pain (Grossi et al., 2009), impairment of reproductive functions, type 2 diabetes, cardiovascular disease and cardiovascular related events (Melamed et al., 2006). In addition, burnout is associated with mortality (Ahola et al., 2010).

In conclusion, stress-related ill health is a major problem in our society and there has been nothing to indicate that this trend is on the decline. Thus, there is a great need for findings ways to counteract this problem. Preventive and “early” interventions seem particularly important to develop and study.

Theoretical Framework

Although this thesis is not fully consistent in terms of behavioral principles (Sundel & Sundel, 2018), it has largely been shaped by these. In addition, the thesis is based on the biopsychosocial model, stating that biological, psychological and social factors all play significant roles in human functioning in the context of health/ill health (Pilgrim, 2015).

The Stress Concept

According the Selyean view, the stress response is defined as an increase in unspecific physical activation (i.e., arousal) that follows as a response to any type of demand (Selye, 1974). However, the response has been shown to have some degree of specificity depending on the context (Goldstein, 2010). Another highly influential conceptualization of stress is the one stated by Lazarus and Folkman (1984), which emphasizes the cognitive aspect of stress: Stress is a situation that is appraised by the individual as personally significant and as having demands that exceed the person’s resources for coping (this view on stress ignores the existence of biogenic stressors, such

as drinking coffee or taking a very cold bath; Widmaier et al., 2004). In addition to these views on stress, the current doctoral project is also based on the assumption that stress behaviors can be learned via respondent and operant processes (Sundel & Sundel, 2018) and that we are in principle capable of learning how to respond with stress behaviors to anything, which may result in more or less chronic stress behaviors.

The Stress Recovery Concept

In stress recovery studies, the term *recovery process* is often used. This concept refers to stress deactivation - i.e., psychophysiological deactivation after effort expenditure - that leads to restoration of depleted resources (e.g., Geurts & Sonnentag, 2006; Zijlstra & Sonnentag, 2006). Through this, the ability to deal with future demands increases (Zijlstra & Sonnentag, 2006), for example in terms of being engaged in work tasks and using proactive behaviors (Sonnentag, 2003). In accordance with behavioral principles, I view this process as behavior. Therefore, I will most often use the term *(stress) recovery behavior* henceforth. If conceptualizing recovery behavior as the opposite of stress behavior, according to the Selyean view of the stress response (Selye, 1974), recovery behavior means that the unspecific responses that increased due to any type of demand returns to normal ("baseline") as a result of the cessation of the demand. According to the *generalized unsafety theory of stress* (Brosschot, et al., 2016), stress behavior is a default response and in order for it to stop the absence of demands, challenges and threats is not enough, it is also necessary to perceive signals of safety (for example friendly people around us). Presumably, such perceptions are needed in order for recovery behavior to occur. The generalized unsafety theory of stress also postulates that the person may need to engage in activities for perceptions of safety to occur (Brosschot et al., 2018). In accordance, I suggest that recovery behavior should not only be considered a *withdrawal behavior* but also an *approach behavior*.

In this thesis, *recovery behavior* is defined as *any type of activity that involves psychophysiological deactivation of responses activated during stress/effort, leading to an increase in resources that were reduced due to the stress/effort*. An assumption is that recovery behaviors can be learned via respondent and operant processes (Sundel & Sundel, 2018). Researchers have suggested there is not one set of behaviors that leads to recovery effects for everyone (Baumeister et al., 2007; Sonnentag et al., 2017). In accordance with this, as well as behavioral principles (Sundel & Sundel, 2018), in this thesis it is

assumed that the recovery function of a behavior depends on the current context.

Good and Bad Sides of Stress Behavior

In an acute life-threatening situation, the organism mobilizes resources to flee or deal with the threat through what Walter Cannon (1932) labeled as the *fight-or-flight response*. Modern life includes repeated exposure to situations in which stress behavior is activated since the behavior is not only adaptive in perceived life-threatening but also in everyday life challenging situations (McEwen, 2005). Stress behavior can improve mental as well as physical performances in a wide sense (Dhabhar, 2018), for example enhancements of reaction time and movement time (Arent & Landers, 2003), which can be useful in both life-threatening and everyday life challenging situations. Stress behavior may also contribute to “positive” emotions (Folkman, 2008) and the ability of the immune system to respond to organisms that can produce diseases (McEwen, 2002). In line with the latter, deliberately activate short-term stress behavior may be a way to enhance immune protection and performances (Dhabhar, 2018).

Although stress behavior is primarily adaptive it is also related to a wide range of negative aspects, for example impaired decision making (Dias-Ferreira et al., 2009), serious traffic accidents (Lagarde et al., 2004), higher fat diet, less frequent exercise, and cigarette smoking (Ng & Jeffery, 2003). High levels of stress are also associated with a greater risk for poor health, declines in cognitive and physical functioning, and mortality (Seeman et al., 2001). Of particular importance in our society, as already stated, is that stress increases the risk for mental disorders and burnout (e.g., Aronsson et al., 2017; Hintsa et al., 2016; van der Molen et al., 2020). Accordingly, McEwen (2002, 2006) emphasizes two opposite effects of stress: protective and damaging effects.

Sustained Stress Behaviors and Deficiencies in Recovery Behaviors

In contrast to acute life-threatening situations that evoke the fight-or-flight response, the most common stressors are everyday hassles (McEwen, 2006). Although daily hassles normally lead to low intense stress behavior, the behavior may operate (more or less) chronically. An important difference

between what constitutes “good stress” and “bad stress” is that the former generally occurs temporary while the latter is generally sustained. Short-term stress behavior most often promotes adaptation whereas sustained stress behaviors - implying deficient recovery behaviors - lead to “wear-and-tear” on the body and possibly illness, disease and morbidity (McEwen, 2006). Although there may be a time space in between everyday life stressors, in a context of stress overload the likelihood increases that the person behaves in ways - such as worrying (Brosschot, 2010) and not meeting friends or taking work breaks (McEwen, 2006) - that may hinder recovery.

Several researchers explain stress-related ill health, such as burnout, explicitly in terms of lack of or impaired stress recovery behaviors rather than stress overload (e.g., Söderström, 2012; Sonnentag et al., 2022). Impaired recovery behavior prospectively predicts cardiovascular health independently of stress reactivity (i.e., magnitude of stress behavior in stress situations), and recovery seems to be a better predictor for cardiovascular health than stress reactivity (Steptoe et al., 2006; Steptoe & Marmot, 2005; Stewart et al., 2006). Impaired recovery behavior can, for example, be indicated by low levels of relaxation in potential recovery situations (Sonnentag & Fritz, 2007), continuation of stressful cognitions after termination of stress situations (Boekhorst et al., 2017; Sonnentag & Bayer, 2005), that it takes a long time to recover from stressful events (e.g., Brosschot et al., 2005; Steptoe et al., 2006), and insufficient sleep (Söderström et al., 2012). The primary function of recovery behaviors is probably to protect the individual from reducing or losing the ability to mobilize resources to cope with demands, and this ability is clearly reduced during the occurrence of stress-related ill health, such as burnout, depression, and maladaptive levels of anxiety. Accordingly, in a recent systematic review of burnout predictors, regarding protective factors, the strongest support was found for recovery potential activities at leisure time, such as relaxation, social activity, and physical exercise (Shoman et al., 2021). In addition, high levels of work demands and effort may even be beneficial for health in terms of reduced burnout if accompanied by high levels of recovery behaviors (Stein et al., 2021). As for stress, negative consequences of recovery behavior are also possible. For example, Fritz et al. (2010) found a curvilinear relationship between recovery behavior during leisure time and performance at work. Very high levels of recovery behaviors may undermine generally positive aspects of life, such as work engagement (Sonnentag et al., 2017).

Although stress recovery research has a long tradition (Sonnentag et al., 2017), it has been neglected for decades (Linden et al., 1997). For example, Ji et al. (2016) have stated that research on cortisol recovery is far behind the research on cortisol reactivity regarding its role in human health. Stress and recovery can be considered as two sides of the same coin, and to understand the coin, it is important to study both sides.

Physiological Components of Stress and Recovery Behaviors

The human stress physiology involves a wide range of processes in our body (McEwen, 2006). In particular, the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis have been pointed out as crucial (McEwen & Seeman, 1999). The often-used indicator of HPA activity is the steroid hormone cortisol, which is important in many ways (not only in stress situations), including when it comes to regulating and allocating resources in connection with long-term stress. The HPA axis reflects prolonged, including maladaptive, chronic stress behavior (e.g., Wolfram et al., 2013). If high cortisol supplementation lasts for a long time, the risk of disease increases (Kristenson et al., 1998). However, both hyperactivity and hypoactivity of the HPA axis are associated with ill health (Herane Vives et al., 2015), such as a disturbed circadian rhythm (McEwen, 1998a, 1998b), cardiovascular disease (Kristenson et al., 1998), chronic fatigue, hypothyroidism, rheumatism, obesity (Lundberg, 2005), and burnout (Wolfram et al., 2013).

In order to act in response to a perceived threat/challenge, the sympathetic nervous system, one of the two divisions of the autonomic nervous system, needs to be activated, which is characterized by generalized arousal (e.g., increased heart rate) and energy consumption (e.g., Cannon, 1932; Everly & Lating, 2019; Rice, 1999; Taylor et al., 2000). In contrast, the parasympathetic nervous system, the other division of the autonomic nervous system, is activated when the perceived threat/challenge is over. Activation of this system involves inhibition, deactivation/relaxation, and restoration functions (e.g., Everly & Lating, 2019). The parasympathetic nervous system is the major driving force for stress recovery (Dhabhar, 2018) and its activity has, in analog with the fight-and-flight response, been labeled as the *“rest-and-digest response”* (VanPatten & Al-Abed, 2017), which is related to the term suggested by Benson (1975): the *“relaxation response”*.

Not only a hyperactive sympathetic system but also a hypoactive parasympathetic system is associated with several pathological conditions, such as the leading cause of death worldwide: cardiovascular disease (Thayer et al., 2010). The so called “autonomic imbalance” may be a final common pathway for a wide range of health conditions and diseases.

Sustained physiological indicators of stress behavior are, for example, associated with anhedonia, distress, depression, mood disorders (Carbone, 2021; McEwen, 2003), migraine (Borsook et al., 2012), sleep apnea, insomnia (Chen et al., 2014), fatigue, feelings of being recovered (von Thiele et al., 2006), burnout/exhaustion (Bellingrath et al., 2009), reduced cognitive functionality (Misiak et al., 2019; Ottino-González et al., 2019; Vaccarino et al., 2018), somatic disease (Sabbah et al., 2008), and mortality (Borrell et al., 2010; Gruenewald et al., 2006).

Stress Theories

An early stress theory that hypothetically explains stress-related ill health, such as clinical burnout, is the *general adaptation syndrome*, formulated by Hans Selye (1950). The model postulates that a psychological or physiological stressor results in an initial alarm response. The reaction is due to activation of the sympathetic nervous system. If the activation lasts for a long time, resources needed for the activation become exhausted and cause experiences of exhaustion. In this phase, the vulnerability is very high for diseases and in some cases collapse or death. The more modern stress theory, the theory of *allostatic load*, points out stress and other types of associated responses as adaptive and necessary to maintain stability through changes, but potentially harmful if prolonged (McEwen, 1998a, 1998b; Sterling & Eyer, 1990). The allostatic systems may lead to disease processes and ill health if they are overactive as well as under-active, i.e., 1) overworked, 2) failing to deactivate after stress, or 3) failing to respond adequately to the initial challenge, leading other systems to overreact (e.g., the immune system, leading to inflammatory responses). Importantly, the theory emphasizes that there are many aspects in everyday life that we may not consider as stressors but that may nevertheless lead to allostatic load. The theory predicts cumulative negative effects if the system is activated for long periods of time, and that maintaining a balance between sympathetic and parasympathetic activity (autonomic balance), despite external situational changes, such as exposure to stressors, is crucial for health (Sterling & Eyer, 1990). A theory in accordance with the theory of allostatic

load and the theory of general adaptation syndrome is the *cognitive activation theory of stress* (Eriksen et al., 2005). According to this theory, the stress response depends on acquired expectancy of the outcome of the stimulus and the available responses. The stress response itself is an alarm, an increase in arousal necessary for performance and adequate reactions to challenges. The response is healthy and necessary for survival. Only when sustained over time may health risks occur.

The theory of allostatic load, the theory of general adaptation syndrome and the cognitive activation theory of stress all postulate that short-term stress behavior is necessary for adaptation and health, and that sustained (or highly frequent) stress behavior is a risk factor for ill health. Consequently, the intensity of the stress behavior may not be a health critical parameter although it can be aversive. More important parameters are frequency and duration. Although the concept of recovery is - surprisingly so - not explicitly incorporated or only peripherally mentioned in these theories, the theories are compatible with the recovery hypothesis: That recovery behavior is crucial for health and wellbeing.

Stressors

Many stressors have been shown to be associated with ill health. Examples of stressors that increase the risk for burnout are job insecurity (Aronsson et al., 2017), sex discrimination, role conflicts (Sandmark & Renstig, 2010), demands overall at work (including cognitive, emotional, and physical demands; Shoman et al., 2021), relationship conflicts in the private life (Hasselberg et al., 2014) and work-family conflicts (Tugsal, 2017). Thus, both work stressors and non-work stressors can contribute to the development of burnout, although the former seems to contribute the most, at least according to self-reports (Hasselberg et al., 2014). A hypothetical mediator between stressors, such as these, and burnout is insufficient recovery behaviors.

Stress-Related Behavioral Patterns

There are some general patterns of behavior that are associated with sustained physiological stress behavior. Example of such behaviors are *type A behavior*, *overcommitment to work* and *excessive worry*. Importantly, stress reactivity and stress recovery often go together: People who are prone to stress reactivity are often less prone to stress recovery (Ji et al., 2016).

Type A Behavior

In the 1950s the cardiologists Friedman and Rosenman hypothesized that there was a behavior pattern that could contribute to cardiovascular disease (Friedman & Rosenman, 1959, 1974). This behavior pattern, labeled *type A*, is characterized by a high frequency of competitiveness, perceived time urgency, impatience, anger, and hostility. It has been shown to be associated with physiological indicators of stress, such as a higher heart rate, higher diastolic blood pressure, higher levels of adrenaline responses (van Doornen & van Blokland, 1989) and index of allostatic load (Sun et al., 2007), poor wellbeing (Van den Berg & Schalk, 1997), job dissatisfaction (Jamal, 1999; Lavanco, 1997), general mental illness (Nowack, 1986), stress-related somatic symptoms (e.g., headache, loss of appetite and sleep problems; Barling & Charbonneau, 1992; Jamal & Baba, 2003), and burnout (Alotaibi, 2003; Hallberg et al., 2007; Jamal, 1999; Jamal & Baba, 2003; Lavanco, 1997; Nagy & Davis, 1985). There are also studies that have shown mixed results. For example, Lohse et al. (2017) found that the competitiveness component of the behavior positively correlated with all-cause mortality, cardiovascular disease mortality and ischemic heart disease mortality for women but not men.

Most of the studies that I have referred to are relatively old. This is due to a lack of recent studies. The interest in studying type A behavior seems to be diminished, which is probably because the role of type A behavior as a risk factor for cardiovascular disease has been questioned (Myrtek, 2001; Petticrew et al., 2012). Petticrew, et al. (2012) have argued that the role of type A behavior has been exaggerated due to the tobacco industry's funding of a large portion of type A research based on an interest in undermining smoking as a risk factor for cardiovascular disease.

Perhaps researchers have thrown the baby out with the bathwater. Type A behavior may be important for recovery. For example, people scoring high on type A behavior are associated with impaired or suboptimal levels of recovery (indicated by higher levels of sympathetic activity during rest; Lee & Watanuki, 2007). The most health problematic component of the type A behavior seems to be anger/hostility (Hallberg et al., 2007; Miller et al., 1996). Both inhibited and expressed anger are associated with slow cardiovascular stress recovery and persistently low parasympathetic activation (Brosschot & Thayer, 1998).

Behavioral interventions have shown to be effective in reducing type A behavior (e.g., Burell, et al., 1994; Friedman et al., 1986; Lisspers & Almén, 2009; Lisspers et al., 2005). A typical type A behavior intervention is the so-

called type A drills, which consist of acting excessively incompatible with one's type A behaviors, for example, eating very slowly instead of eating fast (Friedman & Ulmer, 1984).

Overcommitment to Work

Overcommitment to work is a stress-related behavioral pattern (OSW; Siegrist et al., 2004; Wirtz et al., 2008) which is associated with type A behavior. The pattern of behavior is related to increased levels of physiological indicators of stress (higher levels of norepinephrine and cortisol; Wirtz et al., 2008), and reduced levels of feelings of being recovered after a workday (von Thiele Schwarz, 2011).

Overcommitment to work is characterized by continuous work commitment, high achievements and work at leisure time, which may lead to energy depletion. This behavior is not only related to fatigue (Siegrist et al., 2004; Wirtz et al., 2008), but also reduced work ability (Håkansson et al., 2020), anxiety, depression (Mark & Smith, 2012), burnout (Violanti et al., 2018) and somatic disease, such as coronary heart disease (Kuper et al., 2002). The behavioral pattern is closely (negatively) related to a recovery important behavior that has been quite well studied in the recent decade, namely *psychological detachment from work*, which I will describe below.

Interventions which are aimed at reducing high levels of OCW are few and therefore conclusions regarding the possibility of reducing OCW via stress management cannot be drawn.

Excessive Worry

While the interest in type A behavior has diminished, interest in another stress-related behavior has increased: excessive/highly frequent worry. Worry is associated with physiological indicators of stress, such as higher heart rate, blood pressure and cortisol levels, lower heart rate variability, (Ottaviani et al., 2016) and higher levels of skin conductance (Capobianco et al., 2018). Worry can be seen as a cognitive behavior aiming at anticipating and coping with possible future aversive events. As Mathews (1990) pointed out, the more the cognitive process is successful, the less likely we are to regard it as worry. Instead, we will probably consider the behavior as preparation, planning, coping, stress management, problem solving or such. Excessive worry may represent an experience of constant threats and constant trying (but often failing) to cope with these.

Excessive worry has long been considered the core component of generalized anxiety disorder (Borkovec, 2005; Hirsch et al., 2013) as well as hypothesized as an important transdiagnostic variable (McLaughlin & Nolen-Hoeksema, 2011). Studies have demonstrated that worry is an important variable in explaining sustained physiological stress activation (Ottaviani et al., 2016). Accordingly, worry predicts ill health and illness, such as somatic disorders (Verkuil et al., 2012) and cardiovascular disease (Borkovec, 2005). Perseverative cognition, partly indicated by worry, affects cardiovascular, autonomic and endocrine nervous system activity, which probably explains the association between sustained stress and ill health (Ottaviani et al., 2016). Of particular importance is the fact that worry can prevent psychophysiological deactivation from occurring in potential recovery situations (Capobianco et al., 2018).

In comparison with type A behavior and OCW, worry has been subjected to a lot of intervention research and several psychological interventions have proven to be effective. A general intervention principle is to increase behaviors that are adaptive and incompatible with excessive worry (Borkovec, 2005), which may for example be relaxation (Hayes-Skelton et al., 2013), exposure to avoided stimuli (Andersson, et al., 2017; Behar et al., 2009), postponing worry (Borkovec, 1998), and discriminating worry as thoughts, detaching from the thoughts and engaging in valued actions (Hayes, et al., 2012). Perhaps recovery behavior is a further example of a behavior that is adaptive and worry incompatible.

To the best of my knowledge, it has not been studied whether stress behaviors such as type A behavior, OCW or excessive worry can be reduced through an intervention that solely aims to strengthen recovery behaviors.

Factors Positively Associated With Stress Recovery

While the above-described behavioral patterns have a negative association with recovery, I will now turn the attention to behavioral and contextual factors that are positively associated with recovery.

Sleep

Sleep is, by no surprise, of fundamental importance for recovery. Regularly sleeping less than seven hours per night is associated with more serious

health consequences such as high blood pressure, weight gain and obesity, diabetes, heart disease and stroke, depression, and mortality (Watson et al., 2015). In line with this, it has been shown that generally sleeping six hours or less per night predicts clinical burnout (Söderström et al., 2012) and that recovery from burnout accompanies improved sleep continuity (Ekstedt et al., 2009). In addition, an intervention study by Santoft et al., (2019) demonstrated that a higher reduction in burnout for a CBT condition, in comparison with a return-to-work condition, was to a certain degree mediated by improved sleep quality.

Relaxation

Sonnentag and Fritz (2007) have pointed out *experiences of relaxation* at leisure time as a highly important aspect of work/stress recovery. Accordingly, relaxation is closely related to, or even synonymous with, the fundamental aspect of stress recovery behavior: psychophysiological deactivation (e.g., Geurts & Sonnentag, 2006; Zijlstra & Sonnentag, 2006). Relaxation is accompanied by slower breathing, which is associated with increases in parasympathetic nervous system activity (Van Diest et al., 2014). It is correlated with "positive" emotions (Fredrickson, 2000; Stone et al., 1995) and negatively correlated with "negative" emotions (van der Klink et al., 2001). Relaxation can be achieved by applying a relaxation technique (Öst, 2002), and/or through everyday activities, such as walking leisurely in nature (Hartig et al., 2003), and listening to music. (Pelletier, 2004).

A concept used in recovery research which is related to relaxation is low-effort activities. Examples of such activities are watching TV, scrolling on social media, and listening to music. Research on the recovery effects of low effort activities has shown mixed results (Rock & Zijlstra, 2006; Sonnentag, 2001). This can probably be explained by the fact that these activities are compatible with both relaxation and tension. Low-effort activities can contribute to physiological stress behaviors and low levels of recovery (for example indicated by nonbeneficial sympathetic and parasympathetic changes; Carney & Freedland, 2009), and to the maintenance of depression (Jacobson et al., 2001).

Control

Control in terms of having the opportunity to decide for oneself which behavior to apply, for example, what to do during leisure time and during

lunch breaks at work, is important for recovery to occur (Sonnentag & Fritz, 2007; Trougakos et al., 2014). This may be due to the option of choosing activities with great recovery potential in the specific situation when perceiving a need for recovery. In addition, when having control, one can choose to engage in activities that one prefers, enjoy or that feel pleasant, and such activities seem to facilitate recovery (Hunter & Wu, 2016; Ten Brummelhuis & Trougakos, 2014; Reinecke et al., 2011).

Importantly, decision-making control can also make it difficult to psychologically distance oneself from work (Sonnentag & Bayer, 2005). Control means not only that one can take a recovery break when tired but also that one can "overwork" and postpone recovery. Therefore, a combination of control and OCW may not be beneficial for recovery. Accordingly, organizationally scheduled breaks can lead to individuals taking their work breaks to a greater extent (Henning, et al., 1994), however, in general they tend to become less recovery-effective when compared to organizationally non-scheduled work breaks (Boucsein & Thum, 1997). In conclusion, *experiences of control* seems to be a path for recovery to occur.

Focused Attention

Mentally focusing on an object or activity, for example, on how the food tastes when you eat, and refocusing when the thoughts start wandering in an undesirable direction, seems to facilitate recovery processes after stressful situations (Borchardt & Zoccola, 2018). Experimental studies indicate that distraction facilitates recovery after stress situations (Chafin et al., 2004, 2008) and focused attention may function as a distractor from stressors. Focused attention may also be related to recovery via relaxation and slow breathing (Van Diest et al., 2014), and perceptions of safety (Brosschot et al., 2018). A way to attempt to increase focused attention is mindfulness training (Borchardt & Zoccola, 2018). An alternative, and possibly simpler, way is to engage in activities that tend to capture one's attention, such as activities that we find interesting or activities that require some cognitive effort.

Physical Activity

The evidence regarding the importance of physical activity for health is strong (Bishop-Bailey, 2013; Warburton et al., 2006). In line with this, increases in physical activity are associated with decreases in burnout over time (Lindwall et al., 2014).

Physical activity may facilitate immediate recovery processes but perhaps the most important recovery function is to pave the way for subsequent recovery processes. This can be exemplified by an experiment conducted by Chafin et al. (2008), which showed that a brief poststress physical exercise increased arousal during the activity but improved cardiovascular recovery after the completion of the exercise, during relaxation, in comparison with people who relaxed immediately after the exposure to a stressor. The fact that physical activity subsequently facilitates good recovery sleep (Kredlow et al., 2015) is an additional indication that the association between physical activity and recovery can be explained by behavior that comes after completion of the physical activity. Other such indications are studies that have showed that having a great oxygen uptake capacity facilitates fast cardiovascular recovery in poststress situations (e.g., Huang et al., 2013) and that physical activity immediately reduces heart rate variability whereas it leads to increased variability in the long term (e.g., Tuomainen et al., 2005).

Cultural Activities and Music

Studies have shown a positive association between cultural activities and recovery (e.g., Tuisku et al., 2016). A specific type of cultural activity possibly eliciting recovery is listening to music (de Witte et al., 2020). Although silence has the potential to reduce arousal, classical music seems to have a greater potential of reducing arousal after exposure to stress (Chafin et al., 2004). Also, practicing music seems to be beneficial for recovery. For example, participation in choral singing is associated with physiological, emotional, social and cognitive benefits and quality of life (Livesey et al., 2012; Williams et al., 2018). In addition, other types of cultural activities, such as listening to audiobooks, can enhance recovery (Radstaak et al., 2014).

Natural Environments

A well-studied factor that has shown to support recovery is natural environments (Berto, 2014). The evidence is strong for the conclusion that exposure to natural environments produces cognitive as well as affective improvements (Scott et al., 2021). Several factors have been proposed to mediate the relationship between natural environments and recovery

outcomes, such as sense of control, privacy, fascination, distractions, temporary escape from “reality”, and involuntary attention. Natural environments often elicit greater psychophysiological deactivation in comparison with urban environments (Berto, 2014). Psychophysiological deactivation is perhaps a common feature of the proposed mediators. Paradoxically, natural environments can be unnatural (e.g., virtual trees or watching a nature film) and still produce recovery effects (de Kort et al., 2006).

Social Activities

Social activities may be helpful in order for recovery to occur (Sonnentag & Zijlstra, 2006). It may possibly be explained by several factors, such as perceptions of safety (Brosschot et al., 2018), relaxation and psychological detachment from stressful situations (Boekhorst et al., 2017; Sonnentag & Fritz, 2007), enjoyment (Reinecke et al., 2011), laughter or hearing laughter (Fujiwara & Okamura, 2018), counteraction of worry and other perseverative stressful cognitions (Brosschot et al., 2005), for example via reappraisal (Han et al., 2020), or other types of coping support (Folkman & Lazarus, 1985). However, research on the impact of social activities on recovery has shown mixed results (Cheng & Cho, 2021). The mixed results should not be surprising as social activity is a category of activities which can vary greatly in topography and function. There is for example a big difference between being obligated to meet a person you feel insecure with and do not experience any enjoyment with compared to someone you feel safe with and enjoy being with.

Psychological Detachment

While physically detaching oneself from work consists of leaving the workplace, psychological detachment from work means to leave work psychologically (Sonnentag & Bayer, 2005). The theory of psychological detachment from work implies that being mentally absent from previous stressors is crucial for work stress recovery to occur. If we are not working but are psychologically attached to work, the same functional systems or internal resources as those required when we work may be activated, which will interfere with recovery (Sonnentag & Fritz, 2007). This factor may be the most studied recovery factor over the last decade. In a meta-analysis by Wendsche and Lohmann-Haislah (2017), including 86 papers, regarding

antecedents and outcomes of psychological detachment from work, it was concluded that the following correlated positively with psychological detachment: life satisfaction, wellbeing, good sleep, positive affect, and task performance, whereas these factors correlated negatively with psychological detachment: fatigue, exhaustion, and physical discomfort. Regarding antecedents, job demands were negatively related and job resources were positively related to psychological detachment, which confirms the “recovery paradox”, which states that it is when we need recovery the most that recovery processes are the least likely to occur (Sonnentag, 2018). As expected, the study by Wendsche and Lohmann-Haislah (2017) showed that affectivity/neuroticism (i.e., reactivity) and heavy work investment were negatively related to psychological detachment from work.

Type of activity seems to be important to psychological detachment from work. It may be easier to detach psychologically when occupied with something, such as listening to music, a challenge or nature experiences. Distractions seem to be particularly important for recovery after negative emotional stressors (Gerin et al., 2006). Passive poststress behaviors give more room for stress associated cognitions, such as ruminating about the previous work situation or worrying about the upcoming workday.

Mastery Experiences

Experiences of mastery entail challenging experiences and/or learning in other domains than work that distract the person from thinking about the job (Sonntag & Fritz, 2007). A study by Conlin et al. (2021) showed that a mastery designed work break as short as 40 seconds was enough for psychological detachment from work to occur. Paradoxically, mastery experiences, which potentially lead to recovery from work effort, normally require some kind of effort (particularly regarding cognitive processes; Conlin et al., 2021). Thus, mastery experiences can be contrasted to low-effort activities. Importantly, activities accompanied by mastery experiences do not overtax the person’s capabilities (Sonntag et al., 2008).

Although confirmatory factor analysis supports mastery experiences as a recovery factor, it is not as clearly related to recovery in terms of psychophysiological deactivation as relaxation is. However, recovery behavior according to the definition used in this thesis means that responses that were activated during stress deactivate, and during a mastery experience such responses may deactivate whereas other responses are activated. In line with this, mastery experiences has been shown to predict

recovery outcomes such as decreased levels of exhaustion/burnout (Fritz & Sonnentag, 2006). However, this relationship has not been consistently demonstrated in studies (Ginoux et al., 2021).

Concluding Remarks

Stress recovery is not only a matter of removal of stressors but also the presence of factors. As demonstrated, recovery is positively associated with several factors in the current post stress situation. Hypothetically, perceptions of safety and accompanied psychophysiological deactivation are common features among these factors. In line with this, Sonnentag and Fritz (2007) have stated that it is our experiences during activities and not activities in themselves that lead to recovery outcomes. Behaviors that have been shown to be associated with recovery in a relatively (although not perfectly) consistent way are experiences of relaxation, mastery, control, and psychological detachment from work (Sonnentag et al., 2022; Sonnentag & Fritz, 2007; Sonnentag et al., 2017). Among these, relaxation is the factor that is most clearly associated with recovery behavior, as defined earlier. Although all four factors may lead to recovery outcomes, such as vigor, feelings of being well-rested and task performance (e.g., Bennett et al., 2018; Binnewies et al., 2009), they may not lead to identical recovery outcomes. For example, Sonnentag et al. (2008) have concluded that in order to achieve positive activation and serenity it is not enough to avoid negative activation via psychological detachment from work, but to also engage in activities that facilitate mastery experiences and relaxation respectively, and according to the meta-analysis of work recovery by Bennett et al. (2018), control experiences are more associated with vigor than experiences of psychological detachment from work and experiences of relaxation. Importantly, the recovery effectiveness of one and the same activity may differ depending on the preceding stress situation. For example, if a work stressor consisting of high levels of social interactions is followed by a work break also consisting of social interactions, recovery may not occur since the same type of internal resources are probably required in the two situations. (Craig & Cooper, 1992; Meijman & Mulder, 1998). Finally, and of great importance, psychophysiological deactivation, recovery experiences and perceptions of safety are behaviors that can be increased through learning (Brosschot et al., 2018; Hahn et al., 2011; Sundel & Sundel, 2018).

Measuring Recovery Behaviors

The imbalance between how much stress and recovery respectively have been researched also concerns measures. There are many validated stress behavior measures to find in the literature whereas the number of validated stress recovery behavior measures (sleep measures excluded), are surprisingly few.

In order to measure behaviors that are important for recovery, activities that have the potential to lead to recovery effects may be measured (Rock & Zijlstra, 2006). In research, questions have been asked about how often or how much time people spend on different activities. But to my knowledge there is no such instrument that is validated. The recovery behavior measure that has been validated and used most frequently in research is the *Recovery Experiences Questionnaire (REQ)*; Sonnentag et al., 2022; Sonnentag & Fritz, 2007). The REQ is based on the previously described idea that it is not activities per se but different types of experiences during activities that lead to recovery effects. The instrument consists of 16 items and four subscales that reflect the following latent dimensions of recovery experiences (which have all been described above) during leisure time: *Psychological detachment* from work effort/stress (4 items), *Relaxation* (4 items), *Control* (4 items), and *Mastery* (4 items; Sonnentag & Fritz, 2007). The items (which are all non-reversed) are scored on a five-point Likert scale ranging from 1 (*do not agree at all*) to 5 (*fully agree*). Using confirmative factor analyses, Sonnentag and Fritz (2007) contrasted the proposed four-factor structure against alternative models; one-factor, the best-fitting two-factor model, and the best-fitting three-factor model. The results showed that the items on the scale were better represented by four factors compared to a one common factor, a two-factor or a three-factor structure. Only Relaxation and Control were rather highly correlated: .65–.71². Mastery and Psychological detachment only correlated .19-.20². One study has showed a correlation as low as .07 between two recovery experiences (Psychological detachment and Control; Panthee et al., 2020).

Apart from the study by Sonnentag and Fritz (2007), which was conducted in Germany, REQ has to date been translated into several languages and validated in different countries, such as Spain (Sanz-Vergel et al., 2010), Japan (Shimazu, et al., 2012), South Africa (Mostert & Els, 2015), South Korea (Park, et al., 2011), Finland (Kinnunen, et al., 2011), Argentina

² The two correlations coefficients derive from two different samples.

Trógolo et al. (2020) and Holland (Bakker, et al., 2015). In competition with a variety of contrasting models, all of the studies above found support for the proposed four-factor structure.

Many studies have demonstrated that REQ is associated with health and wellbeing (Sonnentag et al., 2017). More specifically, REQ has been shown to mediate the relationship between demand-resource imbalance and wellbeing (Geurts & Sonnentag, 2006). Regarding burnout specifically, there are several studies that have shown an association, sometimes strong, between the factors included in REQ and low levels of burnout (e.g., Ginoux et al., 2021; Poulsen et al., 2015; Song et al., 2021).

Stress and Recovery-Related Ill-Health

Three relatively wide and correlated domains of ill-health are burnout, anxiety and depression (e.g., Akova et al., 2021; Creedy et al., 2017), which are all related to stress and recovery.

Burnout

There are different definitions of burnout. A common feature among them is *exhaustion*. Pines, et al. (1981) have defined burnout in terms of non-transient physical, emotional and mental exhaustion. Accordingly, burnout has also been defined as a chronic depletion of an individual's energetic resources (Shirom, 1989) demonstrated by prolonged feelings of physical fatigue, emotional exhaustion and cognitive weariness (Melamed, et al., 2006). Continuous and prolonged exposure to stressors (Melamed, et al., 2006), or maladaptive coping with stressors (Weber & Jaekel-Reinhard, 2000), has been proposed to explain burnout. Burnout has by many researchers, for example Maslach and Jackson (1981), been explained in terms of work stress and not stress in general. However, people experiencing burnout have been reporting both work stressors and non-work stressors as important antecedents (Hasselberg et al., 2014). Accordingly, the *conservation of resources theory* (COR) postulates that burnout is a consequence of cumulative exposure to chronic work and life stressors (Freedy & Hobfoll, 1994; Hobfoll, 1989; Schaufeli et al., 1993).

Anxiety

Anxiety can be defined as an alarm reaction in response to imminent perceptions of threat or danger and a future oriented mood which facilitates the individual to prepare to cope with an eventual upcoming negative event, without necessarily having to be aware of the triggering stimuli (Barlow, 2002). Anxiety can be considered a stress behavior that consists of a negative affective state and physiological activation closely related to the fight-and-flight response. However, factorial analysis suggests that one should differentiate between stress behavior and anxiety behavior: While stress is indicated by irritability, tension, impatience, agitation and difficulties to unwind, anxiety is indicated by subjective experience of worry, anxiety and panic (Lee et al., 2019; Lovibond, & Lovibond, 1995).

Most often anxiety is not pathological. "Chronicity", and not intensity, can in particular make anxiety pathological (Barlow, 2002). Anxiety can be seen as an antipole to recovery. If anxiety is chronic, there is no room for recovery to occur. If the anxiety is intense but nonchronic there is room for recovery. Not surprisingly, anxiety disorder, which is characterized by "chronic" (i.e., high frequent and/or prolonged) anxiety, is related to an imbalance between sympathetic and parasympathetic activation (Pittig et al., 2013).

Depression

Depression is a term that covers a wide set of behaviors (Stringaris, 2017). According to the American Psychiatric Association's (2013) *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5), low mood and reduced interest in, or enjoyment of, most activities in life are emphasized. Although depression is commonly considered a mental disorder, research suggests that it is better conceptualized on a continuum (Caspi et al., 2014; Kotov et al., 2017; Schonfeld et al., 2018). Depression, whose development has been shown to correlate with stress (O'Keane et al., 2005), is a gigantic burden worldwide (Ferrari et al., 2013; Lopez & Murray, 1998). Depression decreases around the age when people usually retire and are no longer are exposed to work stress. Studies have demonstrated that depression is accompanied by changes in sympathetic and parasympathetic activation (Carney & Freedland, 2009; Lin et al., 2011) and that resting heart rate is higher in depressed than non-depressed people (Carney & Freedland, 2009), which can interfere with recovery. Furthermore, depression is also associated with dysregulation in the HPA axis (Holsen et al., 2013; O'Keane

et al., 2005). In line with this, depressed individuals have been shown to have a less dynamic and less responsive cortisol activity, which indicates inadequate adaptability to different situations (Burke et al., 2005). The fact that neurobiological changes which occur during chronic and mild stress also occur during depression constitutes an argument for defining depression not only as an affective state that can be a result of stress but also a stress behavior (Hill et al., 2012), which potentially interferes with adaptive recovery behavior.

Stress Management Interventions

A large amount of research on stress and ill health has studied associations between work factors, in particular factors that can be attributed to the basic demand-resource model, and ill health. Unfortunately, intervention research on this basis, which aims at improving work conditions, has not led to satisfactory effects (Burgess et al., 2020). In a review study by Ruotsalainen et al. (2015), the only positive results found were low-quality evidence that changing work schedules can reduce levels of stress. In a systematic review of occupational health psychology interventions, Burgess et al. (2020) concluded that lack of effects of organizational stress interventions is due to the fact that the interventions are based on a trial-and-error approach instead of being theory driven. In accordance, Ruotsalainen et al. (2015) have stated that organizational interventions need more theoretical underpinning, and perhaps to be more specific, to reduce stress.

Based on empirical data that supports the theoretical assumption that behavioral factors are at least as important as external factors in explaining stress-related ill health such as burnout (Bianchi et al., 2021), it is reasonable to explore the possible potential of various interventions aiming at helping individuals who have developed, or are considered at risk of developing, stress-related ill health, to improve their coping behaviors. This has also been done in many studies (Richardson & Rothstein, 2008). Below I will summarize some obtained results. To determine levels of effect sizes in this thesis, the measure Cohen's d and the following rule of thumb will be used: 0.20 = small effect size, 0.50 = medium effect size, and 0.80 = large effect size (Cohen, 1988).

According to several meta-analyses and review studies of stress interventions (Richardson & Rothstein, 2008; Ruotsalainen, et al., 2015; van der Klink et al., 2001), stress management interventions are more effective than organizational stress interventions regarding psychological outcome

variables, such as perceived stress. The study by Richardson and Rothstein (2008) and a study by van der Klink et al. (2001) showed that in a comparison between the following interventions: relaxation, multimodal and CBT, the latter yielded the largest effective sizes ($d = 1.26$ and $d = 0.68$ respectively). Relaxational intervention was the second most effective stress management intervention in the study by Richardson and Rothstein, but the least effective in the study by van der Klink et al. ($d = 0.50$ and $d = 0.35$ respectively). The generally most comprehensive intervention, namely multimodal interventions, yielded small ($d = 0.24$; Richardson & Rothstein, 2008) and medium effect sizes ($d = 0.51$; van der Klink et al., 2001). In the review study by Ruotsalainen et al. (2015) it was concluded that there is evidence - albeit of low-quality - to suggest that CBT and relaxation reduce stress. An additional review and meta-analysis on stress management intervention by Heber et al. (2017), which only included web- and computer-based interventions, demonstrated that both traditional CBT and so-called third wave of behavioral therapy have produced significant effects in perceived stress levels. The effect sizes were small ($d = 0.40$) for traditional CBT and medium ($d = 0.53$) for third wave behavior therapy.

In a review study of stress interventions aiming at preventing burnout by Awa et al. (2010), which included fourteen RCT-studies, seven out of ten person-directed interventions showed burnout reductions. In two of the studies no effects were found. In one study the level of burnout increased. One organizational intervention study was included, but no reduction in burnout was shown. The final three intervention studies tested interventions combining personal- and organizational directed intervention components, and all reduced burnout significantly, and showed more long-lasting effects than the interventions focusing solely on the person.

Usually, stress management studies do not exclude people having subclinical levels of problems/symptoms. When it comes to interventions that only include people with clinical problems, a diagnosis is often used as an inclusion criterion. Since exhaustion disorder only exists in Sweden, and clinical burnout is not a concept that includes clinical criteria, studies that include people with this problem are rare. However, some studies have been conducted. Perski et al. (2017) performed a systematic review and meta-analysis of interventions for exhaustion syndrome in which eight articles met the criteria for inclusion. Commonly used intervention components were psychoeducation, relaxation, mindfulness training, time management and coping strategies training (four studies explicitly

investigated CBT). They found no significant effects on exhaustion, depression or anxiety but on return to work.

The Recovery Intervention Paradigm

Most often, stress management interventions (as well as organizational oriented stress interventions) tested in research are based on a *reactivity* paradigm and accordingly aim to change or manage stressors and/or regulate stress behaviors when exposed to stressors. The number of stress management intervention studies based on a recovery paradigm are, to say the least, few. Most stress recovery research - including intervention studies - have studied recovery during off-work. Recovery research often seems to imply that work is stress, and that off-work is the situation in which recovery should occur. However, the present doctoral projects are based on a different perspective, namely that stress activation and stress recovery may, and preferably, occur in both life spheres. Accordingly, in recent years there have been some research on recovery at work and this research indicates that recovery behaviors not only after work but also at work are important, for example to promote health and the ability to be engaged in the job (Bosch et al., 2018; de Jonge, 2019). However, recovery intervention studies targeting recovery behaviors both at work and off-work had not been published before the papers in this thesis were published according to the best of my knowledge. Most recovery studies focus on longer time periods off-work that are assumed to elicit recovery processes, such as holidays, weekends and evenings after work (e.g., Blasche et al., 2021).

Mindfulness based interventions have been tested to see whether they can improve work stress recovery. In a study by Michel et al. (2014), an effect was found on psychological detachment, which according to my calculation was small ($d = 0.27$), whereas mixed effects were found in a study by Hülshager et al. (2015): No positive effect regarding psychological detachment but regarding sleep (effect sizes not calculated). A quasi-experimental intervention study by Hahn et al. (2011) targeting recovery experiences (i.e., relaxation, psychological detachment from work, control over leisure time, and mastery) off-work also showed mixed results. For example, sleep quality but not emotional exhaustion was significantly improved one and three weeks after the intervention. Regarding perceived stress, no effect one week but instead three weeks after the intervention was demonstrated. Cohen's d was not calculated but according to my calculations sleep quality increased .60 at both time points whereas

perceived stress decreased .22 three weeks after the intervention. The limited effects may be due to the short duration (two weeks) of the intervention. Notably, the total session time was nine hours and thus it was not considerably brief.

A recovery intervention study, in which an RCT-design was used, has been performed by Dahlgren et al. (2022) including nurses with less than 12 months of work experience. The three-session intervention included some traditional stress management components, such as observing behaviors in stressful work situations and reflecting on alternative behaviors. However, the intervention was dominated by recovery facilitating components, such as unwinding bedtime routines, routines for leaving work, and activities boosting energy during off-work time. Mixed effects were demonstrated: No statistically significant effects regarding insomnia, tension (Tension scale [TES]³), sleep beliefs, or sleep quality (Karolinska Sleep Questionnaire [KSQ]), but regarding burnout (Shirom-Melamed Burnout Questionnaire-22 [SMBQ]), work related fatigue, and somatic symptoms. The effect sizes for the improved variables were small at postassessment ($d = 0.33$ – 0.37) and ranged from trivial to small (but close to medium; $d = 0.02$ – 0.49) at the 6-month follow-up assessment. In addition, an effect ($d = 0.39$) on insomnia, which can be considered good in relation to the relatively brief nature of the intervention (the total session time was 7.5 hours), was indicated ($p = 0.08$).

Another recovery intervention study, in which teachers experiencing clinical insomnia were included, has been conducted by Thiart et al. (2015). The intervention, which was internet-delivered, consisted of established CBT-components for insomnia (i.e., such as sleep restriction, stimulus control and sleep-hygiene) and methods targeting rumination and recreational activities. In comparison with a waiting-list control group (WLC), some variables did not significantly change (e.g., mastery experiences). However, most variables did change in favor of the intervention group. The effects sizes (among statistically improved variables) ranged from small to large ($d = 0.34$ – 1.43). The smallest effect size was demonstrated for control during leisure time whereas the largest effect size was demonstrated for insomnia severity.

There are interventions that have included recovery behavior support as one of several intervention components. Lindsäter et al. (2018) combined recovery support with CBT methods developed for psychiatric problems,

³ Outcome measures used in previous stress management research that are reported in this section and which are also used in the intervention studies included in the present thesis are specified.

such as behavioral activation for depression and exposure for anxiety problems. This internet-delivered intervention for people fulfilling the criteria for exhaustion syndrome or adjustment disorder led to positive effects on perceived stress (Perceived Stress Scale-14 [PSS]) and several clinical symptoms at postassessment ($d = 0.57$ – 1.09). The smallest and largest effect sizes were demonstrated for anxiety and burnout (SMBQ-22), respectively. Uncontrolled evaluations demonstrated maintained effects at the 6-month follow-up assessment.

Another study by Persson Asplund et al. (2018) tested an internet-delivered stress management intervention for managers in which recovery support was combined with traditional stress management interventions such as creating an action plan to reduce work stressors, and CBT (i.e., exposure). In comparison with an attention control group, moderate effect sizes on perceived stress (PSS-14) were demonstrated at postassessment and the 6-month follow-up assessment ($d = 0.74$ and $d = 0.59$, respectively). For burnout (SMBQ-22) and for depression, the intervention had a large impact at postassessment ($d = 0.95$ and 0.86 , respectively), but a small impact at the follow-up ($d = 0.39$). Regarding tension (TES) and insomnia, small improvements were shown at both time points ($d = 0.34$ – 0.39). In accordance with the study by Lindsäter et al. (2018), no significant effects were found for absenteeism.

Concluding Remarks

Generally, organizational oriented stress interventions have not been shown to work well. In contrast, stress management interventions, in particular CBT interventions, have been demonstrated to be effective in reducing stress-related variables. Also, relaxation interventions, which can be integrated in CBT (e.g., Almén, 2017; Lindsäter, et al., 2018), can produce effects. In addition, few intervention components and shorter intervention lengths may generally be more beneficial (Richardson & Rothstein, 2008). Regarding duration, in a study by Heber, et al. (2016) medium long duration of the intervention (i.e., 5–8 weeks) was more effective ($d = 0.59$) than shorter ($d = 0.33$) as well as longer duration (nonsignificant effects). Most stress intervention studies have been based on a reactivity paradigm. Only a small number of stress interventions studies based on a recovery paradigm have been conducted. The interventions that have included recovery behavior support and have been demonstrated to work the best have also included reactivity-based intervention components, which makes it difficult to draw

conclusions regarding the effects of the recovery components. The interventions that have solely intervened recovery behaviors have shown unsatisfactory effects. To test the potential of intervening recovery behaviors, more interventions that exclusively target recovery behaviors are needed.

2 Aims of the Thesis

The primary aim of the thesis was to evaluate stress and health-related effects of an intervention targeting stress recovery behaviors in everyday life among people perceiving high levels of stress in life. A secondary aim was to validate a self-report scale measuring behaviors of importance for stress recovery in everyday life.

3 Empirical Studies

Three empirical studies were conducted to fulfill the primary aim, and one study to fulfill the secondary aim, of the thesis. In this section these studies will be described. First, aspects related to several studies will be reported. Then, each study will be described separately focusing on aspects unique for respective study. Most aspects will be summarized whereas some, especially the measuring instruments used, will be described in more detail in this section than in the papers, where they are described only briefly.

Designs, Participants and Main Analyses

The first three studies are intervention studies that aimed at evaluating stress and health-related effects of a behavioral stress recovery intervention labeled “balance in everyday life (BEL)”. The intervention was delivered individually in the first study and in a group format in the two subsequent studies. The research designs used in these studies were single-subject experimental design ($N=3$), quasi-experimental design ($N=22$) and randomized controlled design ($N=73$) respectively. In both group intervention studies, waiting-list control groups were used. Participants perceiving high levels of stress were included in all three studies. The main analyses used were visual inspection (study 1), repeated measures analysis of variance (ANOVA; study 2) and one-way analysis of covariance (ANCOVA; study 3) respectively. Between-groups effect sizes at postassessment (in study 2 and 3) and at follow-up (in study 3) were calculated using Cohen’s d : $(M^{\text{INT}} - M^{\text{WLC}})/SD^{\text{pooled}}$; Cohen, 1988). The fourth study was a psychometric study in which a Swedish version of REQ was internally examined using factor analysis. The analyses were performed on data from a randomized sample ($N = 815$) from a general Swedish population. In all studies, the analyses were performed on self-report data. The participants in the psychometric study were recruited from Sundsvall and Östersund, both medium sized communities in Sweden, whereas the intervention studies were conducted in Östersund. For information about background and demographical data, the reader is referred to the papers.

The Tested Intervention: Balance in Everyday Life

The BEL was developed and designed for people experiencing high levels of stress behaviors presumably using recovery behaviors inadequately in terms of frequency, duration and/or inefficiency. In addition to a biopsychosocial model (Pilgrim, 2015) and behavioral (in particular operant) principles (Sundel & Sundel, 2018), the intervention is based on theories and empirical data regarding stress and recovery (described in the introduction), and uses CBT-techniques (O'Donohue, et al., 2003).

The Primary Principles and Targets

The intervention aims at supporting the individual to act in a way that facilitates so called autonomic balance, i.e., balance between effort/stress activation and stress deactivation; resource consumption and resource restoration, in everyday life. Primary targets in the intervention are 1) tension release training, and 2) the practice of (potential) recovery behaviors. The intervention supports new recovery behaviors (*behavioral generalization*; Sarafino, 2001)⁴, and the use of historically successful recovery behaviors in new situations (*situational generalization*; Skinner, 1953)⁵, at work and outside of work. The general behavioral goal is to 1) be observant of tension/arousal and effects of tension/stress, i.e., resource depletion, particularly indicated by fatigue, 2) use (potential) recovery behaviors after such observations, and 3) observe and evaluate recovery effects (i.e., resource restoration) of applied recovery behaviors. Topographically specific behaviors (e.g., being in nature, listening to music, and physical activation in between stress and relaxation) that in research have been shown to predict, or at least correlate with, measures of stress recovery are generally recommended to be tested and evaluated in different contexts. Importantly, the individual is highly recommended to come up with and evaluate different potential recovery behaviors.

⁴ The rationale for supporting behavioral generalization is to develop a broad behavioral repertoire of (potential) recovery behaviors, in order increase to possibility of having access to a behavior that is possible to perform and that could be recovery beneficial in the specific situation in which the person is.

⁵ The rationale for supporting situational generalization is to increase the likelihood that the person will use a recovery behavior when experiencing a need for recovery in as many situations as possible.

The Basic Structure of Sessions

Each session (except session one) started with a short relaxation training, followed by a discussion about the experiences of the previous homework assignment. After this, eventual new intervention components were introduced and used. Finally, the sessions ended with new homework assignments. The discussion and the assignments always focused on relaxation training and the testing and use of (potential) recovery behaviors.

Applied Tension Release

The relaxation training method ATR (Almén, 2017; Laaksonen et al., 2011; Lisspers & Almén, 2009) is based on the CBT-intervention *applied relaxation* (Öst, 1987, 2002). The purpose of ATR (and applied relaxation) is to teach a coping skill. In most studies the skill has been used to reduce anxiety responses in phobic situations which thereby makes it easier to approach and stay in anxiety provoking situations. What is new in the BEL is the usage of ATR not during stress situations, but afterwards, and during breaks from, stress situations. Important differences between applied relaxation and ATR are that the latter has fewer training components, takes a shorter time to teach, starts the application training much earlier, and requires less therapist resources, particularly since audio instructions are used. Another difference is that ATR has only been evaluated briefly and only together with other intervention components (Amsberg et al., 2009; Laaksonen et al., 2011; Lisspers & Almén, 2009) whereas applied relaxation has been evaluated and demonstrated to be effective in a wide range of studies.

ATR and applied relaxation are based on learning theory and the relaxational method *progressive relaxation* (Jacobson, 1925). Both programs start with progressive relaxational exercises lasting up to twenty minutes. This is a step towards achieving the end goal: To be able to reduce tension in about half a minute. A characteristic aspect of the methods is the portability: The methods are available through the person's own existence (as long as she/he is awake). A very important part is to learn to observe tension (and implicitly relaxation), particularly unnecessary and unwanted tension, in order to release that tension. The milder the tension, the more difficult it is to observe, and the more likely it is to last for a long time, and the milder the tension, the easier it may be – if observed – to prevent it from being highly intense and prolonged. In ATR, observational training regarding tension is done primarily in two ways. First, it is done by self-rating the level (scale 0–

100) of tension before and after each relaxation exercise. Noticing skill improvements is assumed to increase the motivation to further train, and use, the method. In addition, lack of improvements is important to notice in order to analyze and problem-solve the situation. Secondly, it is done by a behavioral sequence repeatedly used in all tension release exercises.

Regardless of which exercise is done in ATR, the following central behavioral sequence is included: (1) observe if you are tense, and if so, where the tension is located and how it feels, (2) take a deep (but not excessively deep) breath with your stomach, and (3) exhale slowly, think "RE-LAX" and relax in your whole body as much as possible (and according to what is appropriate). The training starts with the program "tension release long, program 1", which is a form of progressive relaxation, lasting about fifteen to twenty minutes. The person varies between lying down and sitting. Different parts of the body are tensed followed by tension release. In the beginning all training is based on external instructions (mp3-files were used in the intervention studies in this thesis). Finally, the person is instructed to tense and then relax their whole body. The main purpose for intentionally tensing the body is to make it easier to observe (unnecessary and unwanted) tension, and then practice releasing these tensions. The participant is encouraged to train in different positions, and gradually train more and more without using the external audio instructions. Self-instructional training starts around week two. The purpose of self-instructions is to be able to release tension immediately, anytime, anywhere when tensions release is wanted. After one or two weeks of training, a shorter version of the long relaxation, called "tension release long, program 2", is introduced. This program lasts eight to fifteen minutes. During the first week of using this program the participant is encouraged to vary between the two programs. The main difference between the programs is the duration and that the person in program 2 is instructed to only tense and relax the whole body, as well as only tense moderately. An additional audio program, called "tension release long, program 3", which is not a mandatory part of the training, consists of five minutes of music. Music is played several times in between the instructions in the two previously described programs. While the person is listening to the music, she/he trains to release unnecessary tension in accordance with the instructions given in "tension release long, program 2" without hearing them. The idea is that the music will become a learned tension release stimulus that is helping the person to reduce tension without external instructions.

One to three weeks into ATR-training, “short tension release (STR)” is introduced. This consists of exclusively applying the three componential behavioral sequences described above as many times as needed. Initially, the STR is trained in a variety of everyday situations. To succeed, the person places red tapes, whose aim is to function as signals to practice STR, in her/his natural environment, wherever she/he is and whatever she/he is doing, fifteen seconds at least. If possible, the person can take a break from the current activity while training STR. The training goal is at least 10 STR-exercises per day. After a period of training, the goal in the BEL is to apply STR while involved in recovery activities. The aim is to increase the level of psychophysiological deactivation and consequently the recovery outcomes.

The BEL – A Context for Recovery Behaviors

A fundamental aspect of the intervention is to create context, i.e., anticipatory and reinforcing stimuli, for the target behaviors. Examples of intervention components used primarily to fulfill antecedent functions are psychoeducation about short-term and prolonged stress and recovery and its connection to behavior, rationale for a behavior change, many examples of topographically different behaviors with possible recovery functions in many situations, formulation of behavior goals, and homework assignments at the end of each session. In the two group-based interventions (study 2 and 3), pre-determined tasks between each session were used and a summary of the intervention and each session, including these tasks and working materials, were available in a digital web support system. Examples of important components in the intervention with the aim of increasing the chance that recovery behaviors would be reinforced were questions from the therapist about appetitive recovery behavior effects, positive feedback from the therapist regarding “recovery behavior trials”, participants telling each other about such effects (when the intervention was delivered in a group setting), selective focus from the therapist on successes rather than failures (both regarding applying a goal behavior and experiencing beneficial effects of the applied behavior), information about whether behavior plans have been put into action and if the actions have made the person come closer to her goals, and monitoring recovery behaviors in a diary.

General CBT-Components

Psychoeducation and Rationale

It is common practice in CBT to give psychoeducation and a rationale for the treatment content before starting the treatment (e.g., Beck, 2021). Although psychoeducation in CBT is not an intervention but a preparatory method used before intervening a problem, it can lead to effects by itself (e.g., stress reduction; Van Daele et al., 2012). The psychoeducation and rationale used can be summarized as follows: "Stress is a normal part of life and stress in the form of exertion is important for health, wellbeing, and quality of life. However, prolonged stress reactions and lack of recovery carry a risk of deteriorating health, wellbeing, and function. If we recover in an adequate way in our free time and at work, we can handle relatively high levels of stress and effort. The more stress you have in your life, the more recovery you need. However, it is often particularly difficult to recover in a good way when we need it the most. Everyone can learn to recover better, more often and with higher efficiency, and the BEL consists of systematic training support to achieve this. In the BEL you get to explore which ways to recover are functional for you in different situations. Something that is included for all participants to work on is to strengthen the ability to deactivate in poststress situations, no matter what recovery activity you engage in, to strengthen the recovery processes."

Importantly, we did not give any rationale or intentional support for stress reduction when exposed to external stressors, such as work demands and interpersonal conflicts. Not because we assumed this would not have been effective, but because we wanted to investigate a pure stress recovery intervention.

Rule-Governed Behavior

Rule-governed behavior refers to behavior that is a function of a rule that describes contingencies (Skinner, 1969). This can be compared to behaviors that occur due to previous contact with actual contingencies. In the BEL, rule-governed behavior was used as a method to make it functional to use recovery behaviors before the individual was exposed to actual contingencies (antecedents-behaviors-reinforcing consequences). The used rule could be described as follows: "After a period of stress, tension or effort, or moderate levels of fatigue (antecedent), use a behavior that you anticipate will lead to recovery outcomes (consequences)." According to the theory of

rule-governed behavior, the individual may use the recovery behaviors in order “to do the right thing” even in the absence of experienced consequences that the rule postulates should follow the behavior. This may motivate the person to continue to use recovery behaviors even if they have not yet experienced positive consequences of the new behaviors. A further purpose of the rule was to create a theoretical model that the person could evaluate their new behaviors according to, and an assumption was that, according to the rule, postulated contingencies and the actual contingencies (the person having experiences in accordance with the rule) would mutually reinforce each other.

Goals

Goals are often used as a method in CBT (Ramnerö & Jansson, 2016). Approach goals are related to wellbeing whereas avoidance goals are related to poor wellbeing (Dickson & MacLeod, 2004a, 2004b). The BEL is generally an approach rather than an avoidant oriented intervention. Accordingly, the individuals were mainly encouraged to specify recovery behavioral goals; what recovery facilitating behaviors to strive towards increasing. The participants were encouraged to personalize recovery behavior goals based on the general behavioral goal of behaving in a recovery facilitating way at work and off-work, using the general recommendation of at least five recovery behaviors á 10 minutes or more per day. In addition, the participants were encouraged to formulate goals regarding accumulated effects (e.g., concerning health and wellbeing) of improved recovery behaviors.

Behavioral Experiment

Behavioral experiment is a CBT technique aiming to test and challenge dysfunctional cognitions (McMillan & Lee, 2010). In addition, I have previously suggested the possibility of using behavioral experiment to test the effectiveness of different behaviors (Almén, 2007, 2017). Accordingly, in the BEL the participants were explicitly and continuously prompted to test the recovery effectiveness of different behaviors in different situations in order to learn how to act as recovery-effectively as possible when recovery was needed.

Homework

Homework assignments are vital in CBT, and it has been shown to increase the effectiveness of therapies (Kazantzis et al., 2010). All sessions in the BEL ended up with homework assignments. The participants were given, based on the content during the current session and previous sessions, general recommendations for coming up with a behavior plan. The primary, and continuously used, homework tasks were relaxation training and application of (potential) recovery behaviors.

Behavioral Diaries

Behavioral diaries are often used in CBT (e.g., Beck, 2021; Öst, 1987). To support learning, two diaries were used: A *relaxation training diary* and a *recovery behavior diary*. The relaxation training diary consisted of two parts, one for “tension release long” and one for STR. In the former, the participant monitored which program she/he had completed and at what time, bodily position, if external instructions had been used, and the degree of tension (scale 0–100) before and after the completion of the program. Regarding the STR part of the diary, the person estimated how many exercises had taken place during the day. Finally, the person was asked to briefly comment on today's ATR training. The following questions were included in the recovery behavior diary: What recovery behavior (activity) had been performed and at what time, the duration of the behavior, whether the level of relaxation had increased (scale 1–4), and what (if any) recovery effects (such as increased levels of alertness) were observed immediately after the completion of the (potential) recovery behavior. After session three, the participant was also asked whether ATR had been used when she/he performed a reported recovery behavior.

Web Platform

In study 2 and 3, a web platform was used in between the live meetings containing a summary of the meetings, description of homework assignments, and the diaries.

Outcome Measures

In this section, the outcome measures, which were all self-report measures, used in the intervention studies are described.

Perceived Stress Scale

The PSS-14 is a widely used instrument which contains 14 items (7 reversed items; scale 0–4; 0 = *never*, 4 = *very often*; range 0–56). The scale aims to measure the degree to which situations in a person's everyday life are appraised as stressful in terms of uncontrollability, unpredictability, and overload (Cohen & Williamson, 1988).

In a psychometric study of the Swedish version of PSS-14, no indication of ceiling or floor effects was found, which indicates that the instrument can work well for both people with low and high levels of perceived stress (Eklund et al., 2014).

A 10-item version of the scale (PSS-10) has been tested and both PSS-14 and PSS-10 have demonstrated good psychometric properties (a four-item version of PSS has also been tested but will not be discussed here except that its psychometric properties have not proven to be good; Cohen & Williamson, 1988; Lee, 2012).

The internal consistency (i.e., Cronbach's α) for both PSS-14 and PSS-10 usually shows to be around or above .80 (e.g., Eklund et al., 2014; Eskin & Parr, 1996; Nordin & Nordin, 2013). Also, the test-retest reliability has proven to be satisfactory (Wongpakaran & Wongpakaran, 2010).

The correlation between perceived stress and several clinically relevant variables is high. For example, in the study by Nordin and Nordin (2013), perceived stress correlated .57 with depression, .68 with anxiety, and .71 with exhaustion.

Several studies using exploratory factor analysis and/or rasch analysis have found statistical support that the scale is two-dimensional consisting of one "negative" dimension (non-reversed items) and one "positive" dimension (non-reversed items; e.g., Eklund et al., 2014; Nielsen et al., 2016; Nordin & Nordin, 2013; Wongpakaran & Wongpakaran, 2010). However, researchers (e.g., Nordin & Nordin, 2013) do not find theoretical reasons to consider PSS a two-dimensional scale, but rather a unidimensional scale.

The mean total score for PSS-14 in a Swedish student population was 24.4 (Eskin & Parr, 1996), whereas the mean values in the study by Cohen et al. (1983) for two student samples were 23.2 and 23.7, respectively, and 25.0 for a smoking cessation sample. In the study by Nordin and Nordin (2013),

the mean total score of PSS-10 for a general Swedish population was 14.0 (14.6 for women and 13.2 for men). Among a sample of women with stress-related disorders, the mean value of PSS-14 was 30 (*SD* 8.6; Eklund et al., 2014).

PSS was used as an outcome measure in study 1–3. In study 1 and 3, PSS-14 was used whereas PSS-10 was used in study 2. In study 2, mean values across all items were calculated as scores, which means that the range of the scale was 0–4. In study 1 and 3, PSS-14 (>24 points) was also used as a criterion for participants to be included in the study.

Self-Rating Measurement of Stress Symptoms

For study 1, a self-rating measure consisting of eight items was developed to collect data on experiences of stress symptoms, i.e., stress activation and resource depletion. Based on the question “How are you feeling right now?” the participants estimated the following variables on a scale from 0 (*not at all*) to 4 (*very much*): “Physically wound up/stressed”, “mentally wound up/stressed,” “hurried and/or pressured,” “irritable and/or angry,” “restless and/or anxious,” “physically fatigued,” “mentally fatigued”, and “unenergetic and/or uninspired.” The mean of these variables per week was calculated. Working and nonworking days were analyzed separately. Notably, the psychometric properties of the measure have not been tested.

Melamed Burnout Questionnaire and the Tension Scale

The SMBQ and the Shirom-Melamed Burnout measure have sometimes been represented as two different measures (e.g., Lundgren-Nilsson et al., 2012), and at other times as the same measure (e.g., Shirom & Melamed, 2006). Although the literature gives the impression that different such measures are the same, different numbers of the following subscales have been included in the measures: *Emotional exhaustion and physiological fatigue*, *Cognitive weariness*, *Listlessness*, *Tension*, and *Emotional exhaustion* in relation to customers etc. Also, a different number of items have been included in some of the subscales. In Sweden, a 22-item version of the measure (SMBQ-22) consisting of the subscale’s Emotional exhaustion and physiological fatigue (8 items, 1 reversed), Cognitive weariness (6 items, 0 reversed), Listlessness (4 items, 3 reversed), and Tension (4 items, 1 reversed) has been used the most frequently (e.g., Dahlgren et al., 2022; Lindsäter et al., 2018).

In study 1 and 2, SMBQ-22 was used. The main reason for not using the subscale covering questions about emotional exhaustion in relation to customers etc. was that the aim of measuring burnout context-free and that this subscale solely covers work-related experiences. In study 3, Burnout was measured with an 18-item version of the measure (labeled SMBQ-18 in the present thesis), which consisted of the same items and same factors as SMBQ-22 except Tension. The exclusion of the Tension subscale was based on a psychometric study by Lundgren-Nilsson et al. (2012; which I was not aware of when working with study 1 and 2) that showed satisfactory model fit without but not with Tension included. In study 3, Tension was used as a separate measure. There are also theoretical reasons for the exclusion: Tension is a component of stress behavior, which causes or contributes to health, such as burnout/exhaustion (e.g., Brosschot, 2010; McEwen, 2002). In addition, it is a conceivable measure of stress according to the definition by Selye (1974).

A general Swedish population study demonstrated internal consistencies (Cronbach α s) between .90 and .96 for different versions of SMBQ/M (Almén & Jansson, 2021). The same study showed an internal consistency (i.e., composite reliability) of .83 for Tension. As expected, Tension highly correlated with Emotional exhaustion and physiological fatigue (.86), Cognitive weariness (.82), and Listlessness (.74).

All items are scored on a 7-point scale ranging from 1 (*almost never*) to 7 (*almost always*). The total SMBQ-score, as well as the score on Tension, consists of the mean value across all items. In Sweden, different scores have been used as a threshold for high or severe levels of burnout, e.g., ≥ 3.75 (Grossi et al., 2003) and ≥ 4.00 for SMBQ-22 (Soares et al., 2007), and ≥ 4.4 for SMBQ-18 (Lundgren-Nilsson et al., 2012). A more recent study by Almén and Jansson (2021) suggested ≥ 4.2 for moderately high and ≥ 5.1 for very high levels of burnout on both (revised versions) of SMBQ-22 and SMBQ-18.

Recovery Behavior Scale

The Recovery behavior scale (RBS) was developed for study 2 and was used to assess the frequency of (potential) recovery behaviors in everyday life outside work. The RBS comprised twelve examples of such behaviors, such as: “I take a coffee break”, “I sit or lie down and rest for a while”, “I take a good break from doing something tiring”, “I use some formal method of relaxation, meditation, yoga or the like”, and “I take a slow walk”. These items were to be rated according to how frequently each behavior was used

on a five-point Likert scale (0 = *never* to 4 = *at least once a day*). The instructions given were as follows: "There are many different activities that we can do to interrupt what we are doing, and which may make us cope with load better and become less exhausted. Below is a list of different activities that many people do for that purpose and which for some, and at least sometimes, can make a person wind down. How often do you usually do the following?" The mean value was calculated and used as an overall frequency score. Some psychometric tests have been performed on a general Swedish population sample ($N = 774$; Almén, 2022). The tests showed a Cronbach's α value of .76 and the scale correlated -.29 with PSS, .39 with REQ, -.25 with the Anxiety subscale of the Hospital Anxiety and Depression Scale (HAD-a), -.31 with the Depression subscale of the Hospital Anxiety and Depression Scale (HAD-d), -.22 with SMBQ-22, .49 with the Recovery at Work Questionnaire (RWQ), and -.24 with the Rest and Recovery From Work measure (RRW)⁶.

Recovery at Work Questionnaire

The RWQ was also developed for study 2. The aim was to measure frequencies of behavior with the potential of leading to psychophysiological deactivation and recovery effects at work. The instrument included six items, for example: "How often do you take a break from what you are working on?", "How often do you choose a completely different work task to take a break and try to wind down?", and "How often do you take a coffee break (for at least 10 minutes)?" A Likert scale (0 = *never* to 4 = *several times a day*) was used, and the mean was calculated and used as an overall frequency score. Some psychometric analyses have been performed on a general Swedish population sample ($N = 134$; Almén, 2022): The Cronbach's α was .78 and the scale correlated -.26 with PSS, .39 with REQ, -.23 with HAD-a, -.22 with HAD-d, -.25 with SMBQ-22, and .49 with RBS.

An index labeled Combined Recovery Behavior Frequency Index (CRBFx) was calculated as the mean of the overall scores (scale 0–4) of the RBS and the RWQ. The Cronbach's α for a general Swedish population sample ($N = 123$) for the index was .85 (Almén, 2022). The RBS, RWQ and CRBFx were used as primary behavioral outcome variables in study 2.

⁶ In paper 2 the scale is called *Recovery scale* (RCS).

Rest and Recovery From Work

A shortened 8 item version of the RRW (scale 1–5; 1 = *never*, 5 = *very often*; Gustafsson et al., 2008) was used to measure unwinding and recuperation from work stress in study 1 and 2. Examples of questions are as follows: “During the past three months, have you had difficulties sleeping because work-related thoughts have kept you awake?”, “Do you feel thoroughly rested when you start working in the morning?”, and “Do you experience mental fatigue after a working day?”

Some psychometric analyses have been performed on a general Swedish population sample ($N = 776$; Almén, 2022). The Cronbach’s α was .86, which can be compared with a Cronbach’s α value of .86 for the original scale consisting of 15 items (Gustafsson, et al., 2008). The scale correlated .60 with PSS, .60 with REQ, -.64 with HAD-a, -.56 with HAD-d, .80 with SMBQ-22, -.24 with RBS, and -.28 with RWQ. The original scale has shown to correlate with salivary cortisol levels (Gustafsson et al., 2008).

A combined index labeled Combined Clinical Stress and Recovery Index (CCSRx; scale 0–4) was calculated as the mean of the overall scores of PSS and the RRW after transforming the item-scores on the RRW to 0–4 (the scale used in PSS). PSS, RRW and CCSRx were used as primary clinical outcome variables in study 2.

Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HAD) includes two subscales aiming to measure anxiety and depression, respectively (Zigmond & Snaith, 1983). Each subscale contains 7 items (scale 0–3). A score of 0–7 corresponds to a *low level (a non-clinical case)*, 8–10 to a *moderate level (a possible clinical case)*, and 11–21 to a *high level (a probable clinical case)*.

The instrument was designed for non-psychiatric patients (Zigmond & Snaith, 1983). An important characteristic of the HAD is that it mainly contains questions about emotional and cognitive aspects of anxiety and depression, i.e., the number of physical indicators of anxiety and depression are limited. This has an advantage: The risk that symptoms due to somatic conditions (such as physical exhaustion), which are similar or identical to the somatic symptoms that often occur in anxiety and depression respectively, do not incorrectly lead to higher scores on anxiety and depression.

The HAD has been validated for several populations, such as non-clinical populations, hospital outpatients, psychiatric outpatients, hospital

inpatients, chronic fatigue syndrome, eating disorders, intellectual disabilities, coronary heart disease, and musculoskeletal pain (Cosco et al., 2012). The psychometrics of the HAD have been demonstrated to be good, for example regarding sensitivity, specificity, and reliability (Bjelland et al., 2002; Brennan et al., 2010; Herrmann, 1997). A systematic review of studies (N=50) analyzing the factorial structure of the HAD showed mixed results (Cosco et al., 2012). However, most studies have demonstrated a two-factor structure (covering anxiety and depression respectively) of the scale. Lisspers et al. (1997) have internally and externally validated the Swedish version of the HAD as well as reported norm values for a general Swedish population aged between 30 and 59 years (the sample was selected from the same region as the participants in the intervention studies included in the present thesis). The study indicated that the Swedish version of the HAD is two-dimensional. The Cronbach's α s were satisfactory for both anxiety (.84) and depression (.82), and for the total scale (.90). The mean score on the total HAD, HAD-a, and HAD-d were 8.53, 4.55 and 3.98, respectively. The two subscales were used as separate measures in all three intervention studies.

Penn State Worry Questionnaire

The Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990) is a widely used instrument when measuring worry. The instrument was used in study 1 and 2. The reliability has been demonstrated as satisfactory (internal consistency .95, 1-month test-retest correlation .93, and 4-month test-retest correlation .74, Meyer, et al., 1990). Worry is closely related to anxiety (Borkovec, 1998). However, PSWQ measures a construct separated from anxiety (and depression; Meyer et al., 1990). In study 1, the original 16 item version of the scale (labeled PSWQ-16 in the thesis) was used with the following thresholds: 16–29 (*very low worry*), 29–38 (*low worry*), 39–48 (*average worry*), 49–59 (*high worry*), and 60–80 (*very high worry*; van der Heiden et al., 2009). In study 2, the “ultra-brief” three-item version of the instrument (labeled PSWQ-3 in the thesis) was used (Berle et al., 2011). The psychometric properties have shown to be similar to those of the original scale (Berle et al., 2011; Kertz et al., 2014). For example, it has demonstrated an internal consistency of .85 compared to .91 for the original scale (Berle et al., 2011).

Everyday Life Stress Scale

The Everyday Life Stress Scale (ELSS⁷) was used in study 1 and 2 to measure type A behavior. The original scale, which contains 20 items (labeled ELSS-20 in the thesis; scale 1–4; Burell, 1996; Claesson et al., 2003), was used in study 1, whereas a brief 9-item version of the scale (labeled ELSS-9; scale 0–3) was used in study 2. The anchors of the scale represent “*almost never*” and “*almost always*”, respectively. The ELSS consists of statements referring to stress-related behavior in everyday life, mainly focusing on competitiveness, perceived time urgency, impatience, anger and hostility (e.g., “I move quickly, as if in a hurry”, “I am wound up and push myself”, “I get annoyed at people who are clumsy or sloppy” and “I feel irritated and upset”).

Some psychometric tests have been performed on a general Swedish population sample (Almén, 2022): The average score for ELSS was 41.9 (*SD* 10.9; *N*=811) and the Cronbach’s α was .89. The average score was 1.25 (*SD* .64; *N*=798) and the Cronbach’s α was .86 for ELSS-9. The correlation between the scales was .94. The correlation between ELSS-9 was .51 with PSS-14, -.49 with REQ, .60 with HAD-a, .42 with HAD-d, .53 with SMBQ-22, -.23 with RBS and -.29 with RWQ.

Karolinska Sleep Questionnaire

The 18-item version of the KSQ (labeled KSQ-18 in the thesis) aims to measure nocturnal insomnia symptoms (scale 1–5; 1 = never, 5 = always; 7 items; sleep quality, 4 items, and non-restorative sleep, 3 items), sleep apnea (3 items), sleepiness (6 items), sleeping too few hours (1 item) and nightmares (1 item; Nordin et al., 2013). In study 1, a total score for all items was reported. In study 2, a three-item sleep quality index was used (Leineweber et al., 2003). This index (labeled KSQ-3) consisted of the following items from the KSQ: “difficulties falling asleep”, “disturbed/restless sleep” and “premature awakening”. Mean values of the item-scores were reported. Studies have demonstrated satisfactory internal consistency for the three-item sleep quality index (Cronbach’s α : .80; Kecklund & Åkerstedt, 1992). In the study by Nordin et al. (2013), KSQ-18 correlated .40 with PSS-10, .53 with SMBQ-22, .50 with HAD-a and .46 with HAD-d.

⁷ The acronym ELS was used in study 2.

Overcommitment to Work Measure

In study 2, OCW was measured with six items (scale 1–4; Joksimovic et al., 2002; Leineweber et al., 2010). The measure has demonstrated satisfactory internal consistency (i.e., Cronbach's α .85; Leineweber et al., 2010). However, the scale would benefit from further psychometric testing.

Study 1

Almén, N., Lisspers, J., & Öst, L.-G. (2020). Stress recovery management: A pilot study using a single-subject experimental design. *Behavior Modification*, 44(3), 449-466. <https://doi.org/10.1177/0145445518825363>

Aims

The primary purpose of the study was to investigate whether the BEL, delivered in an individual setting, could reduce stress symptoms, particularly during working days, among individuals perceiving high levels of stress in life. The secondary purpose was to investigate whether the intervention was followed by a reduction in perceived stress, anxiety, depression, burnout, worry, type A behavior, unwinding and recuperation from work stress, and sleep.

Method

Procedure and Design

A single-subject multiple-baseline design (with follow-up) across individuals was used to evaluate the effects of the intervention (Barlow et al., 2008; Kazdin, 2011, 2017). Data regarding stress symptoms were collected three times a day, at 12:00, 17:00, and 21:00, during baseline and intervention, and during a 1-week period at the 1-year and 5-year follow-up. These data were supplemented by self-report inventories at the start of baseline, at the start and the end of intervention, and at the 1-year and 5-year follow-up.

Participants

Participants were recruited at a government authority. Inclusion was based on a self-perceived need to reduce one's stress symptoms, scores above 24

points on PSS-14, and a clinical interview potentially excluding individuals with extensive clinical problems. Three individuals applied for participation, fulfilled the described criteria, and were included in the study. No participants were excluded.

Participant 1 was a 34-year-old woman living on her own. She described herself as an active and performance-oriented person who liked her office-work, worked full time and never worked overtime. Her doctor had recommended her to go on sick leave due to stress symptoms, but this had not been implemented. She had previously tried various stress management methods but had not maintained the application of any method.

Participant 2 was a 39-year-old woman who lived together with her husband and their young child. She worked full-time, enjoyed her job and often worked overtime at home. Almost always she experienced time urgency and stress symptoms. She had several hobbies but after becoming a mother she spent very little time on hobbies due to time constraints.

Participant 3 was a 35-year-old man who lived with his wife and their two young children. He worked full-time as a project leader, which he enjoyed even though he experienced a lot of work stress. He often thought that he should perform more or better. Privately, he and his family had many practical problems that interfered with recovery at leisure time. He experienced stress symptoms such as difficulty sleeping at night, irritability, and fatigue.

The intervention

An exclusive component for the version of the BEL used in this study, except delivered in an individual setting, was that the participants at the end of each day evaluated whether the recovery behaviors during the day had been enough in relation to stress and effort (scale 0–4). Moreover, the only intervention material used in this intervention were relaxation instructions (mp3-files), the relaxation diary and the recovery behavior diary (on paper; introduced the first week of the intervention), and the red tape tags that were used as signals for training STR. I (licensed psychologist as well as a licensed psychotherapist trained in cognitive behavior therapy) was the therapist for all three participants.

Assessments

The earlier described self-rating measure created for this study, which included questions about stress symptoms (i.e., stress activation and

resource depletion), and the following self-report inventories were used: PSS-14, HAD-a, HAD-d, SMBQ-22, PSWQ-16, ELSS-20, RRRW, and KSQ-18.

Results

Daily Self-Ratings

On working days, the levels of stress for Participants 1 and 3 were stable during their baseline periods (Figure 1). For Participant 3, reported stress symptoms were reduced somewhat immediately after the baseline measurement started. However, the baseline had been stable for six weeks when the treatment started for this participant. For Participant 1, a trend of reduced stress symptoms was visible during the intervention while the baselines for participants 2 and 3 were stable. For Participant 2, there was also a trend of reduced stress symptoms during the intervention phase, while the levels of stress during baseline for Participant 3 were stable. A trend of reduced stress symptoms can also be observed for Participant 3 during his intervention phase. The mean stress levels during working days were lower during intervention and both follow-up periods compared with baseline periods for all three participants. Regarding maintenance, the stress levels at the 1- and 5-year follow-up assessments for all participants were in parity with or lower than the levels during the intervention period. The trends for working days were similar to those for nonworking days (Figure 2).

Self-Report Inventories

Results from the self-report scales for each participant and mean values across the participants are displayed in Table 1. Regarding single scores, 133 were lower, four the same, and three higher at any postintervention assessment in comparison with any pre-intervention assessment. All means were lower (i.e., better) at the end of the intervention and at the 1- and 5-year follow-up in comparison with the start of baseline and the start of intervention. Regarding cut-off scores for problematically high levels, for the inventories that had this, a clear pattern of improvements can be noted.

Conclusions

The study indicated that a relatively brief version of the BEL delivered in an individual setting leads to beneficial changes in stress symptoms and with

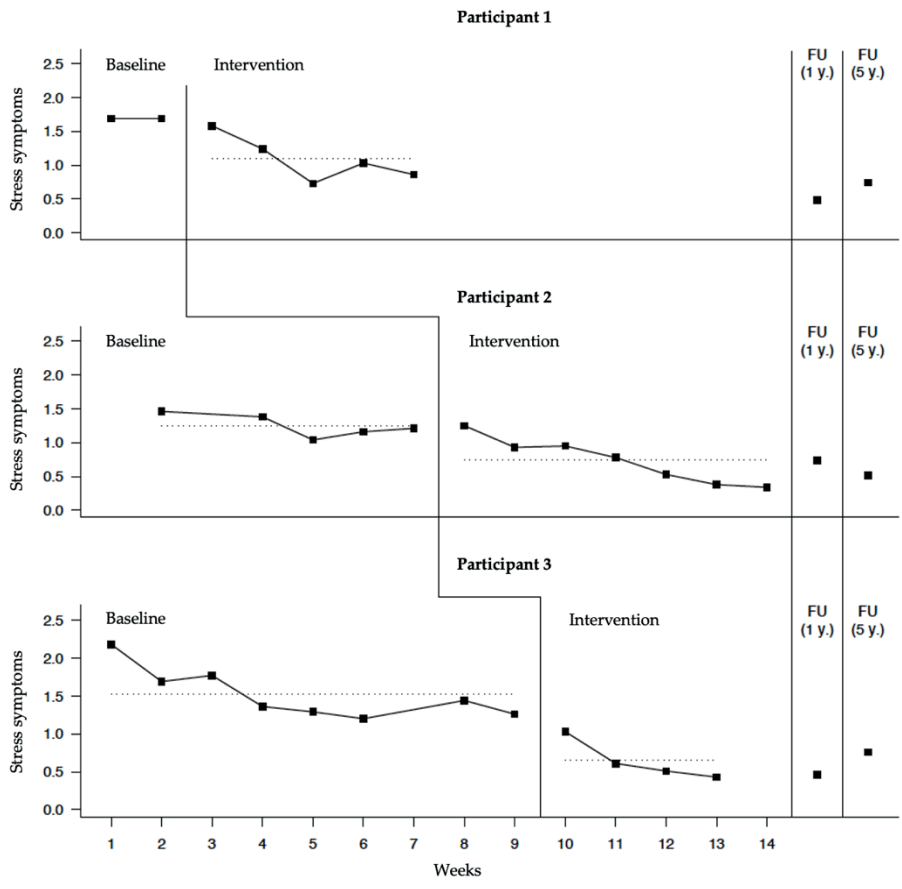


Figure 1. Daily self-ratings (scale 0–4).

Note. Stress symptoms on working days for each participant during baseline, intervention, 1-year FU, and 5-year FU. Each data point represents a mean value for a week of measurements. Dashed lines represent the mean value for a whole period (baseline and intervention). There are no data for Weeks 1 and 3 for Participant 2, and Week 7 for Participant 3, because the participants did not work those weeks. FU = follow-up.

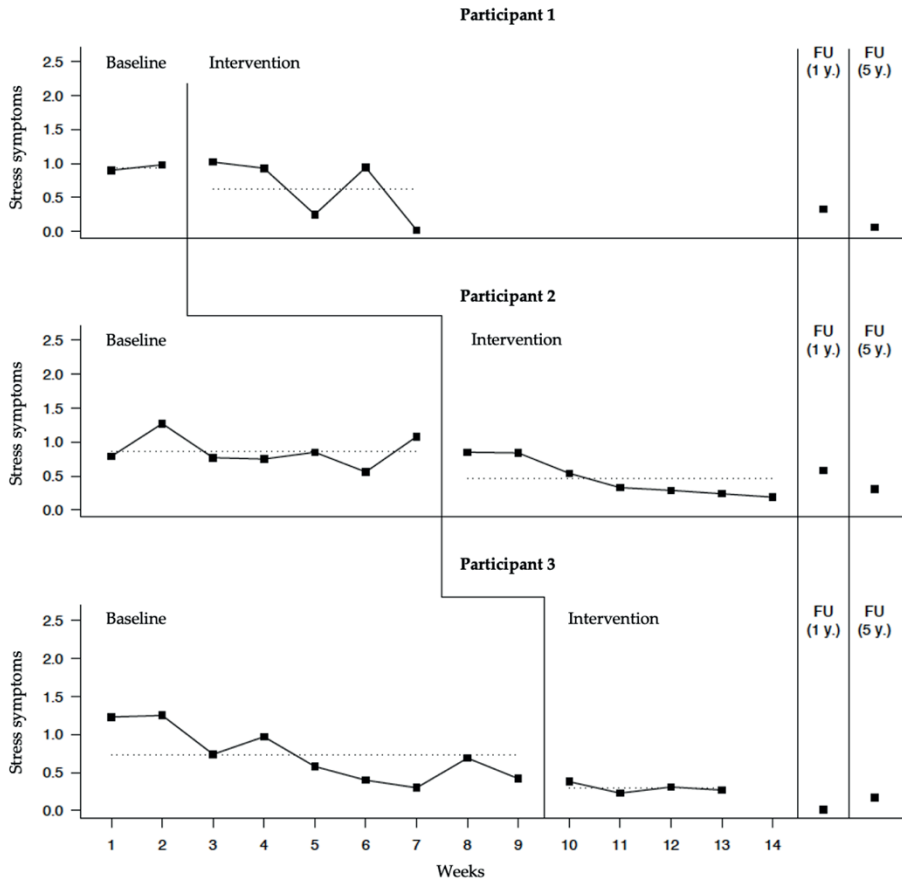


Figure 2. Daily self-ratings (scale 0–4).

Note. Stress symptoms nonworking days for each participant during baseline, intervention, 1-year follow-up, and 5-year follow-up. Each data point represents a mean value for a week of measurements. Dashed lines represent the mean value for a whole period (baseline and intervention). FU = follow-up.

Table 1

Self-Report Inventories for All Participants and Mean Values of Those

Variables (range)	Measurement time	Participant 1		Participant 2		Participant 3		Mean ^b	
		Severity ^a		Severity		Severity		Severity	
PSS (0-56)	Start of baseline	40	high	29	high	38	high	35.7	high
	Start of intervention	26	high	37	high	25	high	29.3	high
	End of intervention	26	high	24	low	13	low	21.0	low
	Follow-up, 1 year	9	low	24	low	17	low	16.7	low
	Follow-up, 5 year	26	high	24	low	16	low	22.0	low
HAD-a (0-21)	Start of baseline	9	moderate	9	moderate	11	high	9.7	moderate
	Start of intervention	16	high	13	high	9	moderate	12.7	high
	End of intervention	7	low	6	low	4	low	5.7	low
	Follow-up, 1 year	3	low	6	low	4	low	4.3	low
	Follow-up, 5 year	3	low	5	low	2	low	3.3	low
HAD-d (0-21)	Start of baseline	7	low	6	low	8	moderate	7.0	low
	Start of intervention	8	moderate	8	moderate	5	low	7.0	low
	End of intervention	5	low	0	low	1	low	2.3	low
	Follow-up, 1 year	0	low	3	low	2	low	1.7	low
	Follow-up, 5 year	2	low	3	low	2	low	2.3	low
SMBQ (1-7)	Start of baseline	6.1	yes	3.9	no	5.4	yes	5.1	yes
	Start of intervention	6.0	yes	4.6	yes	4.9	yes	5.2	yes
	End of intervention	4.9	yes	2.8	no	2.8	no	3.5	no
	Follow-up, 1 year	1.7	no	3.1	no	2.2	no	2.4	no
	Follow-up, 5 year	3.7	no	3.4	no	3.3	no	3.5	no
PSWQ (16-80)	Start of baseline	48	average	48	average	56	high	50.7	high
	Start of intervention	51	high	54	high	26	very low	43.7	average
	End of intervention	45	average	49	high	28	very low	40.7	average
	Follow-up, 1 year	28	very low	41	average	28	very low	32.3	low
	Follow-up, 5 year	31	low	34	low	17	very low	27.3	very low
ELSS (20-80)	Start of baseline	61	-	49	-	63	-	57.7	-
	Start of intervention	-	-	50	-	55	-	52.5	-
	End of intervention	-	-	36	-	50	-	43.0	-
	Follow-up, 1 year	26	-	39	-	50	-	38.3	-
	Follow-up, 5 year	47	-	34	-	45	-	42.0	-
RRW (8-40)	Start of baseline	32	-	25	-	31	-	29.3	-
	Start of intervention	27	-	28	-	24	-	26.3	-
	End of intervention	27	-	25	-	19	-	23.7	-
	Follow-up, 1 year	19	-	25	-	22	-	22.0	-
	Follow-up, 5 year	27	-	19	-	16	-	20.7	-
KSQ (18-108)	Start of baseline	46	-	46	-	51	-	47.7	-
	Start of intervention	40	-	51	-	35	-	42.0	-
	End of intervention	34	-	40	-	27	-	33.7	-
	Follow up, 1-year	22	-	38	-	30	-	30.0	-
	Follow-up, 5 year	43	-	30	-	17	-	30.0	-

Note. Due to technical problems, there was loss of data for ELSS for Participant 1. PSS = Perceived Stress Scale; HAD-a = The anxiety subscale of the Hospital Anxiety and Depression Scale; HAD-d = The depression subscale of the Hospital Anxiety and Depression Scale; SMBQ = Shirom-Melamed Burnout Questionnaire; PSWQ = Penn State Worry Questionnaire; ELSS = Everyday Life Stress Scale; RRW = Rest and Recovery From Work; KSQ = Karolinska Sleep Questionnaire.

^aLevels of severity. There are no cut off scores used for ELSS, RRW, or KSQ.

^bMean value for Participants 1 to 3, except for ELSS, measurement time "start of intervention" and "end of intervention," where the results are mean values for only Participants 1 and 2 due to missing data.

good maintenance. The self-report inventories overall demonstrated lower (i.e., better) scores at the end of intervention and at the two follow-ups in comparison with the scores at the start of baseline and the start of the intervention, which indicates that the BEL has the potential to lead to effects regarding several stress and health-related variables. A measurement weakness in the study was the absence of reliability and validity testing of the measurement used for collecting the daily levels of stress symptoms. An experimental weakness in the study was that the stress-level reduction started early during the baseline measurements for the third participant. However, it was stabilized 6 weeks before the intervention started for him. The result in this pilot study, acknowledging the methodological weaknesses as well as the limits of possible generalization of the results, motivated further exploration of the efficacy of the BEL, for example in terms of a replication study or a study where the intervention was going to be tested in a group setting.

Study 2

Lisspers, J., Almén, N., & Sundin, Ö. (2014). The effects of a recovery-focused program for stress management in women – An exploratory study. *Health, 6*, 2825-2836. <http://dx.doi.org/10.4236/health.2014.620321>

Aims

The aim of the study was to investigate whether the BEL, delivered in a group setting, would lead to beneficial effects regarding stress and health-related variables among women perceiving high levels of stress in life. An additional aim was to analyze stress-related behavioral patterns and (potential) recovery behaviors as predictor of perceived stress and feelings of rest and being recovered.

Method

Procedure, Design and Participants

Employees of the local city council, in the context of a work place health project, were invited to participate in the BEL. A quasi-experimental design was used (randomized allocation of participants was unfortunately not possible). Employees who perceived high levels of stress in life and were

interested in participating in the intervention were allowed to participate. Two intervention waves were carried out. First, applications were accepted for wave one out of two waves. When the first wave was filled up, applications for the second wave were accepted. Those included in the second wave constituted a WLC-group for the participants in the first wave, which constituted the intervention group (INT). Data from participants who dropped out from the intervention or who completed the intervention but did not want to participate in the study were excluded in the analyses. In addition, since only eight participants were males and none of them applied for the second intervention wave (i.e., the WLC), all males were excluded in the analyses. Forty-three individuals applied to participate in the intervention and 32 were included in the analyses.

Intervention

Six to nine participants were included in each group. The intervention consisted of six three-hour sessions scheduled over a period of approximately ten weeks (one session a week during the first three weeks and then gradually greater intervals between sessions). Exclusive for this study in the thesis was a recommendation to practice different “recovery behavior drills” (such as eating slowly and relaxing in waiting situations) each week at work and outside of work, testing different recovery potential activities such as Qigong and “Nordic walking” during the last hour of each group session, and review and discussions of each participant’s pre-post results of outcome measures during the last session. One group in the first wave and one group in the second wave was run by two pairs of clinical psychology Master of Science students, and one group in each wave was run by me (who also educated and supervised the student therapists in leading the intervention).

Assessment

Primary measures were RBS, RWQ, CRBFx (behavioral variables), PSS-10, RRW and CCSRx (clinical variables). These were secondary measures: ELSS-9, OCW, PSWQ-3 (behavioral variables), SMBQ-22, HAD-a, HAD-a and KSQ-3 (clinical variables).

Statistical Analyses

Effect analyses. The mean changes from pre- to postassessment were compared between the INT and the WLC. In addition, to confirm the results, changes between pre- and postassessment for the INT were compared to the changes from pre- to postassessment for the participants who took part in the second wave of the intervention. The analyses were performed using repeated measures ANOVA.

Prediction analysis. Pre-post change scores regarding the recovery behavior measures RBS and RWQ as well as the stress behavior measures ELSS, OCW and PSWQ were used as predictor variables in a linear multiple regression analysis with change in CCSRx as the dependent factor. A critical α -level of .05 was adopted in all analyses.

Results

Effects of the Intervention

No significant differences on any outcome variable were found between the INT ($n = 15$) and the WLC ($n = 17$) at preassessment. Means for the outcome variables at pre- and postassessments for the INT and the WLC, p -values, and between group effect sizes (Cohen's d) are presented in Table 2.

Primary outcome variables. Regarding the primary behavioral outcome variables, there were significant group*phase interactions in the repeated measures ANOVA for RBS (recovery behaviors outside work; $d = 0.67$), RWQ (recovery behaviors at work; $d = 0.60$) and CRBFx (index of RBS and RWQ; $d = 0.74$). Regarding the primary clinical outcome variables, there were significant group*phase interactions in the repeated measures ANOVA for PSS (perceived stress; $d = 1.17$), RRW (feelings of recovery; $d = 0.89$) and CCSRx (index of PSS and RRW; $d = 1.27$).

Secondary outcome variables. There were significant group*phase interactions in the repeated measures ANOVA for the secondary behavioral outcome variables ELSS (type A behavior; $d = 0.85$), OCW (overcommitment to work; $d = 0.52$) and PSWQ (worry; $d = 0.67$). For the secondary clinical outcome variables there were significant group*phase interactions in the repeated measures ANOVA for SMBQ (burnout; $d = 0.54$), HAD-a (anxiety; $d = 0.60$), and HAD-d (depression; $d = 0.89$) but not for KSQ (sleep; $d = 0.37$). There were no significant differences in intervention effects between the two waves of intervention.

Table 2

Means for Outcome Variables at Pre- and Postassessments for the INT and the WLC, *p*-values from Repeated Measures ANOVA, and Between-Group Effects Sizes (Cohen's *d*)

Variables (range)	Pre		Post		<i>p</i>	ES
	M		M			
	INT	WLC	INT	WLC		
Primary behavioral variables						
RBS (0–4)	2.17	1.83	2.83	1.96	<.025	.67
RWQ (0–4)	2.03	1.87	2.41	1.82	<.009	.60
CRBFx (0–4)	2.10	1.85	2.62	1.89	<.001	.74
Primary clinical variables						
PSS (0–4)	1.93	1.82	1.48	1.84	<.025	1.17
RCS (1–5)	3.45	3.29	2.79	3.26	<.001	.89
CCSRx (0–4)	2.19	2.06	1.64	2.06	<.001	1.27
Secondary behavioral variables						
ELSS (0–3)	1.82	1.48	1.36	1.56	<.001	.85
OCW (1–4)	2.68	2.71	2.41	2.80	<.046	.52
PSWQ (0–4)	2.80	2.86	2.16	2.92	<.025	.67
Secondary clinical variables						
SMBQ (1–7)	4.48	3.94	3.60	4.01	<.003	.54
HAD-a (0–21)	9.20	8.65	5.46	8.00	<.005	.60
HAD-d (0–21)	7.47	5.64	3.47	5.00	<.001	.89
KSQ (1–5)	2.44	2.78	1.82	2.57	<i>ns.</i>	.37

Note. INT = intervention group; WLC = waiting list control group; ANOVA = analysis of variance; ES = Effect size; RBS = Recovery Behavior Scale; RWQ = Recovery at Work Questionnaire; CRBFx = Combined Recovery Behavior Frequency (RBS and RWQ) Index; PSS = Perceived Stress Scale; RRW = Rest and Recovery From Work ; CCSRx = Combined Clinical Stress and Recovery (PSS and RRW) Index; ELSS = Everyday Life Stress Scale; OCW = Over commitment to work; PSWQ = Penn State Worry Questionnaire; SMBQ = Shirom–Melamed Burnout Questionnaire; HAD-a = the Anxiety subscale of the Hospital Anxiety and Depression Scale; HAD-d = the depression subscale of the Hospital Anxiety and Depression Scale; KSQ = Karolinska Sleep Questionnaire.

Behavioral Predictors of Clinical Effects

The prediction model was significant ($p = .002$) and accounted for approximately 37% of the variance in CCSRx (perceived stress and feelings of recovery; $R^2 = .458$, Adjusted $R^2 = .365$). Change in RWQ (recovery behaviors at work) received the strongest weight in the model ($p = .005$).

Conclusions

The results indicated that the BEL delivered in a group setting is effective in increasing the frequency of (potential) recovery behaviors at work and outside of work, reducing different stress related-behaviors and achieving clinical effects among women who perceive high levels of stress and who have an interest in improving their stress management skills. Moreover, the results indicated that the change in behavior, in particular recovery behavior at work, explained the changes in perceived stress and feelings of rest and being recovered. The present study had several methodological limitations, particularly the non-random allocation of participants to one of the two conditions and the absence of follow-up assessments. In conclusion, the results were in accordance with the theory in the introduction and the results from the first study. Thus, the BEL merited further research. An appropriate next step was to conduct a randomized controlled trial using follow-up assessments.

Study 3

Almén, N., Lisspers, J., Öst, L-G., & Sundin, Ö. (2020). Behavioral stress recovery management intervention for people with high levels of perceived stress – A randomized controlled trial. *International Journal of Stress Management*, 27(2), 183-194. <https://doi.org/10.1037/str0000140>

Aims

The aim was to further investigate effects on stress and health-related variables of the BEL delivered in a group setting, now with a more rigorous research methodology, for individuals perceiving high levels of stress in life.

Method

Procedure, Design and Participants

Participants were recruited through advertisements in the local newspapers, on Facebook, and on Google. The inclusion criteria were (a) experiences of stress, in particular including stress activation and resource depletion; (b) high levels of perceived stress (>24 on PSS-14); (c) professional work at least 20 hours per week, (d) being aged 25 to 55; (e) having practical possibilities of participating in the program. The exclusion criteria were circumstances that were expected to complicate participation in the program and/or indicated that other interventions were more relevant and should therefore be prioritized. Included participants were randomized to the INT or the WLC. Each group in five waves of allocation consisted of a minimum of 3 and a maximum of 9 participants. Out of 219 individuals who signed up for the study, 73 were subsequently randomized to either the INT ($n = 35$) or the WLC ($n = 38$). An intention-to-treat approach was used.

Assessment

Background data were collected immediately before the intervention. Self-report inventories were used as outcome measures and these data were collected immediately before the intervention (pre), immediately after the intervention (post), and 3-months after the end of the intervention (follow-up). Primary outcome measures were PSS-14, TES, and SMBQ-18. Secondary outcome measures were HAD-a and HAD-d.

Intervention

The intervention was slightly modified in comparison with study 2. In the present study, the intervention consisted of seven 2.5-hour sessions and six phases scheduled over a period of about 10 weeks. In the middle of each session, during a break, the participants were guided to behave as recovery effective as possible. Also, an app was used containing most of the components from the web platform and the therapist sent text messages to the participants two days a week, which were meant to function as antecedents and/or reinforcers of target behaviors. For this study, we developed an additional ATR exercise: “tension release in the presence of tension release disturbing stimuli”. The rationale for this training was that when you need to recover from stress, recovery disturbing stimuli may be

Table 3

Additional description of the intervention contents for each session.

Session	Content
1	<p>Psycho-education on stress and recovery; i.e., differentiation of short-and long-term stress, operationalization of the concept "recovery behavior", and rationale about the role of recovery behaviors (including relaxation skills) in everyday life. Information about the web support platform and the app. Start the training of "tension release long, program 1."</p>
2	<p>Based on a list of different behaviors with possible recovery function in many situations, the subjects rated which ones they used, which of those behaviors usually produced recovery effects, which of the recovery effective behaviors they would like to use more often, in new situations, and what kind of new recovery behaviors they would like to test. Psycho-education about the importance of observing early signs of resource depletion/fatigue. Discussion and analysis of internal and external contextual factors potentially preventing the person from behaving in a recovery effective way, and reflection on how to cope with those potential obstacles. Start "tension release long, program 2."</p>
3	<p>Analysis of which internal and external contextual factors that potentially support recovery effective behaviors and reflecting on how to use those factors more often. Formulation of personal goals regarding recovery behaviors, and "recovery effects" (e.g., reduction of stress symptoms, higher levels of well-being, quality of life and functionality at home and at work). Start the training of "STR".</p>
4	<p>Training "tension release long, program 2" in the presence of potentially recovery disturbing stimuli (e.g., noise), or/and while doing something motorically. Sleep supporting behaviors; the participants received a written text consisting of various sleep advice subsequently discussed based on the participants' questions. The sleep supporting behavior most emphasized was recovery behaviors during the day and evening.</p>
5	<p>Prepare to use relaxation skills in recovery situations (e.g., while eating lunch). Pie chart of the various behaviors the subject engaged in during a typical day. Based on the pie chart, an analysis regarding the balance between "effort-behaviors" and recovery behaviors was done. Subsequently the subject formulated a pie chart of an ideal (and achievable) day, which could function as a general goal for how to prioritize a typical day. Psycho-education about the importance of communication skills in order to succeed in creating opportunities and gaining acceptance for recovery behaviors in social contexts.</p>
6	<p>Psycho-education and discussion about the maintenance of behavior change.</p>
7	<p>General evaluation and analysis of the behavior change process, (e.g., "what behavior change and behavior effects have been achieved?", "have you reached or come closer to your formulated goals?", "is more behavior change needed?", "what components in the program have been helpful?", and "how can you help yourself to continue to engage in recovery facilitating behaviors?"). Formulating a plan for maintenance of current behavior change and for further change of recovery behavior.</p>

present that is not possible to eliminate or avoid, and through mindfulness, acceptance and defusion (Hayes, et al., 2012) the disturbing function of the stimuli could be reduced significantly. The training consisted of exercises during which one would use “tension release long, program 2” without audio support in the presence of deliberately applied tension release disturbing stimuli. Such stimuli could be music or radio programs that the person disliked, tension when using an uncomfortable chair, feeling cold (for example by opening the window during winter), or the sound of a vacuum cleaner. See Table 3 for additional details about intervention contents for each session. I was the therapist for all groups.

Statistical Analyses

Missing data, 14.4%, was imputed at item level for each condition separately using multiple imputation creating 50 imputed data sets (Sterne et al., 2009; Sullivan et al., 2018). A series of ANCOVAs were conducted to determine statistically significant differences at postintervention and at follow-up assessment between the INT and the WLC on each outcome variable, controlling for the preintervention assessment scores on the variable analyzed (Tabachnick & Fidell, 2013). A critical α level of .05 was adopted in the analyses. Bonferroni correction was applied when dividing the α value with the number of measures ($.05/5 = .01$). To test whether the results were sensitive to the selected statistical methods, intervention effects were also analyzed without using preintervention assessment scores as covariates and by replacing missing data using the generally conservative imputation method last observation carried forward (Overall et al., 2009). The effects of the intervention were analyzed using a series of 2 (group: INT vs. WLC) \times 3 (time: pre-, post- and follow-up assessment) mixed between-within-subjects analysis of variance (Tabachnick & Fidell, 2013).

In addition, analyses of reliable and clinically significant changes in PSS and SMBQ at postintervention and at follow-up were conducted (Jacobson & Truax, 1991). Cutoff scores were based on the formula preintervention $M - 2 SD$ (for the INT), yielding ≤ 21 points for PSS and ≤ 3.21 points for SMBQ. Using the formula of Jacobson and Truax (1991), Reliable Change Index was calculated to be a 7-point reduction for PSS and 1.73 points for SMBQ. Based on the Reliable Change Index, the result for the participants on each measure at postintervention and at follow-up assessment was categorized as a *reliable improvement*, a *no change*, or a *reliable deterioration*. If the cutoff score

criterion was met among those categorized as reliably improved, the result was upgraded to the category *clinically significant change* (Jacobson & Truax, 1991). Fisher's exact probability test (2-tailed) was used to test differences between groups.

Results

No statistically significant differences on any background or outcome variables were found between the INT ($n = 35$) and the WLC ($n = 38$), or between participants that completed ($n = 59$) and did not complete ($n = 14$) the postassessment.

Based on the participants' recovery behavior diary, reported recovery behaviors were categorized, and the most frequently reported category of behavior were (in chronological order): "Physically active or exercising", "eating and/or drinking", "relaxing (exclusively)" and "social interaction."

Effects of the Intervention

Primary outcome variables. There were statistically significant ($< .01$) differences at postintervention assessment and at follow-up assessment between the INT and the WLC in favor of the INT on PSS (perceived stress), TES (tension) and SMBQ (burnout). Between group effect sizes differences according to Cohen's d were 1.00, 0.80 and 0.83 respectively at postintervention assessment, and 0.81, 0.74 and 0.78 respectively at follow-up assessment.

Secondary outcome variables. There were statistically significant ($< .01$) differences at postintervention assessment and at follow-up assessment between the INT and the WLC in favor of the INT on the anxiety measure HAD-a and the depression measure HAD-d. Between group effect size differences according to Cohen's d were 0.81, and 1.01, respectively, at postintervention assessment, and 0.71 and 0.79, respectively, at follow-up assessment. The results from the series of ANCOVAs and the obtained effect sizes are presented in Table 4.

Sensitivity analyses. Regarding the sensitivity analyses, there were statistically significant ($p < .05$) interactions between condition and time for all outcome variables. Independent-samples t tests were carried out to determine possible differences in outcome variables at post- and at follow-up assessments between the groups. Statistically significant ($p < .05$) differences in favor of the INT were demonstrated for all variables on both

occasions. These results were achieved when using both multiple imputation and last observation carried forward as imputation methods. When using last observation carried forward, the between-groups effect sizes (d) at posttreatment assessment were as follows: PSS, 0.64; TES, 0.58; SMBQ, 0.66; HAD-a, 0.61; HAD-d, 0.79; the between-groups effect sizes (d) at the follow-up assessment were as follows: PSS, 0.62; TES, 0.51; SMBQ, 0.66; HAD-a, 0.48; HAD-d, 0.62.

Table 4

Means for Outcome Variables at Pre-, Post-, and Follow-up Assessments for the INT and the WLC, p -values from ANCOVA With Adjustments for Preassessment values, and Between-Group Effects Sizes (Cohen's d)

Variables (range)	Pre		Post				Follow-up			
	M		M		p	ES	M		p	ES
	INT	WLC	INT	WLC			INT	WLC		
Primary variables										
PSS-12 (0–24)	33.9	32.8	24.7	31.0	<.001	1.00	24.5	30.0	<.001	.81
TES (1–7)	5.2	5.3	4.0	4.9	<.001	.80	3.8	4.8	<.001	.74
SMBQ (1–7)	4.8	4.8	3.5	4.4	<.001	.83	3.4	4.3	<.001	.78
Secondary variables										
HAD-a (0–21)	11.3	11.1	7.1	10.0	<.001	.81	7.0	9.4	<.001	.71
HAD-d (0–21)	8.5	8.1	4.5	7.5	<.001	1.01	4.9	7.4	<.001	.79

Note. INT = intervention group; WLC = waiting list control group; ANCOVA = analysis of covariance; ES = Effect Size; PSS = Perceived Stress Scale; TES = Tension Scale; SMBQ = Shirom Melamed Burnout Questionnaire; HAD-a = the Anxiety subscale of the Hospital Anxiety and Depression Scale; HAD-d = the depression subscale of the Hospital Anxiety and Depression Scale.

Reliable and Clinically Significant Changes

The INT had a significantly higher proportion of reliably improved clients on PSS (perceived stress) at posttreatment ($p < .001$), and at follow-up ($p < .001$), compared to the WLC. The INT also had a significantly higher proportion of clinically significant improvements at posttreatment ($p = .010$), but not at follow-up ($p < .058$) on PSS. Regarding SMBQ (burnout), the INT

had a significantly higher proportion of reliably improved clients at posttreatment ($p = .005$) and at follow-up ($p < .001$), and a significantly higher proportion of clinically significant improvements at posttreatment ($p = .016$) and at follow-up ($p = .008$).

Conclusions

The results supported the implied hypothesis that the intervention would lead to stress and health-related effects. Clinically meaningful improvements in perceived stress, tension, burnout (primary variables), anxiety and depression (secondary variables) were demonstrated. These results are consistent with the two previous studies of the BEL. The study had some limitations, particularly the relatively high level of missing data (14.4%) and the use of only one therapist. The intervention warrants further research, such as testing to deliver the intervention in other contexts with other therapists. In addition, it would be of interest to study possible recovery important behaviors as mediators of intervention effects on stress and burnout.

Study 4

Almén, N., Lundberg, H., Sundin, Ö., & Jansson, B. (2018). The reliability and factorial validity of the Swedish version of the Recovery Experience Questionnaire. *Nordic Psychology, 70*(4), 324–333.
<https://doi.org/10.1080/19012276.2018.1443280>

Aim

The aim of the study was to empirically evaluate the multidimensional model of a Swedish version of the REQ, seeking support for the proposed four-factor model.

Method

Instrument, Participants and Procedure

The REQ was translated from English into Swedish. Both back-translation and the use of a committee was applied. The Swedish version of the REQ was sent to 4,000 randomly selected individuals in the working-age

population (24–55 years). The response rate was 20.4%, i.e., 815 individuals (483 women and 332 men). Those with ≥ 20 h/week paid work and with no missing data were included in the analyses. This left 680 individuals, i.e., 17.0% of the total sample, for analyses (mean age = 41.19, $SD = 9.31$). Cronbach's α s for the four proposed factors were: Psychological detachment .88; Relaxation .86; Mastery.84; Control .89. Cronbach's α for the entire instrument was .92.

Design and Statistical Analyses

The total sample ($N = 680$) was randomly split into two subsamples. The first subsample ($n = 340$) was used for finding the best-fitting model using exploratory factor analysis (applying oblique rotation). The second subsample ($n = 340$) was used for performing confirmatory factor analysis to test the model suggested by the confirmatory factor analysis, and the proposed four factor model.

Multiple measures were used to evaluate the overall fit of the models: Relative chi square statistics (χ^2/df), the root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR) and the comparative fit index (CFI). Regarding RMSEA, a lower level than .08 indicates an adequate fit, and lower level than .06 indicates a good-fitting model (Hu & Bentler, 1999). In terms of SRMR, .08 or lower indicates a good fit. Regarding CFI, values higher than .90 suggest an acceptable fit and values higher than .95 a close fit. Obtained modification indices was used to consider removal of eventual cross loaded items in the best-fitting model.

In addition, for the best fitting model, composite reliability, convergent validity, and discriminant validity were estimated. Composite reliability (CR) was used as a measure of internal consistency of each factor, and .70 was used as a cut-off value for good reliability (Hair, et al., 2010). Discriminant validity was determined if the average variance extracted (AVE) was greater than the maximum shared squared variance (MSV) or the average shared squared variance (ASV). For convergent validity, AVE had to be equal or greater than .50 and lower than CR.

Results

When performing the exploratory factor analysis, three factors were extracted: (1) eight items regarding control and relaxation, (2) four items

regarding psychological detachment and (3) four items regarding mastery. The result from the exploratory factor analysis indicated an inadequate model fit, i.e., only one out of three model fit indices suggested an adequate fit of the model (SRMR but not RMSEA or CFI). When testing the proposed four-factor structure of the REQ, using confirmatory factor analysis, the chi square statistics demonstrated a significantly better model fit than the three-factor model. SRMR and CFI, but not RMSEA, suggested an adequate model fit. The modification indices showed that item 14, "I take time for leisure", from the factor Relaxation highly loaded on both Relaxation and Mastery. After removing this item, the model fit was significantly improved, and all fit indices reached acceptable levels. Table 5 shows the chi square statistics and model-fit indices obtained from the confirmatory factor analysis of the three-factor model, the four-factor model, and the modified four-factor (i.e., final) model.

Table 5

Estimates of confirmatory factor analyses: model-fit indices for the three-factor structure model obtained via exploratory factor analysis, the proposed four-factor structure model, and the modified proposed four-factor model (with item 14 removed).

Model	χ^2 (df)	χ^2/df	CFI	SRMR	RMSEA	$\Delta\chi^2$, df (p)
Three-factor	595.15 (101)	5.89	.88	.08	.11	
Four-factor	459.02 (98)	4.68	.92	.08	.10	136.3 (<.001)
Modified four-factor (final)	286.47 (84)	3.41	.95	.07	.08	173.14 (<.001)

Note. CFI = Comparative Fit Index, SRMR = Standardized Root Mean Square Residual, RMSEA = Root Mean Square Error of approximation.

For the final model (the 15-item version of the 4-factor model), CR indicated good reliability for all factors (all above .70). Indices of convergent validity indicated no validity concerns (i.e., all four factors AVE were less than CR and greater than .50). Indices of discriminant validity indicated good validity for all four factors (all AVE clearly higher than MSV and ASV). Table 6 shows the indicators of composite reliability, convergent validity and discriminant validity, and factor correlations for the final model.

Table 6

Indicators of factorial validity, reliability and factor correlations for the final model.

REQ-factors	Indicators				REQ-factors			
	CR	AVE	MSV	ASV	MA	PD	RE	CO
Mastery	.835	.560	.384	.292	–			
Psychological detachment	.901	.697	.245	.197	.408	–		
Relaxation	.870	.691	.612	.393	.569	.495	–	
Control	.889	.667	.612	.391	.620	.422	.782	–

Note. CR = Composite Reliability; AVE = Average Variance Extracted; MSV = Maximum Shared squared variance; ASV = Average Shared squared Variance; MA = Mastery; PD = Psychological detachment; RE = Relaxation; CO = Control.

Conclusions

The results supported the proposed four-factor model of the Swedish version of the REQ. The model fit was improved after removing one item from the original Relaxation factor. This modified (15-item) version of the scale showed satisfactory convergent validity, discriminant validity and composite reliability for all factors. The study had some shortcomings, particularly the low response rate (17 %). Notwithstanding this, the scale can be recommended for use, for example in recovery intervention studies.

Ethical Permissions and Informed Consent

Study 2–4 were approved by the regional committee in Umeå, Sweden. For the first study, approval was obtained from the Research College Board, Department of Psychology, Mid Sweden University. All participants were informed about the research and questions concerning confidentiality, anonymity, and the participants' rights were emphasized. Informed consent was requested and obtained from all participants.

4 Discussion

The primary aim of the current thesis was to evaluate stress and health-related effects of an intervention targeting (stress) recovery behaviors in everyday life among people perceiving high levels of stress in life. A secondary aim was to validate a self-report scale measuring behaviors of importance for (stress) recovery in everyday life. Three studies were conducted to evaluate effects of the BEL, and one study was conducted to validate a Swedish version of the REQ.

Intervention Study 1

The first intervention study in the thesis, in which a relatively brief version of the BEL was delivered in an individual format, indicated positive changes regarding daily self-ratings of stress symptoms as a function of the intervention. Even though the intervention was brief and did not include any maintenance support, follow-up assessments 1 year and 5 years after the completion of the intervention indicated good maintenance. According to the best of my knowledge, this was the first scientific support for a behavioral recovery intervention to be effective in achieving reduction in stress symptoms on both working days and nonworking days. The self-report inventories measuring stress, worry, anxiety, depression, type A behavior, rest and recovery, and sleep demonstrated results in accordance with the primary data (i.e., self-ratings of stress symptoms). The intervention seemed promising and worthwhile to study further.

Intervention Study 2

After study 1, we were given the opportunity to test the BEL again, now in a real practical situation, in a context of a health project at a workplace. In this study, the BEL was delivered in group settings, and effects were demonstrated in line with those in study 1. Eleven out of twelve measures showed significant improvements between pre- and postintervention assessment for the BEL compared to the WLC. The effect sizes (according to Cohen's d and the chosen cut-off scores for low, medium, and large effect sizes) were medium to large. The largest effect size was demonstrated for the index covering perceived stress and feelings of rest and being recovered.

Regarding sleep, no statistically significant effect was found, perhaps due to an underpowered sample size ($N = 32$). Unlike study 1, this study measured the intervention target: Recovery behaviors outside work and recovery behaviors at work, and the effect sizes at postassessment (compared to WLC) were medium for both behavior changes. This showed that the BEL achieved what was primarily its purpose. An important conclusion regarding recovery behaviors is that a behavioral intervention can increase the frequency of such behaviors outside work and at work.

Also, the stress-related behavioral patterns, type A behavior, OCW and worry, decreased as a function of the BEL. The effect sizes were medium to large, although the behaviors were not explicitly intervened. A hypothetical explanation for the effects is that impaired recovery behaviors is an important common factor among these patterns of behavior. The results are in line with a profound insight of early behavior therapy, that the best way to change a non-adaptive behavior is to strengthen an opposite, incompatible and adaptive behavior (Borkovec, 2005).

In addition, although the targeted behavior change was “only” medium, perceived stress and feelings of rest and being recovered, depression, anxiety, and burnout exhibited medium to large between-group effect sizes. In this study, several therapists were used (in comparison with study 1 and study 3 in which only I worked as therapist), which indicates generalizability in terms of who delivers the BEL. The therapists who were used in addition to myself were clinical psychology Master of Science students (who worked in pairs), which indicates that experience as a clinical psychologist is not necessary to achieve effects via the BEL. However, differences in effects between therapists were not possible to analyze since we were only therapists for one group each. Of presumed importance was that the student therapists during their education gained knowledge in general conversational methodology and CBT, that they received training and supervision regarding the delivery of the BEL as well as used session manuals (which I also did).

In line with our expectations, change in stress-related behavioral patterns and recovery behaviors predicted changes in perceived stress and feelings of rest and being recovered. Recovery behaviors at work received the strongest weight in the model, which was an important finding since recovery research has been focused on studying recovery behaviors in leisure time but not at work.

Since the study was quasi-experimental, no firm conclusions could be drawn regarding the intervention effects. In the context of the results of

study 1 and 2, a larger scale study using a more rigorous research design further testing the efficacy of the BEL was warranted.

Intervention Study 3

In study 3, the group-based BEL was further investigated using a randomized controlled design, the intention-to-treat principle and follow-up assessments. In addition, sensitivity analyses, and analyses of reliable and clinically significant changes were performed. Regarding the intervention, some changes were made based on experiences from the previous study. A change that I find was particularly appropriate was recovery-training during sessions and to make two sessions out of session one in the previous study.

The ANCOVAs demonstrated statistically significant improvements for all measures at postintervention and at the follow-up. The between-groups effect sizes for perceived stress, tension, and burnout (primary variables) were large at postassessment and medium-to-large at follow-up. The between-groups effect sizes were also large at postintervention for anxiety and depression (secondary variables). At follow-up, the effect sizes for these variables were medium. The sensitivity analyses demonstrated results that were in line with the results from these primary analyses (i.e., ANCOVAs), which indicated that the results were not sensitive to the selected analytical method. In addition, the results regarding reliable and clinically significant changes in PSS and SMBQ further confirmed the efficacy of the BEL.

The recovery behaviors reported in the recovery behavior diary (see Table 1 in paper 3) were generally in line with research described in the introduction. The most reported category of behavior was “physically active or exercising”, which is interesting as the behavior may not primarily be a recovery behavior in itself, but rather a facilitator for subsequent recovery. Several categories of reported recovery behaviors were everyday life activities, which I consider stress/recovery neutral in themselves in the sense that it is highly possible to both activate and deactivate stress responses during these activities. Examples of such categories were “eat and/or drinking” and “housework or other everyday life task”. Such types of activities occur frequently and continuously in most people’s lives which means a great potential for improved recovery among those who psychophysiologically deactivate poorly during these activities. Since everyday life activities were often reported as recovery behaviors, they were presumably valuable for the participants’ recovery, which may serve as a

rationale for studying the recovery potential of solely supporting people to psychophysiologicaly deactivate during such activities.

In conclusion, the results from the three intervention studies point in the same direction, that the BEL is an intervention that produces meaningful effects regarding stress- and health-related variables.

Reflections Regarding the Intervention Studies

Comparison With Other Stress Management Studies

I will now compare results from previous stress management studies with the results obtained in the scientifically strongest intervention study in the thesis, study 3 (the RCT-study). The effect sizes (medium to large) at the follow-up in study 3 are difficult to compare since little is known about the long-term effects of stress management (Richardson & Rothstein, 2008). Therefore, I will focus on postassessment comparisons. In the RCT-study, the BEL yielded large effect sizes on all variables at postassessment. This can be compared to the most effective reactivity-based stress management intervention - individualistic CBT - which in meta-analyses/reviews has achieved effect sizes from low to large on stress-related variables (Heber et al., 2017; Richardson & Rothstein, 2008; van der Klink et al., 2001).

Regarding interventions that have included both recovery behavior support and other types of support, the study by Persson Asplund et al. (2018) produced small to large effect sizes whereas the study by Lindsäter et al. (2018) produced medium to large effect sizes, at postassessment, for different stress and health-related variables. These two interventions have been mediated via the internet, which, for example, has the advantage that participants can be recruited regardless of where they live.

As reported in the introduction, a small number of different types of interventions that focus exclusively on recovery behaviors have been tested and the results have been mixed. Many variables have not been improved and among those that have been improved, the effect sizes have mostly been small. A contrast to this is the large effect size concerning reduction of insomnia severity, in the study by Thiart et al. (2015). It should be taken into account that these interventions were less extensive than group-based BEL in study 3 (and 2).

In conclusion, compared to results from other stress management intervention studies, the BEL performed well. Regarding recovery interventions, the intervention studies in the present thesis contribute to the conclusion that the recovery intervention paradigm has potential, but that we need to learn what is effective and ineffective. Conventional stress management has been studied for several decades while recovery focused stress management intervention research is in its infancy.

Unexpected Results

In general, the results in the three intervention studies were expected based on the theories and empirical studies presented in the introduction. However, it is surprising that greater effect sizes were achieved for depression than for burnout in both study 2 and 3 since burnout is theoretically more related to stress and recovery than depression. Burnout is assumed to be - and even defined as - a consequence of sustained stress behaviors (implying impaired recovery behaviors), whereas depression is defined solely in term of its symptomatology. Depression has been suggested to be explained by a wide range of factors, for example cognitive distortions (Beck, 2021), inflexible and maladaptive response pattern to cognitive events manifested in terms of persistent worry and rumination (Hagen et al., 2017; Wells, 2009), work stress and lack of coping via distancing (Chen et al., 2009), lack of physical activity (Kvam et al., 2016), passivity, lack of pleasant activities and positively reinforced behaviors (Chen et al., 2009; Jacobson et al., 2001; Lewinsohn & Libet, 1972), and interpersonal problems and a lack of social support (Lipsitz & Markowitz, 2013). One can speculate that improved recovery behaviors potentially affect all of these factors. That is, recovery behaviors have the potential to reduce the risk for cognitive distortions or increase the chance of detecting and correcting distortions due to lower levels of stress and cognitive weariness, and thereby prevent or counteract worry and rumination, as well as facilitate mental distance to work stress through exposure to other types of stimuli than those that trigger these cognitions. Recovery behavior may also consist of socializing and thereby increasing the likelihood of social support. Recovery behaviors may also lead to decreased levels of fatigue, which in turn will make it easier or more reinforcing to exercise and socialize. According to the frequency distribution of categorized recovery behaviors reported in the recovery behavior diary in study 3 (see Table 1 in paper 3), “physically active or exercising” was the most frequent recovery behavior,

and “social interaction” was the fourth most frequent recovery behavior. Moreover, and perhaps of particular importance, recovery behavior is probably associated with pleasant experiences, as indicated by comments made in the recovery behavior diary (e.g., “read a book in bed just for pleasure”, “enjoyed the landscape” and “enjoyed some time in the sun”). Participants have also described that improved recovery has contributed to a better ability to handle interpersonal situations. It is important to emphasize that confidence intervals regarding the effect sizes were not calculated in any of the studies, which means that we do not know whether the differences in effect sizes between depression and burnout were statistically significant or not. However, burnout reductions were not superior to the reductions in depression, which one might have expected.

An additional and somewhat surprising finding in study 2 was that recovery behaviors at work were at least as associated with perceived stress and feelings of rest and being recovered as recovery behaviors off-work. This indicates that it is at least as important to intervene recovery behaviors at work as at leisure time to accomplish beneficial changes regarding experiences of stress and recovery.

Behavioral Perspectives on Recovery

In the present project, recovery was approached from a behavioral, primarily operant, perspective. An assumed benefit of this approach is that it potentially gives people a sense of agency and optimism to improve their recovery, since most people presumably find that behaviors are possible to change. This approach on recovery may also have its risks, for example that this adds demands on people (to change behavior) who are already experiencing too many demands in life. For these individuals, it may be important to inform them that perceived stress overall will probably be reduced as a function of improved recovery behaviors. The approach also risks leading to an underestimation of the importance of contextual factors. To reduce the risk of this, the BEL can be considered a context that compensates for a problematic context that the individual lives within.

Stress management, including recovery management, is easy to associate with avoidance behavior. However, based on the behavioral perspective used in the BEL, recovery behavior is not only conceptualized as a withdrawal but also as an approach behavior. This implies withdrawal from stressful stimuli (stressors) as well as approaching recovery behavior eliciting stimuli. This may be of great importance since high levels of

withdrawal/avoidance behavior have been suggested to be a critical factor when explaining psychopathology in general (Hayes, et al., 2012), chronic worry (Borkovec, 2004) and burnout (Almén, 2021; Naidoo et al., 2012). The approach perspective on recovery behavior is in line with the recently developed stress theory *general unsafety theory of stress*, which states that in order for recovery to occur signals of safety are needed (Brosschot et al., 2018). This is highly different from the established stress paradigm, in which it is assumed that it is enough for the stressor to cease, for example by staying away from or leaving a stress situation, in order for recovery to occur. Based on the approach perspective on recovery, one can for example question sick leave as the only action in clinical stress-related ill health.

Recovery Behavior – a Transdiagnostic Intervention Target?

During the last two decades, research interest on transdiagnostic factors has increased, in particular regarding factors that explain depression, anxiety and related diagnoses (Barlow et al., 2014). Transdiagnostic factors that have been suggested are for example chronic worry (Wahlund et al., 2021), avoidance (Hayes, et al., 2012) and neuroticism (Barlow et al., 2014). Based on these suggestions, transdiagnostic treatments have been developed and tested with good results, such as meta-cognitive therapy (Wells, 2009), unified protocol (Barlow et al., 2017) and acceptance and commitment therapy (Öst, 2014). Based on the empirical evidence that stress behaviors are related to a number of different problems other than burnout, such as high levels of anxiety and depression (Barlow et al., 2014; Chen et al., 2009; Lin et al., 2011; Pittig et al., 2013), and the fact that the BEL has demonstrated efficiency regarding several health-related factors, in particular anxiety, depression and burnout, a tentative conclusion is that recovery behavior has potential as a transdiagnostic intervention target and the BEL as a transdiagnostic intervention.

Acceptance and Adaptability

To make the BEL acceptable, we tried to make the intervention “straight forward”, easily understood, normalizing and with limited levels of jargon. The intervention largely involved practicing common activities such as listening to music, reading a paper, and walking in nature, and the individual was generally encouraged to choose activities she/he preferred

(as long as they were predicted to accomplish recovery effects and was not considered destructive in any way). Preferences are not only important for the recovery potential of activities (Ten Brummelhuis & Trougakos, 2014; Trougakos et al., 2014), intervening “preferred activities” probably also increases the likelihood that participants will accept the intervention. For instance, we can assume that meditation, Qigong or visiting green environments generally have great recovery potential, but people can also find these activities unattractive or too demanding. Presumably, activity restricted interventions are not suitable for as many people as interventions that leave a great deal of room for the individual to choose for himself/herself what to do. Also, if the goal is to learn to recover via a range of (self-chosen) activities, it is probably easier to find ways to recover in many different situations in life since different activities differ in how easy or difficult they are to perform, or get recovery effects of, depending on situational circumstances.

The BEL is meant to be primarily controlled by principles. Based on its principles, the intervention can take many different forms and adapt to different participants and contexts, such as an individual, group, or organizational format. The intervention can be delivered in isolation as well as one of several intervention components in a multi-componential intervention (in which the intervention can be primary or secondary). Of course, the efficiency of different variants of the BEL in different contexts (and for different populations) needs to be tested empirically to determine its generalizable utility.

Possible Ways to Achieve Greater Effects

A challenge that always exists in behavioral interventions is to create conditions for target behaviors to be followed by reinforcing stimuli. If there is one thing I see as a priority to improve, it is this. In addition, there are several interventions that may have the potential to increase the impact of the BEL. Below are some interventions that one may consider using.

Sleep support

Insufficient sleep increases the risk of burnout (Söderström et al., 2012) and improved sleep predicts recovery from burnout (Ekstedt et al., 2009; Santoft et al., 2019). In the BEL, only information during one session (in the two group intervention studies) was provided on how sleep can be improved (in

study 1, no such information was given). The information included sleep hygiene but recovery behaviors were emphasized the most, based on empirical data that have showed that lack of recovery during the day, when awake, increases the risk of disturbed sleep and insomnia (Åkerstedt et al., 2007; Tucker et al., 2008), the therapeutic idea to focus on one factor (i.e., recovery behavior) only, and that we wanted to test an intervention that purely supported individuals in improving recovery behaviors in the awake state. Our studies do not provide an answer as to whether the BEL improves sleep or not. Regardless, if the goal is to maximize the effects of the BEL, it seems reasonable that more sleep support than we gave can increase the health effects. In addition to the evidence-based intervention for insomnia, *sleep restriction* (Miller et al., 2014), insomnia can be reduced via the brief intervention *paradoxical intention* (Jansson-Fröjmark et al., 2022). The latter intervention may be preferable since sleep restriction is often experienced as very aversive for clients and may distract the client from the primary purpose of the intervention: To improve recovery behaviors during the day. Importantly, we should not forget that lack of sleep among stressed people does not need to be due to insomnia but the fact that sleep can be less prioritized than other activities. Also, sleep problems among people experiencing clinical burnout can consist of *hyposomnia* (Grossi et al., 2015; Hauri, 2002). These two sleep problems motivate other types of interventions than those for insomnia.

Exposure interventions

In general, exposure intervention is essential in CBT for anxiety problems (Bandelow et al., 2017; Craske et al., 2014). Exposure interventions usually target fear/worry related avoidance behaviors. Surprisingly, although stress-related ill health is related to worry (Brosschot, 2010; Ottaviani et al., 2016) as well as avoidance coping (Almén, 2021; Hayes, et al., 2012; Skinner et al., 2003), exposure is not an established but a rather unusual intervention in stress management. For example, the exposure methodology is not even mentioned in the reviews/meta-analytical evaluations of stress management interventions by Burgess et al. (2020), Richardson and Rothstein (2008), Yusufov et al. (2019), and van der Klink et al. (2001). Worry is an important factor when explaining sustained physiological stress and stress-related ill health/disease (e.g., McCarrick et al., 2021). Based on the hypothesis that worry is explained by avoidance behaviors, several CBT worry-treatments involve exposure interventions (Behar et al., 2009; Borkovec, 2004).

Moreover, stress-related behaviors, such as overcommitment to work, type A behavior and maladaptive perfectionism, can be explained by negative reinforcement and thus be conceptualized as avoidance behaviors, which would motivate the use of exposure interventions. Exposure therapy can take various forms (Craske et al., 2014), which should make it possible to integrate one form or another into the BEL.

Motivational interviewing

Many participants who have participated in the BEL have struggled with their ambivalence about recovering or continuing to exert themselves. The so-called recovery paradox, which states that when recovery is most important, it is often the most difficult to achieve (Sonnentag, 2018), is probably partly explained by ambivalence. Motivational interviewing is a method that aims at “solving ambivalence” and at facilitating behavior change (DiClemente et al., 2017; Westra & Norouzian, 2018). Since there is great evidence for the possibility of improving therapeutic outcomes when integrating motivational interviewing with CBT (Westra & Norouzian, 2018), it is conceivable to use motivational interviewing methods to increase the frequency of recovery behaviors, in particular among people struggling with ambivalence.

Focused attention

Focused attention, which seems to facilitate recovery in poststress situations (Borchardt & Zoccola, 2018) was, as previously stated, generally recommended in the BEL when performing a recovery behavior. However, it was a highly peripheral target. A common way to seek to increase focused attention is through mindfulness training (Borchardt & Zoccola, 2018). While there is a risk that such a practice conflicts with ATR or makes the recovery training problematically complex it may be worth reflecting on whether it is possible to seek to strengthen focused attention via mindfulness training without undermining the use of ATR.

In conclusion, there are several different interventions that are compatible with the BEL that could be used and perhaps make the BEL more effective. In addition to the intervention components described above, there are also others that could potentially enhance the effects, such as involving relatives (Sensiba & Franklin, 2015), cognitive restructuring (Beck, 2021), cognitive defusion (Hayes, et al., 2012; Larsson et al., 2016) and physical activity (Ginoux et al., 2021). However, additional intervention

components may not improve, but even reduce, the effects (Richardson & Rothstein, 2008), for example by distracting the individual from the primary target of the intervention. Also, an increased number of components, in particular non-simple ones, can make the intervention complex and more difficult for therapists to learn. I find it important to carefully consider and be cautious about adding intervention components into the BEL.

The REQ-Study

To improve the BEL, it would be of importance to study recovery behavioral factors as mediators between the intervention and health outcomes (Kazdin, 2009). To conduct such a study there is a need for a validated recovery behavior measure, preferably one that includes several factors since different factors can have different importance as mediators. According to the best of my knowledge, the REQ is the most used validated instrument measuring recovery behavior factors. The measure is not perfect, but relatively compatible with a behavioral approach to recovery. An advantage of the instrument is that it measures several fairly generic factors. The measure has been translated into several languages and has demonstrated good reliability and validity in several countries. Although I found some potential problems with the scale, which I will elaborate on in a while, we decided to translate the scale into Swedish and then test its internal validity (study 4). After removing one item, the four-factor solution of the scale showed similar results as in most other studies: good model fit to the data. Analyses suggested that the model had adequate fit for the data across younger and older cohorts and across genders. We also studied something that is less frequently studied: The discriminant and convergent validity of the factors included in the REQ. The used indices for convergent validity and discriminant validity demonstrated good validities for all four factors. Also, indices for internal consistency (i.e., composite reliability) indicated good reliability.

Reflections Regarding the REQ-Study

A fundamental psychometric aspect involves construct validity (Messick, 1993). The construct "recovery experiences" are hypothesized to have (at least) four dimensions, and since several confirmatory factor analyses, including the REQ-study in this thesis, confirm this hypothesis, evidence of construct validity is supported (Peter, 1981). Construct validity is also

strengthened by the fact that the REQ and its factors have been shown to correlate – however, not perfectly – with other factors in expected directions (e.g., Panthee et al., 2020; Sonnentag & Fritz, 2007). Construct validity of a measure reflects whether it performs as it is postulated to do (Peter, 1981) and such postulation is dependent on the operationalization of the construct. Sonnentag et al. (2022) have considered recovery experiences as core recovery processes and accordingly, Sonnentag and Fritz (2007) have stated that the REQ assesses individuals' unwinding (i.e., psychophysiological deactivation) and recuperation processes. Below, I will reflect on this.

Relaxation

Relaxation is the factor most clearly associated with the definition of recovery as a process of psychophysiological deactivation. However, the research regarding relaxation and its role for recovery is not completely consistent. For example, a study by Duarte and Pinto-Gouveia (2017) demonstrated no relationship between physiological indicators of deactivation (parasympathetic activity) and experiences of relaxation. A theoretical as well as empirical question is whether recovery is primarily a matter of experiences of being relaxed or physiological measures of relaxation, or a combination of the two.

Psychological Detachment

Psychological detachment from work is the most studied factor among the factors included in the REQ (Sonnentag et al., 2022). Sonnentag and Fritz (2007) on the one hand stated that “when individuals do not detach and are still thinking about job-related issues, the identical functional systems are continuously challenged and no full recovery can occur” and on the other hand that “not detaching from work does not necessarily imply that thinking about work is negative per se. Positively reflecting about one’s work (e.g., thinking about a recent success or about an inspiring goal) might even improve wellbeing.” These two statements can only go together if one changes “systems are” in the first statement to “systems may be”. This factor in the scale possibly suffers from so called “construct-irrelevant variance,” which means that the assessment is too broad (Messick, 1994). Also, it is problematic to claim that solely withdrawal from work stressors/demands is a recovery processes per se since this can allow mental room for being cognitively occupied with nonwork stressors/demands. In conclusion, it

might be more appropriate to define psychological detachment from work as a behavior that is *potentially* accompanied by psychophysiological deactivation and resource restoration (i.e., a potential recovery process) rather than a recovery process.

Mastery

Sonnentag and Fritz (2007) stated: “Mastery experiences refer to off-job activities that distract from the job by providing challenging experiences and learning opportunities in other domains”. To me, it seems as though Sonnentag and Fritz regarded mastery as an activity that contributes to psychological detachment from work via distraction. Accordingly, a mastery experience is not a recovery process per se, but an experience that has the potential of capturing our attention, and thus may function as a distractor from stressful things, which can contribute to psychophysiological deactivation. The study by Ginoux et al. (2021), showed a close to zero correlation between mastery experiences and burnout, which further questions mastery as a recovery process per se. Sonnentag and Fritz (2007) have also stated that mastery experiences are expected to result in recovery outcomes since they will help to build up new internal resources such as skills, competencies, and self-efficacy. However, I find it difficult to understand what these resources have to do with recovery/deactivation. As for psychological detachment, mastery seems to refer to a behavior that is potentially but not necessary accompanied by psychophysiological deactivation and resource restoration. This is possibly explained in several ways, in addition to functioning as a distractor for stressors. First, mastery experiences may elicit or be accompanied by positive emotions, such as contentment, which are related to physiological indicators of recovery (i.e., increased parasympathetic activation; Duarte & Pinto-Gouveia, 2017). Secondly, challenging activities associated with experiences of mastery, such as physical exercise, may be accompanied by physical stress responses and subsequent enhanced deactivation (Chafin et al., 2008).

Control

It is doubtful whether the control factor has a direct impact on recovery outcomes. Rather, it seems to concern the possibility to choose behavior. Control over leisure time can reasonably be used for behaviors that deplete our resources as well as behavior that facilitate recovery of already depleted

resources. I consider control over leisure time as highly important for recovery as it implies perceptions of opportunities to behave in a recovery facilitating way.

The REQ has many strengths, in particular regarding factorial validity. However, there are studies that reveal some questions regarding the construct validity based on nonsignificant associations between REQ-factors and recovery outcomes (i.e., exhaustion; Burke & El-Kot, 2009). Variation in study results regarding the relationship between REQ factors and recovery outcomes is an additional argument for viewing the factors, with the possible exclusion of relaxation, as behaviors that potentially facilitate recovery rather than recovery behaviors (i.e., processes/experiences) per se. This is in line with the following statement from Sonnentag and Fritz (2007): “When individuals psychologically detach from work during off-job time, *the chances increase* that demands on the functional systems taxed during work are reduced (italics made by me; Sonnentag & Fritz, 2007). In addition, one can question whether it is our *experiences* that lead to recovery outcomes, which is an important assumption that the REQ is based on (Sonnentag & Fritz, 2007). This can perhaps be most clearly exemplified by what many researchers (e.g., Dahlgren et al., 2022) consider to be essential for recovery: sleep. Sleep is characterized by the absence of experiences. We can fall asleep and then wake up and experience that no time has passed. In conclusion, the Swedish version of the REQ can be recommended to be used to measure behavioral factors of potential importance for recovery.

Ethical Considerations

Since the BEL was empirically untested prior to this doctoral project, we considered it most ethical to start the project with a study which required only a small number of participants. After this study, we were given the opportunity to test the intervention again, now in a real practical situation, in the context of a health project at a workplace. Since we and the person responsible for the health project considered it unethical to randomize the participants, the design used was quasi-experimental. An additional ethical decision was not to require participation in the *study* in order to participate in this *intervention*. As this study also showed beneficial intervention effects, we went on to a more comprehensive (efficacy) study and considered it most ethical, particularly in terms of being able to advance the state of knowledge, to use a randomized controlled design. A decision that probably affected the levels of missing data in a non-advantageous way was to

maximize the number of reminders to complete the assessments to two. A further important ethical question was how we would handle people with extensive problems, or other types of problems than stress problems, who applied for treatment through our studies but whom we excluded (this was mainly an issue in study 3). We chose to handle this by giving these people guidance on where they could seek care for their problems and inform them that I, as a licensed psychologist, was responsible for the assessments and the guidance.

Methodological Issues

The research methods used in this doctoral project have, of course, their advantages and disadvantages. In this section I will focus on issues that will, or may, limit the conclusions that can be drawn from the studies.

Designs

Single-subject experimental design, the design used in study 1, is cost-effective and requires only a few participants, which we as previously mentioned considered ethically correct when scientifically testing the BEL for the first time. A subsequent step, in particular to strengthen the external validity, could have been systematic replications using the same design (Barlow et al., 2008). However, as a next step we chose to further test the BEL in a group format. The most obvious design weaknesses are found in the second intervention study since the participants were not randomized. Fortunately, there were no significant differences between the groups on any of the variables at the preassessments, which indicated but not proved that the groups did not differ on any factor important for the results of the study. After further indications that the BEL is an effective intervention, we found it appropriate as a next step to conduct a randomized controlled trial, the gold standard of intervention research (Bell et al., 2014), in order to achieve evidence for the intervention.

The three different research designs used in this doctoral project fulfill criteria for evaluation of treatment efficacy stated by the American Psychological Association (2002). In addition, using WLC as a controlling condition, which was done in study 2 and 3, allows one to determine not only if an intervention is beneficial but also adverse effects (APA, 2002). Therefore, WLC is an appropriate control condition in the early stage of an intervention evaluation. However, it has its limitations, one example being

that no conclusions can be drawn as to whether the intervention is more or less effective than previously demonstrated effective interventions or placebo.

Regarding the design used in the psychometric study of the REQ, the perhaps largest limitation was that only factorial validation was investigated. No conclusions could be drawn regarding its relationship with other measures, such as measures of resource depletion.

Participants

Often intervention studies include participants based on diagnostic criteria. This may be a beneficial method for selecting participants that represent a clinical population of interest. The population of interest in this doctoral project can be described as “people perceiving high levels of stress and who have an interest in improving their stress managing skills”. On the one hand, this is a non-specific and broad population, which allows one to draw the conclusions that the results of the studies are potentially relevant for many people. Although on the other hand, there are probably subgroups that differ greatly, which means that such a conclusion should be drawn with caution. Regarding study 4, since the main rationale for validating the REQ was having access to self-report instrument measuring behaviors important for recovery in everyday life when conducting behavioral recovery interventions, it can be argued that invariance tests should have been performed for people with low and high levels of perceived stress, respectively.

Measurements

In the first intervention study, a weakness is the absence of reliability and validity testing of the measurement used for collecting the daily levels of stress symptoms. The index used consisted partly of questions about stress activation and partly of questions concerning resource depletion. It may have been advantageous to create two separate indices for the two, alternatively one could have created an index for resource depletion only, since this is closely related to recovery behavior according to the operational definition used in the thesis.

When it comes to measuring stress, there is a risk that intensity, frequency and duration are mixed up, and to the best of my knowledge there are no studies that have validated the commonly used PSS as a

measure of sustained stress behavior, which is a problem in this thesis as the theoretical assumption is that it is this type of stress that poses a risk to health. A further construct validity issue is that the factorial validity of SMBQ (after the completion of the studies included in the thesis) has been demonstrated to be improved when removing some items that we have used (three items from SMBQ-22 and one item from SMBQ-18; Almén & Jansson, 2021). These removed items were problematic due to a high load on more than one factor, which is primarily a problem when analyzing the subscales separately.

In study 1, there was a strength with the very long follow-up assessments (one and five years respectively), however, there was a limitation that there was no control condition for these. It is noteworthy that the results in these follow-ups were in line with those in study 3, in which a control condition was used.

Since positive effects have been shown for many stress and health-related variables in the three intervention studies, one can regard them as validating each other. Nevertheless, it would have been an advantage, for the possibility of drawing definite conclusions on the effects of the intervention, if the measures had been used more consistently in the studies.

The plan was to conduct a study using heart rate variability as an outcome measure, but due to large, non-random loss of data the plan was cancelled. Consequently, the BEL has solely been evaluated based on self-reported data. This is a limitation, in particular since such data can be influenced by social desirability (Crowne & Marlowe, 1960). Importantly, no conclusions can be drawn when it comes to intervention effects on two important parameters in clinical intervention research, life function and quality of life (APA, 2002), since such measures were not used.

Statistics

Established statistical methods were used in all studies except in study 1 in which statistical analyses were not performed. I will say some words about two important statistical issues that need to be handled: missing data and effect sizes.

Although missing data is a potential threat to internal validity it is almost impossible to avoid in research (and trying to avoid this by all means may pose a threat to external validity). Therefore, how to cope with it is important. The perhaps most important weakness regarding missing data was in study 3. In the study the level of missing data was non-negligible,

14.4%, and necessary to impute since an intention-to-treat analytical approach was used, which require data for all randomized participants (Hollis & Campbell, 1999). To cope with the missing data, the recommended multiple imputation method was used (Baraldi & Enders, 2010; Enders, 2017). In addition, in the sensitivity analyses data was analyzed using last observation carried forward, which has been found to be appropriate to protect against Type I error (Overall et al., 2009).

Effect sizes are the most important outcome of intervention studies (Lakens, 2013). Cohen's *d*, which was used in study 2 and 3, is probably the most used effect size measure in psychological intervention research. The use of this measure and the established cut off scores for different levels of effect sizes have great advantages, such as comparing results between studies. However, Cohen's *d* should not be interpreted rigidly (Thompson, 2007). For example, a small effect size can be highly important, such as an intervention that leads to statistically significant suicidal reduction with an effect size between zero and small (Lakens, 2013), and a high-level of reduction in burnout does not necessarily correspond much to the levels of improved work ability (Lindsäter et al., 2018).

Therapists and Protocol Adherence

A further weakness was that only one therapist was used in the first and the third intervention study. This confounds intervention methodology with the therapist factor. However, in study 2, where several therapists were used and where results in the same direction were demonstrated, indicates that it is primarily the intervention methodology and not the therapist that explains the intervention effects. Another important factor regarding intervention methodology is therapist adherence to the protocol, which was not checked in any of the studies. Adherence check was assumed to be unnecessary as I, who was the only therapist in two of three studies and supervised the other therapists used in study 2, was the one who was mainly responsible for the development of the intervention.

Future Studies

The studies included in the thesis have demonstrated results that warrant further research. Below I provide some suggestions.

Further Studies of the BEL

Replication and Additional Measures

Of primary value is to conduct a replication of the third intervention study to strengthen the conclusion regarding the effects of (the group-based version) the BEL. Minor changes are suggested, such as using other therapists (and do adherence checks) and deliver the intervention in another setting. It is advantageous if another research group conducts the study. The same outcome measures should be repeated (except that a revised version of SMBQ should be used; Almén & Jansson, 2021). It would be valuable with additional follow-up assessments to examine long-term maintenance under controlled conditions. Additional measures can be considered, such as work ability, quality of life and participant satisfaction (APA, 2002). It would be of great value also to use non-self-report measures, such as objective measures of sick-leave, and heart rate variability as an indicator of autonomic balance and general health. Moreover, to conclude what the value of the BEL may be, economic analyses (e.g., cost-benefit, cost-effectiveness, and cost-utility analyses) can be performed. Such analyses can contribute to making the BEL as cost-efficient as possible and provide a base for decision-making regarding funding research on and use of the BEL.

Mediator Analyses

We have relatively good knowledge about the health/wellbeing effects of different types of psychological interventions, while there is no evidence-based explanation of how or why even the most well-studied interventions produce change (Kazdin, 2009; Taubner et al., 2021). An important building block – and a recommended first step (Taubner et al., 2021) – for understanding why an intervention increases health/wellbeing is knowing what mediates improvements (Kazdin, 2009).

In line with the fundamental hypotheses of this thesis, that recovery behavior is a critical factor for health, a study by Santoft et al. (2019) showed that burnout reduction achieved via CBT was mediated by improved sleep quality. A strategy to further improve the BEL, and to gain insights into the recovery research in general, is to study potential recovery behaviors as mediators in the context of the BEL. Of primary interest is to investigate recovery behaviors as mediators for restoration of depleted resources (e.g., burnout). To test the hypothesis that recovery behavior is an important

transdiagnostic factor, improved recovery behavior can be studied as a mediator for reduced levels of anxiety and depression.

The factors in the REQ, and other recovery important behavioral factors, could be used as mediator variables. If one of the factors turns out to be a stronger mediator than the others, one could perhaps consider focusing more on this specific factor in the BEL. It may also be valuable to study whether the factors – or certain combinations of factors – vary in how important they are to health in different circumstances and for different individuals (Bennett et al., 2016). Knowledge regarding this can give rise to context adapted versions of the BEL.

Comparison With Conventional Stress Management

According to theories described in the introduction, recovery may be more critical for health than reduction of stress behaviors in stressful situations. If so, “recovery management” should have greater potential to improve health than conventional stress management. Also, it may often be easier, and/or more desirable, to learn how to increase recovery behaviors rather than reduce stress behaviors. A recovery perspective can also normalize limited time periods of stress, which may undermine the risk of meta-stress behavior (to be stressed about being stressed), which according to clinical experience is common among people with severe stress-related ill health (Almén, 2017). Also, it may reduce maladaptive beliefs about stress and thus stressor appraisal processes (Kibly, et al., 2022), and the risk of dysfunctional avoidance behaviors as well as lack of acceptance, which both characterize psychological suffering and psychopathology (Hayes, et al., 2012).

The strongest recommendations for a new intervention are based on results that show that it is more effective than other interventions that are evidence-based or believed to be effective (APA, 2002). Comparing the effect sizes obtained in study 2 and 3 with the effect sizes obtained in studies on conventional stress management yields a certain indication. However, for a valid comparison, different interventions should be examined under the same conditions. Therefore, a suggestion is to complement a replication study with a conventional (empirically supported) stress reducing intervention arm.

It is possible that different stress management interventions fit different people. Some people have difficulties winding down after a period of stress exposure (McEwen & Seeman, 1999) due to perseverative cognitions (Brosschot et al., 2010; Verkuil et al., 2010), and for those individuals a

recovery intervention may be the most helpful approach, while those who fail to recover due to difficulties in adapting to stressors (McEwen & Seeman, 1999) might benefit from a stress management intervention that directly targets adaptation processes. Therefore, it would be valuable to study whether effects can be maximized through matching different response patterns in stress reactivity and recovery deficiencies to either an evidence-based stress management intervention or the BEL (Öst et al., 1981).

Others Populations

It would be valuable to test the BEL on people with clinical burnout to find out if an intervention that solely and systematically targets recovery behaviors can lead to meaningful health-related effects. Notably, regarding perceived stress, the level at preassessment for the total sample used in the RCT-study was in-between two samples of people with clinical burnout and clinical burnout and adjustment disorder, respectively (Eklund et al., 2014; Lindsäter et al., 2018), while the level of burnout was roughly half to one standard deviation lower in comparison with three samples fulfilling the criteria for clinical burnout (Lindsäter et al., 2018; Sonntag-Öström et al., 2015; van de Leur et al., 2020). This indicates slight but not considerable differences between the sample used in the RCT-study in this thesis and clinical samples of critical variables, which gives reason to be optimistic about achieving meaningful effects even for samples consisting of people diagnosed with clinical burnout.

Not only formally defined stress-related disorders, such as clinical burnout/exhaustion syndrome, but also affective disorders, involve dysregulation of major biological stress systems, such as the HPA axis and the ANS (Vinkers et al., 2021). Therefore, it is warranted to test whether the BEL (or other behavioral recovery interventions) is beneficial for people with different affective disorders. It could also be relevant to test the efficacy of the BEL for other clinical conditions that have been demonstrated to be associated with high levels of stress/low levels of recovery, such as ADHD (Isaksson et al., 2015) and chronic pain (Blackburn-Munro & Blackburn-Munro, 2001). The BEL could be studied as a key intervention component in a comprehensive program where stress recovery is the primary variable to intervene, but also as a secondary, additional component when strengthened stress recovery would be beneficial but of secondary interest to intervene.

Additional or Removal of Intervention Components

Based on what has been discussed above about possible additive interventions – and that burnout/resource depletion is often plagued by comorbidity symptoms (Ahola et al., 2005; Glise et al., 2010; Melamed et al., 2006; Weber & Jaekel-Reinhard, 2000; Wurm et al., 2016) – it may be relevant to study whether integrating additional interventions will be beneficial for the effects of the BEL. As well as to study whether additional interventions will make the BEL more effective, it may be appropriate to study whether components can be removed without losing efficiency (or making the intervention more efficient). In the first study a brief version of the BEL was investigated. The results indicated that what is considered the core of the intervention is enough to improve stress and health-related variables. Consequently, it would be motivated to investigate whether a brief group-based version of the BEL, in which only the core components are used, is efficient.

Organizational Version of the BEL

As stated in the introduction, organization-oriented stress interventions have generally not proven to be effective, which may be due to the lack of a theoretical basis (Burgess et al., 2020). The BEL has a solid foundation in stress theory, research on recovery, CBT, and behavioral psychology, therefore, it may be prudent to develop and test an organization-adapted version of BEL. Since the review study by Awa et al. (2010) indicated that adding organization-oriented intervention to an individualistic intervention can lead to more long-term results regarding burnout reduction, a suggestion is to conduct an intervention study including these three conditions: 1) Person directed BEL, 2) Organizational directed BEL, and 3) a combination of 1 and 2.

Internet-delivered Version of the BEL

Therapist-supported internet-delivered CBT-interventions have been demonstrated to be effective, often as effective as face-to-face delivered CBT, for a wide range of problems (Andersson & Carlbring, 2022). This, and the fact that internet-delivered CBT interventions have the potential of being cost-effective for participants experiencing chronic stress (Lindsäter et al., 2019) and may mean increased access to the intervention, suggests studying the efficacy of an internet-delivered version of the BEL.

Patient Research Partners

An approach, which is not new but that has not been used much until recently, is to involve client representatives in clinical research (Goel, 2020). The main reason for this involvement is to increase the probability that results from studies will be as relevant as possible for the clients.

Further Psychometric Studies of the REQ

Although the factorial validity of the Swedish version of the REQ as well as other versions of the REQ have shown to be satisfactory, there is a need to validate the measure further. A major threat to construct validity is “construct underrepresentation”, which means that the assessment does not include important dimensions or facets of the construct (Messick, 1994). It is quite conceivable that recovery outcomes can be mediated by other factors than those included in the REQ. Therefore, it is advisable to study potential factors to add to the measuring instrument, in particular to strengthen the measure’s ability to predict restoration of depleted resources. Since Ginoux et al. (2021) have already demonstrated that a five-factor model including the four REQ-factors and *relatedness* (i.e., experiences of closeness and connectedness with others) showed a satisfactory model-fit with data, this dimension of behavior should be further investigated as a potential factor to include in the REQ. Another possible REQ-factor candidate is *positive feelings*. For example, Oerlemans et al. (2014) showed that social and physical activities were positively associated with recovery (indicated by feelings of rest and being recovered) when happiness was experienced during the activities. When happiness was not experienced the association was negative. In line with this, positive feelings have been demonstrated to be closely related to adaptive parasympathetic activity (e.g., Kok & Fredrickson, 2010). In particular, feelings of safeness and contentment seem to be important for parasympathetic activity (Duarte & Pinto-Gouveia, 2017). According to the generalized theory of stress, *perceptions of safety* are needed in order for stress behavior to stop (Brosschot et al., 2018). Therefore, it may function as an underlying factor in the REQ, not possible to discriminate against the other factors.

An additional aspect of the REQ concerns the fact that the scale only involves self-ratings of experiences during leisure time. Although recovery behaviors at work have been neglected in recovery research (e.g., Gluschkoff et al., 2016), study 2 in the thesis, and the more recent study by Cheng and Cho (2021), shows that recovery behaviors are important not only during

leisure time but also at work. This motivates the validation of a version of the REQ that measures potential recovery facilitating behaviors at work.

5 Conclusions

The primary aim of this thesis was to evaluate stress and health-related effects of an intervention targeting stress recovery behavior in everyday life among people perceiving high levels of stress in life. The results clearly indicate that the behavioral intervention labeled the BEL, which solely aims at strengthening recovery behaviors at work and outside work, is effective in terms of improving stress and health-related variables among people perceiving high levels of stress in life. The evidence is strongest for the reduction in tension, perceived stress, burnout, anxiety and depression, and for delivering the intervention in a group format. Data indicate good maintenance of the achieved effects after termination of the intervention. Study 2 indicated that the intervention can work well in a “real-world” practical situation. The results obtained in the intervention studies correspond well with the theory described in the introduction, postulating that recovery behaviors are critical for health, and the empirically based belief that behavioral principles and CBT methods can work to make a recovery intervention effective.

The secondary aim of the thesis was to validate a self-report scale measuring behaviors important for stress recovery in everyday life. In study 4, support was found for the proposed four-factor model of the Swedish version of the REQ. Thus, the scale can, for example, be used to study potential recovery facilitating behaviors as mediators between the BEL and health outcomes.

When the first intervention study in the thesis was planned and data collection took place, there were no, to the best of my knowledge, stress recovery intervention studies published. Since then, some have been published. Although the number of studies to date is small, they (including the studies of the BEL) indicate that the stress recovery paradigm on stress management has a potential that warrants further research. Regarding the BEL, I have given examples of studies that I find to be relevant to conduct in the future. The immediate step at present should be to replicate the effects of the BEL in another setting using other therapists, preferably by another research group. Also, it would be suitable to carry out a relatively large-scale study in order to enable testing of a relatively large number of theoretically motivated mediators, as well as moderators. A large sample is also needed to compare the BEL with a conventional (empirically supported) reactivity-based stress management intervention.

6 References

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