

Research paper

Emotion regulation strategies moderate the relationship of fatigue with depersonalization and derealization symptoms

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ABSTRACT

Background: The aim of the present study was to investigate the relationships of common emotion regulation strategies (suppression and reappraisal) to self-reported fatigue and depersonalization/derealization symptoms. Specifically, we tested the moderating effect of suppression and reappraisal on the link of fatigue with depersonalization and derealization symptoms. Opposite effects were expected for both emotion regulation strategies assuming that cognitive reappraisal has an adaptive buffering effect, while suppression intensifies the association of fatigue and depersonalization/derealization experiences.

Methods: In a representative study (N = 2524) we assessed emotion regulation strategies, fatigue, depersonalization/derealization, distress, and demographic variables via questionnaires. 55.5% of the participants were female, mean age was 49.4 (SD = 18.2) years with age groups represented in comparable proportions.

Results: In line with the assumptions, moderated regression analyses revealed an interaction effect of emotion regulation strategies and fatigue. Simple slope analyses indicated a buffering effect of cognitive reappraisal on the positive relation of fatigue with depersonalization and derealization symptoms. In contrast, suppression fosters the positive correlation of fatigue and depersonalization and derealization experiences.

Limitations: Our study is limited to these two habitual emotion regulation strategies employing a cross sectional design.

Conclusion: Our findings provide comprehensive empirical data investigating depersonalization/derealization symptoms from the perspective of emotion regulation research. Cognitive reappraisal might help people suffering from fatigue to prevent depersonalization and derealization tendencies.

1. Introduction

Emotion regulation strategies affect health related outcomes when facing stressful circumstances (Gross and Muñoz, 1995; Lazarus and Folkman, 1984), either with regard to daily hassles (Folkman, 1997; Shiota, 2006; Tedlie Moskowitz et al., 1996) or after critical life events (Bonanno et al., 2004; Cohen et al., 2005; Troy and Mauss, 2011). There is a body of evidence pointing out that the ability to regulate emotions is crucial for mental health such as depression, anxiety, post-traumatic disorders, or eating disorders (Aldao et al., 2010; Goldin and Gross, 2010; Goldschmidt et al., 2017). Thus, our self-perception and how we experience our environment are influenced by situational affective states and our ability to control emotions. In the current study, we therefore investigated how individual differences in emotion regulation strategies under stressful circumstances are related to highly

prevalent, yet rarely examined symptoms of depersonalization which are characterized by the subjective experience of detachment from one's sense of self (Lambert et al., 2001; Sierra et al., 2005; WHO, 1993) and derealization symptoms which are characterized by the experience of unreality of the outside world. In the literature, derealization is often subsumed under the classification of depersonalization. Early research on depersonalization/derealization (DD) experiences (Mayer-Gross, 1935; Noyes and Kletti, 1977) had emphasized that DD tendencies are likely to occur under severe stress. However, capacities of self-regulation in terms of personality traits seem to have an impact on DD tendencies (Michal et al., 2006; Sierra, 2009; Simeon, 2014) suggesting a buffering effect of the capability to regulate one's emotions. According to epidemiological studies (Hunter et al., 2004; Michal et al., 2009) as well as a review of literature (Mula et al., 2007), transient symptoms of DD have a high lifetime prevalence rate (between 26% and 74%) in the

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general population, and clinically significant depersonalization has prevalence rates of 1–2%. Despite its health related relevance, depersonalization and derealization have rarely been addressed in clinical routine (Michal et al., 2010a, 2010b; Simeon, 2004). Surprisingly, empirical studies on the relationship of individual effects of emotion regulation on DD tendencies are scarce (Michal et al., 2016). For this reason, we provide a population-based data set in order to shed light on DD symptoms from the perspective of emotion regulation research.

1.1. Emotion regulation

Emotion regulation comprises “the processes by which individuals influence which emotions they have, when they have them, and how they experience or express these emotions” (Gross and John, 2003). In the ‘process model’ of emotion regulation Gross (1998a) suggested five cognitive strategies relating to emotion regulation (cognitive emotional regulation strategies; CERS). Of these, antecedent-focused strategies (situation selection, situation modification, attentional deployment, appraisal; for a more detailed description of these regulation strategies, see Gross, 1998a) are thought to intervene at an early stage of the emotional trajectory, and alter the experience of an emotion before it fully occurs. In contrast, response-focused strategies (response modulation) are thought to act after the emotion has been triggered and focus on the adaptation of the emotional response. A widely used instrument to measure CERS is the Emotion Regulation Questionnaire (ERQ; (Gross and John, 2003)). The 10-item self-report scale of the ERQ was developed using one antecedent-focused (reappraisal) and one response-focused (expressive suppression) strategy that are widely and commonly used in everyday life. Reappraisal is defined as a cognitive change in the way one appraises external or internal situations and one's own capacity to manage demands, thus altering its emotional impact (Gross and Levenson, 1997). It can be achieved by down-regulating negative feelings or by generating positive emotions (Gross and John, 2003). Expressive suppression is defined as a response-focused regulation strategy. In doing so, behavioral responses and/or the emotional expression resulting from emotional experiences are suppressed. Thus, reappraisal is “changing the way one thinks about a potentially emotion-eliciting event”, while suppression is “changing the way one responds behaviorally to an emotion-eliciting event” (John and Gross, 2004).

There is often a desire to broadly evaluate CERS in terms of their adaptivity; however, the adaptivity of a CERS depends on various factors such as situational determinants (e.g. (Egloff, 2015; Egloff et al., 2006)) in which they are employed. While reappraisal is often considered adaptive across various contexts, and seems to often have positive impact on psychological health and decrease of distress, suppression is more widely thought to be maladaptive. In experimental settings, for instance, reappraisal has been proven to be a useful strategy to deal with negative situations (Gross, 1998b; Mauss et al., 2007; Ochsner et al., 2002). Cognitive reappraisal is strongly associated with psychological health (Buhle et al., 2014; Folkman, 1997; Garnefski et al., 2007; Gross and John, 2003; Hu et al., 2014; McRae and Mauss, 2017), and is said to be a corner stone of the therapeutic process (Beck et al., 1979) and a central mediator of the therapeutic outcome in traditional cognitive behavioral therapy (CBT) (Clark, 1999). Modifying dysfunctional cognitions and changing the appraisals one makes in emotional situations has also been studied as a core element of other therapeutic approaches such as f.e. dialectical behavioral therapy (Linehan, 1987), psychodynamic therapy (Maroda, 2010) and even in web-based therapy approaches (Berger et al., 2011; Morris et al., 2015). Cognitive reappraisal has been successfully used in the treatment of a range of disorders, such as f.e. affective disorders (Bryant et al., 2001; Carrico et al., 2005; Cutuli, 2014; Kudinova et al., 2017; Smoski et al., 2015), anxiety disorders (Brozovich et al., 2015; Goldin et al., 2013; Smits et al., 2012), chronic pain (Tracey, 2010), and also depersonalization disorder (Hunter et al., 2005). Although expressive suppression

may reduce the subjective experience of emotion in the short term (e.g., due to perceived emotional distance), concerns exist that its use might lead to increased emotional and physiological arousal over the long term (Gross, 1998a; John and Gross, 2004). Incapability to effectively manage emotional responses in everyday life, may lead to more frequent and persistent periods of distress and emotional exhaustion (Aldao et al., 2010). In fact, some evidence suggests that prolonged or frequent use of suppression is a risk factor for both distress and psychopathology (O'Driscoll et al., 2014) such as depression and anxiety (Mennin et al., 2007; Wenzlaff and Wegner, 2000). There is also a body of empirical evidence that reduced cognitive reappraisal is associated with higher stress-related symptoms (Moore et al., 2008) and emotional exhaustion (Chi and Liang, 2013). Despite these fairly well-established long-term associations, there is less complete understanding of the potential underlying processes.

1.2. Fatigue

A largely unrelated domain of enquiry examines fatigue. Fatigue is a normal, typically rather harmless experience often occurring as a consequence of inadequate sleep, lack of relaxation, increased physical activity and/or distress in everyday life (Smets et al., 1995). According to Shen et al. (2006), more serious fatigue is characterized by an overwhelming sense of tiredness, lack of energy, and a feeling of exhaustion associated with impaired physical and/or cognitive functioning (Shen et al., 2006). The experience and impact of fatigue is subjective and highly variable, both between and within individuals over time. Moreover, people with the same overall fatigue score may differ in their experiences (Smets et al., 1995). For example, women complain more about fatigue than men, and the experience of fatigue seems to differ qualitatively between the genders (Bensing et al., 1999).

Although the specifics depend on the definition and applied diagnostic criteria, it is commonly accepted that fatigue is very common and its severity is continuously distributed in the general population (Loge et al., 1998; Pawlikowska et al., 1994). Reported prevalence rates in the general population range between 7% and 45% (Lewis and Wessely, 1992). Importantly, evidence suggests that fatigue is a primary contributor to ~ 20% of all afflictions reported in primary care (Cathelbras et al., 1992; Cullen et al., 2002). Further, fatigue is a rather nonspecific symptom underlying a number of somatic conditions, stress reaction or psychological morbidity (Cathelbras et al., 1992). As alluded to, previous research supports the assertion that fatigue is related to a wide range of psychopathologies (Bultmann et al., 2002; Nelson et al., 1987; Pawlikowska et al., 1994; Ridsdale et al., 1993), particularly depression, anxiety and an overall decreased quality of life. If the experience of fatigue becomes severely disabling in everyday life and alternative medical and psychiatric causes have been excluded, Chronic Fatigue Syndrome as a pathologically discrete entity can be diagnosed (Fukuda et al., 1994). The direction of the link between fatigue and psychiatric comorbidities, however, is not yet clear.

Over the past years, fatigue has attracted more widespread attention. Its broad prevalence and clinically meaningful relation to numerous adverse psychological and physiological outcomes have been increasingly recognized. Fatigue symptoms are common when suffering from depression, burnout, and after physical illness in terms of chronic fatigue (e.g., Kocalevent et al., 2013; Lievesley et al., 2014; Zalai et al., 2016). Fatigue is frequently related with burnout in the context of the experience of lacking or draining emotional resources (Meeuwesen et al., 2002) or facing exceeding emotional demands. Measures of emotional exhaustion and general fatigue have been shown to share similar predictors to a large extent, and they were highly correlated in previous research (Michielsen et al., 2004). Thus, diagnostic instruments that measure burnout are also commonly used to determine general fatigue (Nubling et al., 2006).

1.3. Depersonalization and derealization

Depersonalization is characterized by a detachment of self-awareness, feelings of disembodiment and subjective loss of emotions and emotional numbing (Sierra and David, 2011). The first scientifically reported cases are based on documentations of the late 19th century (Krishaber, 1873). Similar to fatigue, the individual experience of depersonalization can vary in a continuum ranging from temporary impact in stressful daily life situations to a secondary symptom in the context of other mental disorders or as a primary mental disorder, often accompanied by derealization (Depersonalization-Derealization Syndrome, DDS; ICD-10) (Hunter et al., 2017; Lambert et al., 2001; Sierra et al., 2005; WHO, 1993). According to epidemiological studies, temporary symptoms of DD are relatively common in the general population. In a dimensional concept of depersonalization, the lifetime prevalence ranges between 26% and 76% (Michal et al., 2011). In non-clinical population DD symptoms frequently occur transiently under conditions such as fatigue, trauma (Noyes and Kletti, 1977), and under the influence of recreational drugs (Medford et al., 2003). DD phenomena are also very common as secondary symptoms in association with other psychiatric illnesses; again, this is particularly evident for depression and anxiety, and thus concerns exist that clinically meaningful DDS is widely underdiagnosed (Baker et al., 2003; Michal et al., 2016). Depression and anxieties are in fact the most prevalent comorbid disorders of patients with diagnosed DDS (Sierra et al., 2012; Simeon et al., 2003) and there is body of evidence that the underlying mechanism of developing DDS is similar to the process described in models of anxiety disorders such as panic (Clark, 1986) and health anxiety (Hunter et al., 2005; Warwick and Salkovskis, 1990) and association between panic and the initial onset of DDS has been reported (Mayer-Gross, 1935). Hunter et al. (2003) presented a DDS model suggesting that patients with DDS misinterpret common DD symptoms (such as fatigue) leading to highly threatening catastrophizing thoughts ('catastrophic attribution'), which in turn may lead to cognitions and behaviors that generate further anxiety reinforcing and perpetuating the depersonalization symptoms (Hunter et al., 2003) – a vicious circle. However, patients with DDS are more likely to attribute a catastrophic psychological reason for DD symptoms, while patients with anxiety disorders report more psychological attributions for cognitive symptoms (Hunter et al., 2014). Despite strong comorbidity and similar pathophysiological mechanisms, however, there is evidence in the support of the view that anxiety and DDS are distinctive psychopathological syndromes (Michal et al., 2016, 2011; Simeon et al., 2001).

Overall, research on DDS is rare in cognitive-behavioral approaches (Heidenreich et al., 2006). In contrast, DDS has a quite long research history in psychoanalytic theory, in which DDS is commonly considered a defense mechanism to protect the ego from internally generated psychodynamic conflicts (Ambrosino, 1976) or the impact of external factors such as childhood trauma (Simeon and Abugiel, 2006).

With regard to research on emotion, there is some evidence pointing out the link of depersonalization experiences and the ability of using cognitive reappraisal and suppressing emotions (Medford, 2012; Monde et al., 2013). Emotional processing inhibition and self-focused attention have been postulated as underlying mechanisms associated with DD (O'Driscoll et al., 2014; Sierra and Berrios, 2000). Neurobiological and psychological models have shown that a disordered body schema and emotional and autonomic blunting are essential components of the disorder (Michal and Beutel, 2009). Psychophysiological and neuroimaging studies (Griffin et al., 1997; Lemche et al., 2007; Phillips et al., 2001; Sierra et al., 2002, 2006) were conducted in order to capture physiological correlates of the subjective loss of emotions and emotional numbing.

Neuropsychological findings suggest a role for the right ventrolateral prefrontal cortex (VLPFC) in the suppression of emotional responses in DDS patients (Medford et al., 2011; Phillips et al., 2001).

Right VLPFC activity was also found to be a correlate for the regulation of both, positive and negative emotions, in healthy individuals (Ochsner and Gross, 2005; Ohira et al., 2006); especially for decreasing negative emotional responses (Kim and Hamann, 2007). These studies refer to instructed, thus explicit use of these two emotion regulation strategies. As emphasized by Medford (2012), the investigation of the involuntary use of emotion regulation strategies, in particular of suppression, would be more relevant since DDS patients were affected by involuntary inhibiting mechanisms (Medford, 2012).

From an evolutionary perspective, symptoms of DD are considered as hard-wired responses to severe stress. In early research on this topic, Mayer-Gross (1935) expressed the idea of this particular psychophysiological state of depersonalization as a "pre-formed response of the brain" under certain circumstances, such as overwhelming threat. This idea is in line with findings in which almost all healthy people that are exposed to life-threatening danger reported depersonalization tendencies (Noyes and Kletti, 1977). According to various disease models of DDS, they are perpetuated by personality traits such as low capacities of self-regulation (e.g., low affect tolerance, low self-esteem, low cohesiveness of the self) (Michal et al., 2006; Sierra, 2009; Simeon, 2014).

1.4. The present investigation

Overall, the aim of this study was to investigate the influence of emotion regulation strategies on DD and fatigue in the general population. DD symptoms and fatigue are commonly associated with one another. Both concepts are known to influence psychological as well as somatic aspects of health. Therefore, we wanted to ascertain the relation of fatigue and DD symptoms in our study. Referring to the relation of DD tendencies and emotions regulation strategies, theoretical and empirical findings suggest opposite associations between DD and suppression or reappraisal, respectively (Medford, 2012; Monde et al., 2013). Accordingly, we expected that DD tendencies are positively linked with suppression and negatively with reappraisal. The fact that fatigue and DD involve alterations in one's experience, expression, and processing of emotions (Medford et al., 2016; Michielsen et al., 2004; Mula et al., 2010; Phillips et al., 2001; Sierra and David, 2011) suggest that different emotion regulation strategies might have differential impacts on the relation of these concepts. On the one hand, long-term suppression might lead to an increased emotional and physiological arousal leading to mental and physical exhaustion, which is characteristic for fatigue. Further, DD might independently occur as unconscious forms of coping mechanism in case of emotional exhaustion due to high levels of arousal and the incapability to handle situations of high emotional demand in everyday life in terms of emotion regulation. Thus, increased feelings of fatigue and response-focused CERS could lead to an increase of DD phenomena in individuals who do not apply adaptive coping strategies or inhibit their emotional response (Medford, 2012). Subsequently, we assumed a moderating effect of suppression on the relation of fatigue with DD symptoms. On the other hand, the antecedent-focused strategy of reappraisal enables different interpretations in emotion-eliciting situations, ideally enabling the individual to change the emotional impact (i.e., reduce negative emotional impact or increase positive emotional experience). Thus, when used to down-regulate negative emotions or generate positive emotions, respectively, reappraisal should help to reduce emotional and experiential exhaustion (Gross and John, 2003). Further, reappraisal requires and facilitates emotional self-awareness in order to choose and implement appropriate and helpful cognitive strategies to reduce negative outcomes such as distress. In contrast to suppression as emotion regulation strategy, we expected an opposite moderating effect of reappraisal. Therefore, we tested the following hypotheses (Fig. 1):

H1. Fatigue is positively associated with DD symptoms.

H2. The emotion regulation strategies suppression and reappraisal are conversely related to DD symptoms.

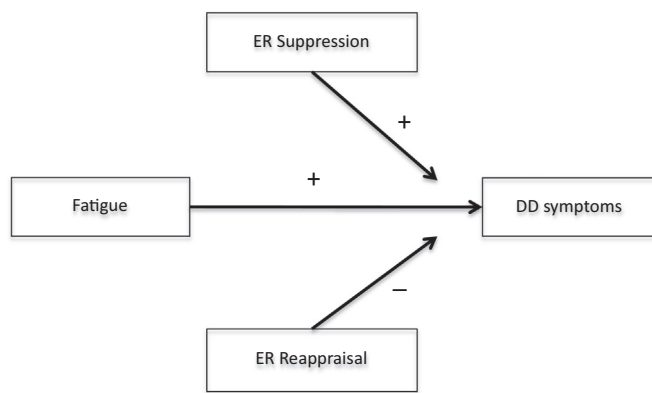


Fig. 1. A conceptual model of the association of fatigue, emotion regulation strategies (ER; reappraisal and suppression) and depersonalization/derealization (DD) symptoms.

H2a. Suppression is a positive predictor of DD tendencies.

H2b. Reappraisal is a negative predictor of DD tendencies.

H3. The relation of fatigue with DD symptoms is moderated by emotion regulation strategies.

H3a. Suppression increases the positive relation of fatigue and DD symptoms.

H3b. Reappraisal decreases the positive relation of fatigue and DD symptoms.

To our knowledge, our study addresses several aspects with refer to emotion regulation strategies, fatigue, and DD phenomenon which have not been investigated up to now. First, we present representative data displaying the association of suppression and reappraisal with fatigue as well as DD symptoms. Second, the moderating effect of emotion regulation strategies with refer to DD symptoms are tested. Although DD has been associated in psychoanalytical and cognitive-behavioral models with emotion regulation processes, our study is the first to target this question empirically. Finally, the current investigation contributes to clarify the role of exhaustion and emotion regulation in DD experiences that might be useful for clinical DDS models.

2. Method

2.1. Sample

A representative sample of the general population of Germany was selected with the assistance of a demography consulting company (USUMA, Berlin). A total of 258 sample points were used. Inclusion criteria were age above 13 years and German as a native language. A first attempt was made for $N = 4630$ addresses following a random-route procedure. From the $N = 4630$ selected addresses, $N = 4572$ were valid. All participants were visited by an interviewer, informed about the investigation and provided written informed consent. A total of $N = 2524$ persons agreed to participate (response rate = 55.2%) and $N = 2512$ interviews and questionnaires were suitable for evaluation. Of those $N = 1401$ were female (55.8%) and $N = 1111$ (44.2%) male. The mean age of the participants was 49.4 ± 18.2 years (range age 14–94). With respect to age, sex, and education the sociodemographic characteristics of the study sample closely match those of the total population in Germany. The survey was conducted in order to investigate different aspects of mental distress, bodily complaints, and emotion regulation.

The study and procedure, including the consent procedure, were approved by the institutional ethics review board of the University of Leipzig (Az 063-14-10032014). The ethics committee of the University of Leipzig approved the consent procedure for the whole sample.

Furthermore, the study adhered to ICH-GCP-guidelines as well as to the guidelines of the ICC/ESOMAR International Code of Marketing and Social Research Practice. All participants were informed of the study procedures, data collection and anonymization of all personal data. All participants provided verbal informed consent, which was noted by the trained interviewer before starting with the survey.

2.2. Measures

Participants provided information regarding their demographic background such as age, gender, partnership, employment, and equalised household income (OECD, 2011). The German versions of the following questionnaires were used for the current investigation. Internal consistency of the scales were indicated by Cronbach's α .

Participants completed the Emotion Regulation Questionnaire (ERQ; (Abler and Kessler, 2009; Wiltink et al., 2011)) which is a measure for individual differences in suppression (e.g. "I control my emotions by not expressing them.") and reappraisal (e.g. "I control my emotions by changing the way I think about the situation I'm in.") tendencies. Satisfactory internal consistencies were reported for both subscales, suppression (4 items, $\alpha = .74$, range 1–28) and reappraisal (6 items, $\alpha = .76$, range 1–42). Items were rated on a 7-point scale (1 = strongly disagree to 7 = strongly agree).

In order to assess general fatigue, the Copenhagen Personal Burnout Inventory (CBI; (Kristensen et al., 2005)) was administered. It is part of the Copenhagen Psychosocial Questionnaire (COPSOQ; (Kristensen et al., 2005; Nübling et al., 2006)) measuring physical and mental exhaustion, independent from work (Pejtersen et al., 2010). The scale consists of six items (tired, physically, emotionally exhausted, unable to go on, weak and prone to illness) beginning with "How often do you feel..." The items were rated on a 5-point scale (1 = never, almost never, 2 = rarely, 3 = occasionally, 4 = often, 5 = always) with a sum score range of 1–30. The corresponding cut off score for high degree of fatigue is ≥ 15 (Borritz and Kristensen, 2004). Internal consistency was very good ($\alpha = .91$).

Severity of DD symptoms was assessed with the CDS-2, the two-item version of the Cambridge Depersonalization Scale (CDS; (Michal et al., 2004; Sierra and Berrios, 2000)). The CDS-2 comprises the following two items of the CDS which measure derealization and depersonalization [22]: "My surroundings feel detached or unreal, as if there was a veil between me and the outside world" (derealization) and "Out of the blue, I feel strange, as if I were not real or as if I were cut off from the world" (depersonalization). The CDS-2 differentiates patients with clinically significant DD well from other groups (cut-off of CDS-2 ≥ 3 , sensitivity = 78.9%, specificity = 85.7%). The response format of the CDS-2 was adopted from the Patient Health Questionnaire. Participants were asked "Over the last 2 weeks, how often have you been bothered by any of the following problems?" (not at all = 0, several days = 1, more than half the days = 2, nearly every day = 3). Internal consistency was good ($\alpha = .84$). The CDS-2 sum score (range 0–6) correlated strongly ($r = .77$ (Michal et al., 2010c)) with depersonalization severity according to a structured clinical interview of depersonalization severity.

As potential confounding variable, distress was assessed additionally. Therefore, we measured the aggregated score of anxiety and depression assessed with the German version of the Hospital Anxiety and Depression Scale (HADS; (Snaith, 2003)). The HADS comprises an anxiety subscale and a depression subscale, both containing seven items each (subscale range 0–21). The answers range from 0 "very often indeed" to 3 "not at all". Good internal consistencies for both scales are demonstrated for the German version of the HADS (Cronbach's alpha: anxiety .80; depression .81) (Herrmann et al., 1995; Hinze and Schwarz, 2001) as well as for the aggregated HADS score (.89). For the detection of depressive and anxiety disorders a cut-off point of ≥ 11 for anxiety and ≥ 9 for depression has been proposed.

Table 1

Means, standard deviations, and simple correlations among measures.

Variable	Mean (SD) or %	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. DD	.41 (.90)		.10**	-.11**	.42**	.03	.01	-.02	.09**	-.11**	-.06**
2. ER suppression	15.87 (4.72)			.18**	.08**	.01	.09**	-.06**	.04	-.01	-.05*
3. ER reappraisal	26.34 (6.13)				-.08	.06	-.01	.03	-.01	-.01	.01
4. Fatigue	12.78 (4.83)					-.01	.17**	.12**	.01	-.01	-.06**
5. Distress	9.32 (7.03)						.02	.05**	.03	-.02	-.01
6. Age	49.44 (18.24)							.03	-.13**	.02	-.09**
7. ¹ Gender	1 _{male} = 44.20, 2 _{female} = 55.80								.06**	-.00	-.06**
8. ¹ Partnership	1 _{yes} = 55.90, 2 _{no} = 44.10									-.23**	-.27**
9. ¹ Employment	1 _{no} = 7.80, 2 _{yes} = 47.80, 3 _{other} = 44.50										.45**
10. Income	1.58 (.48)										

Note. DD = Depersonalization and derealization symptoms. ER = Emotion regulation. Distress = aggregation of anxiety and depression scores. ¹ = categorical variables, therefore descriptive statistics indicate percentage. Gender: 1 = male, 2 = female, Partnership: 1 = yes, 2 = no, Employment: 1 = no, 2 = yes, other (coded as systematic missing) = were in charge of the household, received pension, worked on a fee-per-hour basis, attended school, had vocational training and were on parental leave, military or civilian service. Equivalised income is calculated after OECD guideline: household income/√(people in household); household income per month: 1 = < 1250 Euro, 2 = 1250–2500 Euro, 3 = > 2500 Euro. *N* = 2512. **p* ≤ .05, ***p* ≤ .01, two-tailed.

2.3. Statistical analysis

Bivariate analyses were calculated by using Pearson product-moment correlation analyses. Alternatively, Spearman's Rho was chosen if the categorical variables gender, partnership and employment were involved. In order to test the moderation hypothesis, z-standardized scores were entered in a regression model with DD symptoms as outcome measure. The model predictors consisted of potentially confounding variables based on the bivariate correlation results, the target personality variables as well as their interaction terms. The regression models were checked for multicollinearity using the variance inflation factor, and all values were well below 2. Analyses were performed using SPSS 23 and the SPSS macro PROCESS v2.16 (Hayes, 2013). Effect sizes of correlation and regression coefficients are interpreted after Cohen (1992).

3. Results

Descriptive statistics and intercorrelations of sociodemographic and psychological measures are shown in Table 1. The mean CDS-2 mean sum score of .41 is low since the cut-off for clinically significant DD is ≥ 3 (sensitivity = 78.9%, specificity = 85.7%). Emotion regulation scores for both, suppression and reappraisal, are comparable with previous results of validation studies from Germany and USA (Ablner and Kessler, 2009; Gross and John, 2003). The mean fatigue and distress scores of our sample are below the cut-off scores for high degree of fatigue or combined depression and anxiety, respectively. On the bivariate level, DD symptoms are associated with gender, partnership, employment, both emotion regulation strategies and fatigue, but not with distress consisting of an aggregation of depression and anxiety scores. As postulated in H1, fatigue was positively associated with DD symptoms. In line with the assumptions of H2 referring to emotion regulation strategies, suppression was positively correlated with DD symptoms, while reappraisal showed a negative link. The results of the moderated regression analysis are displayed in Table 2, $R^2 = .22$, $F(8,2407) = 122.80$, $p \leq .001$, $f^2 = .28$. Based on the preceding correlation analysis, partnership, employment, and equivalised income were additionally controlled in the regression model. The main predictors of DD symptoms in the regression model were all significant. The highest effect was observed for fatigue ($\beta = .39$, $t = 21.17$, $p \leq .001$). Also both interaction terms of fatigue with suppression and reappraisal were statistically significant. Overall, the interaction effect was small ($f^2 = .02$).

Simple slope analyses indicate opposite interaction effects of the two emotion regulation strategies with fatigue on depersonalization symptoms (see Fig. 2). While subjects with high fatigue scores and high suppression tendencies are more prone to depersonalization symptoms,

Table 2

Regression model of depersonalization and derealization symptoms on fatigue, emotion regulation strategies, and their interactions controlling for confounding socio-demographic variables.

	<i>B</i>	<i>SE</i>	β	<i>CI</i>	<i>T</i>	<i>p</i>
<i>Sociodemographic variables</i>						
Partnership	.04	.01	.07	[.02, .06]	3.875	.000
Employment	.30	.07	.08	[.12, .48]	4.261	.000
Income	.02	.02	.02	[-.02, .05]	.807	.420
<i>Emotion Regulation (ER) and fatigue</i>						
ER suppression	.08	.02	.08	[.05, .11]	4.286	.000
ER reappraisal	-.09	.02	-.09	[-.12, -.05]	-4.856	.000
Fatigue	.39	.02	.39	[.34, .43]	21.173	.000
<i>Interaction terms</i>						
ER suppression × Fatigue	.08	.02	.08	[.03, .12]	4.220	.000
ER reappraisal × Fatigue	-.11	.02	-.11	[-.16, -.06]	-6.087	.000

Note. Partnership: 1 = yes, 2 = no, Employment: 1 = no, 2 = yes, other (coded as systematic missing) = were in charge of the household, received pension, worked on a fee-per-hour basis, attended school, had vocational training and were on parental leave, military or civilian service. Equivalised income is calculated after OECD guideline: household income/√(people in household); household income per month: 1 = < 1250 Euro, 2 = 1250–2500 Euro, 3 = > 2500 Euro. All variables except partnership and employment are z-standardized. *N* = 2416.

those with high fatigue scores and low reappraisal tendencies are more likely to report DD symptoms. Thus, reappraisal and suppression were significant moderators of the relationship between fatigue and DD symptoms. Simple slope analyses for subjects 1 SD below the mean of reappraisal was $b = .49$, $t = 13.70$, $p \leq .001$, for suppression $b = .31$, $t = 8.74$, $p \leq .001$. For subjects with a mean level of reappraisal and suppression, the regression effect was $b = .38$, $t = 16.13$, $p \leq .001$. The simple slopes for subjects 1 SD above the mean of reappraisal was $b = .28$, $t = 8.50$, $p \leq .001$ and $b = .46$, $t = 14.19$, $p \leq .001$ for suppression (see Fig. 2). In sum, these findings corroborate the assumptions postulated in H3.

4. Discussion

To the best of our knowledge, this is the first study to examine the relation between common emotion regulation strategies (suppression and reappraisal) to self-reported fatigue and DD. In line with previous epidemiological research on clinically significant DD, we found that DD symptoms are common in the general population of Germany (Michal et al., 2010a, 2010b, 2010c). Our results indicate a positive correlation of fatigue and DD symptoms (H1). In line with the assumptions of H2, emotion regulation strategies were conversely linked to DD symptoms:

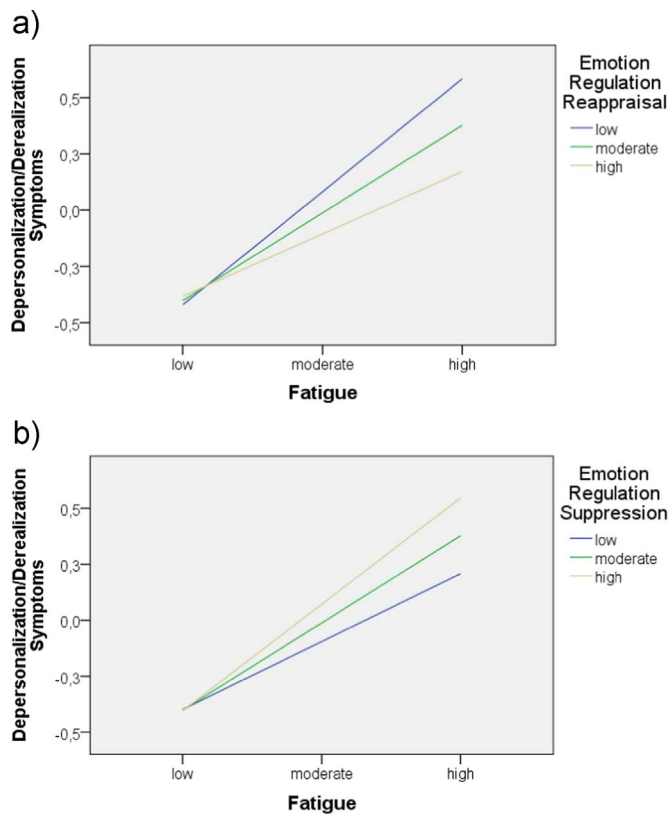


Fig. 2. Simple slope analysis for the moderating effect of the emotion regulation strategies a) reappraisal and b) suppression on the relation of fatigue and DD symptoms in a German representative sample. All measures are z-standardized: -1 = low, 0 = moderate, 1 = high.

suppression was positively associated with DD symptoms, while reappraisal was a negative predictor of DD tendencies. Moreover, emotion regulation strategies moderated the relation of fatigue with DD symptoms. While suppression increases the positive relation of fatigue and DP, reappraisal led to a decreased positive correlation of fatigue with DP.

Our findings are in line with neuropsychological findings on DD symptoms and the two emotion regulation strategies, suppression and cognitive reappraisal (Medford, 2012; Stein and Simeon, 2009) and as well as CBT models of DDS (Hunter et al., 2005, 2003, 2014). Fatigue shares a large amount of variance with DD symptoms and in line with a CBT model of DDS and earlier findings (Hunter et al., 2003) it may be that experiencing fatigue leads to the increase of DD symptoms due to dysfunctional (catastrophizing) cognitive interpretation of fatigue. On the other hand, cognitive reappraisal of fatigue may lead to normalizing of the symptom and thus lead to less self-attention and reduction of overall DD symptoms (Hunter et al., 2014).

In line with that, a cognitive behavioral therapy (CBT) approach for DDS by Hunter et al. (2003) interventions such as psychoeducation and normalizing the DD symptoms, standard CBT interventions for depression and anxiety, the reduction of avoidance behavior and self-focused attention, self-observation and finally progress and relapse prevention strategies. A focus of the therapeutic approach lies in cognitive reappraisal of catastrophizing thoughts through evidence gathering and behavioral experiments. The therapy approach has been shown to significantly improve DD severity and psychological distress such as anxiety and depression in post-treatment and six-months follow-up (Hunter et al., 2005).

Interestingly, our results did not show associations between DD symptoms and anxiety/depression scores. Given the fact that strong links between depression/anxiety and DDS have been found in clinical

samples this might seem like a contradiction. An earlier study on the same representative sample of the German population has confirmed the high co-occurrence of clinically meaningful DDS (CDS-2 scores) and depression/anxiety according to the HADS (Michal et al., 2011), which was comparable to those found in clinical samples of DDS (Baker et al., 2003; Michal et al., 2005; Simeon et al., 2003). However, the shared variance of DD symptom severity with anxiety and depression was only 32.1%, with HADS-A (anxiety) explained 27.3% and HADS-D (depression) only 4.8% of the variance. This may further support the assumption that DDS and depression/anxiety are clear distinct psychopathological syndromes, although anxiety and DDS may share similarities.

Having assessed suppression and cognitive reappraisal as habitual coping tendencies, our study is the first demonstrating the link of non-instructed emotion regulation by suppression and cognitive reappraisal with DD symptoms.

4.1. Clinical implications

Less is known about the relation of specific emotion regulation strategies and DD experiences. Habitual suppression may lead to a sense of discrepancy between an individual's inner experience and outer expression (Rogers, 1951). This sense of being inauthentic or not being true to oneself (Sheldon et al., 1997), may create negative feelings or alienation from one's self. On the other hand, cognitive reappraisal implies the ability to generate positive feelings or decrease negative feelings. Since "de-affectualization" (Davidson, 1966; Michal et al., 2013) is characteristic for DDS, it might be fruitful to evaluate other emotion regulation strategies leading to increased experience of emotions. A first step would be to disentangle cognitive reappraisal strategies in terms of increasing positive emotions vs. decreasing negative emotions (McRae and Mauss, 2017). Another example of emotion regulation strategy to foster emotional experience is acceptance of negative and positive emotional responses (Campbell-Sills et al., 2006; Hofmann et al., 2011).

Our research contributes to the integration of affective and clinical science. As mentioned earlier, many empirical studies corroborate that emotional work is therapeutic, independent of the psychotherapeutic approach (Rottenberg and Gross, 2007). In terms of clinical research on emotion processing (Greenberg and Pascual-Leone, 2006), improving the awareness of emotions is necessary for adaptive emotion regulation. Further, cognitive biases appear important in the development and maintenance of DDS (Hunter et al., 2014), and a CBT approach that uses reappraisal as a central part of its intervention has shown to successfully reduce DD symptoms in patients with DDS (Hunter et al., 2005). Given the fact that transient DD symptoms are very common in the general population and tendencies to misinterpret these experiences in a psychologically catastrophic may be crucial for the development of DDS, it seems important to further investigate the buffering effect of reappraisal to prevent DDS in people who experience severe stress.

As a next step to gain a better understanding on the importance of distinguished phases of emotion regulation, more integration of different scientific approaches on research on emotion are required. Future studies might investigate additional strategies provided by basic research on emotion in combination with abundant knowledge from clinical settings. In our study, we integrated elements of Gross' cognitive process model distinguishing antecedent-focused and response-focused strategies (Gross, 1998a) with psychoanalytical and CBT frameworks.

4.2. Limitations

The effect sizes of the interaction effects of emotion regulation strategies and fatigue are low. However, we analyzed a representative sample which is assumed not to be affected by sampling biases in comparison to most studies on research on emotion regulation. Small

effects in epidemiological research are common observations, especially when the target variable is a multi-factorial phenomenon (Hoffmeister et al., 2012) which is the case for DDS.

While fatigue shares a large amount of variance with DD symptoms, our study indicates that habitual emotional regulation strategies and their interaction effects with fatigue explain only a small percentage of variance of DDS. It has been pointed out that analyses of habitual emotional regulation strategies often do not take account situational appropriateness of a specific strategy (Egloff, 2015). As we aimed to evaluate general tendencies rather than the investigation of concrete specific situations, we too can not provide further information which may help to understand situation specific analyses.

Finally, we used a cross sectional design for the representative survey. In order to claim predictive validity of the emotion regulation strategies and fatigue for DD, a longitudinal design would be appropriate.

5. Conclusion

Although DD has been associated in psychoanalytical and cognitive-behavioral models with emotion regulation processes, our study is the first to target this question empirically with regard to suppression and cognitive reappraisal tendencies. In a state of fatigue, which reflect a psychologically overwhelming and at some point threatening circumstance for an individual, the ability to regulate emotions seem to buffer DD symptoms. Thus, the present study offers a novel contribution to the impact of emotion regulation on health-related outcomes.

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Declaration of interest

None.

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