



**Fatigue and Burnout: A systematic review of etiology,
maintenance and treatment**

Justus Ruppel
s1477692
Master thesis

Primary supervisor: Dr. Peter Meulenbeek
Secondary supervisor: Dr. Christina Bode

UNIVERSITY OF TWENTE
Positive Psychology and Technology
Faculty of Behavioural Science
Psychology

20.09.2017

Abstract

Burnout and fatigue are two concepts that are very similar to each other: they are both centred around the symptom of exhaustion. In addition, they also share the characteristic that both have a high prevalence and have a great impact on people's life. Despite these similarities, not much is known about the relationship between them. Thus, the aim of this research was to systematically review the literature about the relation between fatigue and the etiology and maintenance of burnout, and the implementation of the treatment of fatigue in the treatment of burnout. To analyse these research questions, a systematic literature review was conducted. A study was included if it provided information about the relationship between fatigue and the etiology or maintenance of burnout or the implementation of a treatment-element that directly targeted fatigue in the treatment of burnout. In total, 17 articles were found that gave answers to at least one of the research questions. Firstly, it was found that fatigue is bi-directionally related to burnout with regard to their etiology. In addition, the same bi-directional relation was found with respect to their maintenance. Lastly, two studies were identified that included the treatment of fatigue in the treatment of burnout. With regard to etiology and maintenance, the bi-directional relationship between burnout and fatigue could be described as a 'downward spiral'. Furthermore, it was concluded that the treatment of fatigue was scarcely implemented in the treatment of burnout and that the approaches that integrated the treatment of fatigue, are no common approaches for treating burnout. Because of the heavy impact of fatigue on burnout and the scarce integration of the treatment of fatigue in the (common) treatment of burnout, these results suggest to integrate the treatment of fatigue better. Therefore, several suggestions were made, as to which elements could be helpful in treating fatigue. Further research should analyse their effectivity.

Keywords: burnout, fatigue, exhaustion, tiredness, sleepiness, insomnia, etiology, origin, development, maintenance, treatment, therapy

Table of Contents

RELEVANCE	4
BURNOUT	4
FATIGUE	7
BURNOUT AND FATIGUE.....	9
RESEARCH QUESTIONS	12
<u>METHODS</u>	<u>12</u>
LITERATURE REVIEW	12
SEARCH TERMS	13
LITERATURE SCREENING, INCLUSION AND EXCLUSION CRITERIA.....	14
DATA EXTRACTION.....	16
<u>RESULTS</u>	<u>16</u>
ETIOLOGY	18
MAINTENANCE.....	22
TREATMENT	26
<u>DISCUSSION.....</u>	<u>27</u>
ETIOLOGY AND MAINTENANCE	27
TREATMENT	31
LIMITATIONS	33
IMPLICATIONS	35
CONCLUSION	37
<u>REFERENCES</u>	<u>39</u>
<u>APPENDIX</u>	<u>49</u>

Relevance

A great deal of research has depicted that many physical diseases are related to fatigue (Avlund, 2010; Graff et al., 2011). All of these studies have shown that fatigue has a strong impact on people's life. It decreases the quality of life and it has often been reported by patients as one of the most worrying symptoms (Graff et al., 2011). Although fatigue is very common and it can have a severe impact on the daily lives of patients, the relationship between most psychiatric disorders, as for example burnout, and fatigue is still unknown. This is even more surprising when looking at the prevalence of burnout. Schaufeli (2007) revealed that at a given point in time between 8-10% of the Dutch working population suffers from burnout. This means that about one in ten workers is affected by the strong negative impact of burnout, which influences the working situation as well as the personal life.

Considering the high prevalence and negative impact of fatigue and burnout, this research systematically reviews the existing knowledge about the relationship between both constructs. Thereby, the research investigates to what extent fatigue is related to the etiology and maintenance of burnout, and to what extent the treatment of fatigue is integrated in the treatment of burnout. Leone, Huibers, Knotterus, and Kant (2009) found that the identification of burnout-related aspects in fatigue therapy and fatigue-related aspects in burnout therapy could improve therapy by preventing the negative consequences that are associated with the combinations of both. Thus, knowledge about the combination of burnout and fatigue could help to improve the treatment of burnout.

Burnout

The concept of burnout was firstly introduced under this name by Freudenberger in 1974 (Maslach, Schaufeli & Leiter, 2001). It can be best described as a psychological syndrome which emerges on a long term as a response to chronic interpersonal stressors on the job (Maslach et al., 2001). This description already highlights the work-focus of burnout, although some researchers also tried to widen the scope of burnout to other populations of

people that are not connected to the work-environment (e.g., housewives, elderly, and youth) (Bakker et al., 2000; Leiter & Durup, 1994; Schaufeli, Leiter & Maslach, 2009).

Even though a lot of research was done about burnout and it is widely recognized as a psychiatric disorder, ambiguities remain regarding the diagnosis and definition of burnout (Bianchi, Schonfeld, & Laurent, 2015). Firstly, burnout is not included as a distinct diagnosis in the latest versions of the two standard diagnostic and classification tools for mental diseases – the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and the International Classification of Disease (ICD-10; Keijsers, Vossen, Kriens & Boelaars, 2011). Due to missing transparency regarding the development-procedure of those diagnostic and classification tools, no statement could be found that could shed light onto the reasoning behind the decision to not include burnout (Collier, 2010). However, in the literature, several arguments could be found for the not-inclusion of burnout. Heinemann and Heinemann (2017) pointed out that not enough about the etiology and psychopathology is known to include burnout in the DSM-5. Furthermore, the conceptual foundation of burnout has been criticized in the literature (Bianchi, Boffy, Hingray, Truchot, & Laurent, 2013; Bianchi et al., 2015; Brisson & Bianchi, 2017). For an overview over these flaws, see Bianchi et al. (2015). Secondly, next to the ambiguities regarding the diagnose of burnout, there is also no standard-definition of burnout. Instead, the three dimensions of the Maslach burn-out inventory (MBI) are used as a definition of burnout in the literature (Maslach, Jackson, & Leiter, 1997).

The three dimensions of the MBI are well described by Maslach et al. (2001). Firstly, individuals that are burned out suffer from overwhelming exhaustion, the first dimension of the MBI, which means that they are emotionally and physically fatigued. Secondly, people with burnout suffer from depersonalisation. They react more detached and cynical to other people (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). In a general sense, this means that other people are perceived as objects rather than human beings by burnout sufferers (Maslach et al., 1997). The last dimension is reduced personal accomplishment or efficacy. It

states that people with burnout think they are not efficient and effective in working with people and reaching their (work-related) goals. Thus, they have a self-evaluation that is plainly negative.

When looking at the impact of these three dimensions, it can be said that they strongly affect people's lives. On the one hand, burnout has a range of severe consequences that are work-related. Firstly, employees with burnout engage more often in several forms of job withdrawal (Balch et al., 2009; Maslach et al., 2001; Schaufeli, Bakker, & van Rhenen, 2009). Secondly, burnout was found to be negatively correlated to productivity, effectiveness, quality of care (in medical professions), and professionalism (see, for example, West, Shanafelt, Kolars, 2011; Dyrbye et al., 2010; Balch et al., 2009). Furthermore, people with burnout are also more prone to error. Fourthly, burnout is proven to be negatively related to job satisfaction, satisfaction of patients (in medical professions), and satisfaction of colleagues of burnout sufferers (Maslach, et al., 2001; Shanafelt & Dyrbye, 2012).

On the other hand, work-related consequences can also, as Balch et al. (2009) described, "spill over into personal life" (p.3). First of all, the constant strains of burnout for the body are identical with other forms of chronic stress, resulting in for example headaches or myocardial infarction (Balch et al., 2009; Maslach et al., 2001). Secondly, burnout predicts substance abuse and broken relationships (Balch et al., 2009; Dyrbye et al., 2014; Shanafelt & Dyrbye, 2012). In addition, exhaustion, the first dimension of burnout, was also found to increase the prevalence of depression and anxiety disorders (Ahola, 2007, Hakanen & Schaufeli, 2012). Lastly, Maslach et al. (2001) and Shanafelt and Dyrbye (2012) even found a positive relationship between burnout and suicidal ideation. In summary, it can be said that burnout strongly affects the work-environment as well as the personal life of people suffering from burnout.

For burnout, certain risk-factors were identified (Maslach et al. 2001). Firstly, overload at the workplace increases the likelihood to develop burnout (Bakker, Demerouti &

Sanz-Vergel, 2014; Maslach et al., 2001; Shanafelt & Dyrbye, 2012). Furthermore, uncertainties regarding the role that an employee has to fulfil at the workplace, are also seen as risk-factors of burnout (e.g., perceiving conflicting demands at the workplace; Bakker et al., 2014). In addition, it was proven that lack of autonomy, lack of meaning, lack of feedback and inefficient work are related to burnout (Bakker et al., 2014; Shanafelt and Dyrbye, 2012). Lastly, stressful events and a tension between work and private life were found to be related to burnout (Maslach et al., 2001; Shanafelt & Dyrbye, 2012). Interestingly, those risk-factors are not related to fatigue, a concept that shares many similarities with burnout, as described below (Kant et al., 2003). Although many risk-factors were identified for burnout, not much is known about the etiology of burnout. There is no theory, that is proven and grounded in research, that described the development-process of burnout (de Vos et al., 2016; Maslach et al., 2001).

Fatigue

Fatigue is a very common, but also quite an ambiguous concept that has a high impact on people's lives. Everybody experiences fatigue occasionally and it is a normal reaction to strains that are put on the body or mind. But in contrast to this occasional fatigue, there is also another type of fatigue – chronic fatigue, which is besides burnout the focus of the current research. Chronic fatigue (in the following referred to as fatigue) can be described as having an insidious onset and a long(er) duration, the causes are not clear or there are multiple causes and it has a major impact on daily activities (Zengarini et al., 2015). In addition, fatigue cannot be relieved by restorative techniques such as rest or sleep and it is perceived by patients as being an “abnormal, unusual or excessive symptom” (p.7; Zengarini et al., 2015). It is one of the most frequently observed symptoms in general practice (Avlund, 2010). One reason for this may be that fatigue can be associated with a range of diseases (e.g., arthritis and multiple sclerosis) and, as a side effect, with many pharmacological treatments (Avlund, 2010; Graff et al., 2011; Hjollund, Andersen & Bech, 2007; Joshawa, Khakha, & Mahajan,

2012; Watt et al., 2000). Summarizing all the different possibilities that can provoke fatigue, it can be said that fatigue has a high prevalence. Van't Leven, Zielhuis, van der Meer, Verbeek and Bleijenberg (2009) found, for example, that 30.5% of the general population in the Netherlands could be categorized as chronic fatigued. But prevalence rates of fatigue must be treated with caution, as described later in depth.

In addition to the high prevalence, there is also another factor that stresses the relevance of fatigue. Fatigue has also a strong impact on people's lives. Firstly, Graff et al. (2011) revealed that fatigue is often described by patients as one of the most troubling symptoms. In addition, higher levels of fatigue were proven to correlate strongly to lower quality of life and self-care activities of patients (Graff et al., 2011; Watt et al., 2000). Thirdly, there is widespread evidence that fatigue is also related to functional decline and disablement in elderly people (Vestergaard et al., 2009; West, Tan, Habermann, Sloan, & Shanafelt, 2009; Zengarini et al., 2015). Ekmann, Petersen, Mänty, Christensen, and Avlund (2013) even concluded that fatigue is a strong predictor of future morbidity and mortality in individuals older than 70 years.

Considering the prevalence and impact of fatigue, it is interesting that while there is a consensus over what fatigue roughly entails (e.g., being depleted of one's energy resources), there still remain ambiguities regarding the exact nature of the concept (Kant et al., 2003). A good example of the ambiguity is that different studies tried to analyse the prevalence rate of fatigue and they found prevalence rates between 7% and 42% depending on the study that tried to measure it (Watt et al., 2000). This notion gets further support by the findings that there are no clear relationships between fatigue and different demographics. Watt et al. (2000), for example, described that there are a lot of contradictory results between fatigue on the one hand, and education and age on the other. One factor that surely contributes to this inaccuracy is that despite the fact that there are several definitions that are more or less related to each other, there is no common definition of fatigue (Dolan & Kudrna, 2015).

Nevertheless, to specify fatigue for this research, the definition of Shen, Barbera, and Shapiro (2006) is used, because of the broad nature of their definition. Shen et al. (2006) defined fatigue as “an overwhelming sense of tiredness, lack of energy and a feeling of exhaustion, associated with impaired physical and/or cognitive functioning [...]” (p.8).

Another fact that highlights the ambiguity of fatigue is that it has no own clinical diagnosis in the DSM or ICD-classification systems. Furthermore, it is important to note that the chronic fatigue syndrome (CFS), another fatigue-related disorder, is excluded from the current research, because the diagnose of CFS rules out any other disease that could explain the high levels of fatigue.

As a result of the ambiguities surrounding defining and diagnosing fatigue, it also becomes more complicated to measure fatigue. There is no ‘gold standard’ measurement or biological marker, with which fatigue could be reliably measured (Aaronson, Pallikkathayil & Crighton, 2003; Watt et al., 2000; Zengarini et al., 2015). The measurement of fatigue is even more complicated, because the meaning of the term ‘fatigue’ differs between languages. Thus, it is difficult to translate fatigue in other languages (Avlund, Rantanen & Schroll, 2006; Lerdal, Wahl, Rustoen, Hanestad & Moum, 2005). Avlund et al. (2006), for example, suggested in their study, that the translated Norwegian term for fatigue could be better retranslated as “tiredness” instead of “fatigue”.

In summary, it can be said that while there is an agreement on what fatigue generally entails, there remain ambiguities regarding the exact nature of the concept. Consequently, it gets complicated to define and measure it. This ambiguity could in turn account for the contradictory and very different research results (as for example seen in the prevalence rates or the relationship between fatigue and demographics).

Burnout and Fatigue

When looking at burnout and fatigue more closely, it becomes clear that they are very similar. There are several reasons for this similarity. Firstly, both concepts are centred around the

symptom of fatigue, which results from overload or stress (Huibers et al., 2003; Leone, Huibers, Knotterus, & Kant, 2007; Leone et al., 2009). This means that the sensation of fatigue is predominant in both concepts. The exhaustion dimension of burnout, which encompasses fatigue-related symptoms, is seen by many researchers as the main one (Maslach et al., 2001). Because of this predominance, some researchers even argued that there is no difference between fatigue and burnout (Kristensen, Borritz, Villadsen, & Christensen, 2005). Other researchers think that these concepts differ with respect to what fatigue is related to. Schaufeli and Taris (2005), for example, defined burnout as a form of work-related fatigue, thereby narrowing the definition down and emphasizing the focus of burnout on the work-environment. Another finding that shows the similarity is, what Huibers et al. (2003) demonstrated: many fatigued employees could also be diagnosed with burnout. This notion is further supported by Leone et al. (2007), who discovered that there is a considerable overlap between burnout and fatigue cases. Thirdly, both concepts seem to influence each other strongly (Leone et al., 2009).

On the other hand, there are also differences between burnout and fatigue. Firstly, the background is different. Fatigue has received a lot of attention from the medical sector in contrast to the more psychological concept of burnout (Leone et al., 2007). Furthermore, burnout is conceptualized as work-specific, while the term fatigue is more general (Leone et al., 2007). Another difference is, that burnout and fatigue do not share the same risk-factors, as described in the Burnout-section. Fourthly, according to the diagnose-algorithm of burnout by Von Känel (2008) burnout can be differentiated from fatigue by looking at the number and length of the accompanying symptoms of fatigue (e.g., swallowing difficulties and swelling of the lymph nodes). But it is important to note that fatigue is in the study by Von Känel (2008) defined as a mild/short form of the chronic fatigue syndrome (CFS). Thus, the definition of chronic fatigue differs from the definition that was used in the present research. Lastly, Leone et al. (2008) have shown that there is a difference in the prognosis of burnout and fatigue.

Burnout has a slightly better course than fatigue with regard to the persistence of symptoms and absenteeism. In summary, it can be said that burnout and fatigue are very similar concepts, but they still differ from each other and it is not clear how they precisely relate to each other.

When looking at what is already done, it becomes obvious, that the literature about the relationship between burnout and fatigue is scarce. In addition, while a few researchers have analysed these concepts, no one has described the relationship of these concepts in a systematic way (see for example, Leone et al., 2007). Thus, the aim of this research is to analyse systematically how fatigue is related to burnout by doing a literature review about this topic. Therefore, three sub-questions are formulated. The first research question (RQ1) is to what extent is fatigue related to the etiology of burnout. Burnout develops over a longer period of time (Maslach et al., 2001). This long timespan before burnout is fully developed could be used to prevent it or to at least prevent the full-outbreak of it, but in order to develop a prevention programme it is essential to identify factors that influence the etiology of burnout, because, as already described above, not much is known about it. (Linzer et al., 2014). There are indications that fatigue plays an essential role in burnout and maybe also in the etiology of burnout (Leone et al., 2007; Leone et al., 2008; Leone et al., 2009). Accordingly, the first research question is formulated to investigate the extent to what fatigue is related to the etiology of burnout.

Secondly, the evidence that fatigue influences burnout also suggests that fatigue may play a role in the maintenance of burnout (Leone et al., 2007; Leone et al., 2008; Leone et al., 2009). This notion also gets support from Saleh and Shapiro (2008), who proposed a model in which fatigue, sleep and burnout are interrelated. Thus, the second research question investigates to what extent the maintenance of burnout is influenced by fatigue (RQ2). Lastly, as described above, there is a strong similarity between the exhaustion-dimension of burnout and fatigue, which even lead some researcher to the conclusion that there is no difference

between fatigue and burnout (Kristensen et al., 2005). Because of this conceptual proximity, it would be interesting to analyse to what extent the treatment of fatigue is already included in the common treatment of burnout (RQ3).

Research Questions

Accordingly, this research tries to analyse how fatigue is related to burnout. To answer this question, as described above, three sub-questions were formulated:

1. To what extent is fatigue related to the etiology of burnout?
2. To what extent does fatigue influence the maintenance of burnout?
3. To what extent is the treatment of fatigue integrated in the common treatment of burnout?

By means of this systematic research the scientific findings on this topic shall be collected, sorted and weighted. Based on these results, a conclusion shall be carefully worded.

Methods

In order to analyse the relationship between fatigue and burnout, a systematic literature review was conducted. This review investigated objectively and systematically to what extent fatigue is related to the etiology of burnout (RQ1), to what extent fatigue influences the maintenance of burnout (RQ2), and to what extent the treatment of fatigue is included in the common treatment of burnout (RQ3). To maximize the reliability and validity of this research, the review was conducted based on the structure for conducting a systematic literature review by Cuijpers (2016).

Literature Review

The literature review encompassed research articles that were published in English between 2007 and 2017. The literature review itself was conducted in summer 2017. The electronic databases PsychINFO, Scopus and PubMed were used to scan for literature on the internet and the journal 'Burnout Research' was examined by hand-searching, because it was the only

journal related to burnout or fatigue. The journal was hand searched by looking at every article in every volume and issue of this journal and applying the inclusion- and exclusion- criteria to them. Furthermore, to also include grey literature, which is literature that is not obtainable through normal publishing channels, the database OpenGrey was used. In addition, when a study that met the inclusion criteria was found, the reference list was also searched for further relevant studies.

Search Terms

Because of the systematic nature of this review, a search mask was created. This search mask included different synonyms for fatigue, burnout, and the key terms related to the research question (e.g., treatment, etiology, etc.). To begin with, as already described in the introduction, fatigue is a very ambiguous concept and it is difficult to define. Therefore, the related terms *sleepiness*, *exhaustion* and *tiredness* were added to the *fatigue*-section in the search mask, in order to conduct a comprehensive review about this topic. Secondly, to answer the different sub-questions, different synonyms were used for the sub-question-related key terms. To analyse the extent to which fatigue is related to the etiology of burnout, the terms *etiology*, *origin*, and *development* were used. For the second sub-question, the term *maintenance* was used and for the third one the terms *treatment* and *therapy* were added to get a broader picture of the literature. The different search terms were combined in one search-string using the Boolean operator AND and OR (e.g., *sleepiness* OR *exhaustion* (...) AND burnout AND *etiology* OR *origin* (...)). The resulting search-string was then used for every database successively. For an overview of the different search terms per research question see Table 1.

Table 1
Search terms per research question

	Fatigue	Burnout	Subquestion related terms
To answer RQ1	sleepiness exhaustion tiredness fatigue	burnout	etiology origin development
To answer RQ2	sleepiness exhaustion tiredness fatigue	burnout	maintenance
To answer RQ3	sleepiness exhaustion tiredness fatigue	burnout	treatment therapy

Literature Screening, Inclusion and Exclusion Criteria

The literature was searched in two steps. After conducting the literature search with the previous mentioned search mask on different databases and the burnout journal, and excluding all duplicates, the first step was to scan the titles and abstracts of the articles and applying the exclusion-criteria. For the exact exclusion criteria, see Table 2. Case studies were excluded, because due to their methodological setup, their results lack a sufficient degree of generalizability. In addition, reviews and book chapters were excluded, because they do not conduct any empirical research. Furthermore, only recent literature is used (published between 2007-2017). Because Avlund et al. (2006) and Lerdal et al. (2005) noted that there are difficulties and ambiguities in translating the term ‘fatigue’ in other languages, this review did not use translations of the search terms. Accordingly, all studies that were not published in English were excluded. In addition, the literature about compassion fatigue is excluded, because compassion fatigue is more focused on the emotional reaction of caregivers that treat suffering people (Hoopers, Craig, Janvrin, Wetsel & Reimels, 2010). This means that compassion fatigue is a very specific kind of fatigue that is more related to emotional reactions than to general fatigue. The exclusion of compassion fatigue is explicitly mentioned here, because of the high prevalence of literature about this topic. Finally, literature in which

fatigue can be explained by somatic disorders or a different psychological disorder than burnout, for example chronic fatigue syndrome (CFS), were excluded.

Secondly, after screening the titles and abstracts, the full-text versions of the included articles were obtained. If it was not possible to retrieve a full version, the study was excluded. Then, the full-text was screened. Literature was included if it was about the relationship between fatigue and the etiology of burnout and/or the influence of fatigue on the maintenance of burnout and/or the inclusion of the treatment of fatigue in the treatment of burnout. For the latter, it is important to mention that only articles that explicitly mentioned that treatment-elements are aimed at treating fatigue were included, because otherwise the author would have needed to choose subjectively, if fatigue had been affected by the treatment-elements. See Table 2 for an overview about all inclusion criteria. In some cases, a second assessor, who was a fellow Psychology-student of the author, was used to increase the reliability of the screening. This assessor was used because of two reasons. Firstly, as described in the introduction, burnout and fatigue are both very ambiguous concepts. As a result, it was also difficult to determine whether certain studies met the inclusion-criteria. Secondly, “the concepts of burnout and prolonged fatigue have hardly been compared in empirical research”, as Leone et al. (2007) described it. Thus, there were only few articles, which compared the concepts directly, but more that were (more or less) related to the topic. Because of this, it was also difficult to determine which studies could be used and which could not. Accordingly, when the first assessor was unsure whether one article should be included due to the aforementioned uncertainties, the second assessor also read the article and gave his opinion on the inclusion or exclusion of the article. If the two assessors had consistent results, the study was handled accordingly, if not, the ambiguities were discussed until both assessors agreed upon inclusion or exclusion. The second assessor was used in 7 cases.

Table 2
Exclusion and inclusion criteria

Exclusion criteria	Inclusion criteria
<ul style="list-style-type: none"> - no full-text available - case studies/reviews/book chapters/qualitative studies - not published between 2007-2017 - not published in English - literature about compassion fatigue - literature in which fatigue can be explained by somatic disorders or a different psychological disorder than burnout, such as for example the chronic fatigue syndrome (CFS) 	<ul style="list-style-type: none"> - literature about the relationship between fatigue and the etiology of burnout - literature about the influence of fatigue on the maintenance of burnout - literature that implemented and described a treatment-element that targeted fatigue directly in the treatment of burnout

Data Extraction

From the remaining literature, the following data was extracted. Firstly, the name of the author(s), publication date, location or institution of publication, source of article (e.g., journal), and the digital object identifier (DOI)-number were obtained (see References).

Additionally, the location where the study was conducted, the objective, the study population, the sample size, the study design, the measurement which was used and the times when the variables were measured were noted (see the Appendix). Lastly, the main results of the studies were extracted.

Results

As a result of the searching- and screening-procedure, in total 1276 studies were found, 1227 were identified through database searching and 49 through other sources (e.g., the Burnout Research-journal; see Figure 1). After controlling for duplicates, 1029 studies were screened during the first phase of screening. The first screening-phase resulted in 939 exclusions, so that 90 studies could be used for the second screening phase. In the second screening-phase,

73 articles were excluded. The remaining 17 studies were included in the review. These remaining articles and their findings are reviewed in the rest of this section.

When looking at the included studies, several information are worth mentioning (for an overview about these information see the Appendix). Firstly, there is a great variety in sample sizes. Four studies had included less than 99 participants and six studies had included between 100-999 participants. In addition, there were seven studies that included beyond 1000 participants in their studies. Secondly, it became apparent that most of the studies (n=14) used an observational design. Three studies actively treated participants (treatment design). Thirdly, a majority of the studies were conducted in Europe (n=12), one study was conducted in South America, and two in Asia. Two studies could not be located. Furthermore, there is a great diversity of measurements for burnout and fatigue observable. For burnout, in total eight different questionnaires were used (different versions, as for example the MBI for students and the MBI for social services, of the same questionnaire were counted as a single questionnaire) and 12 different ways for measuring fatigue were applied. Lastly, with regard to the studies that included more than one point of measurement (e.g., cohort studies), it is interesting to mention that the time between the points of measurement varied greatly (from two weeks up to 4 years).

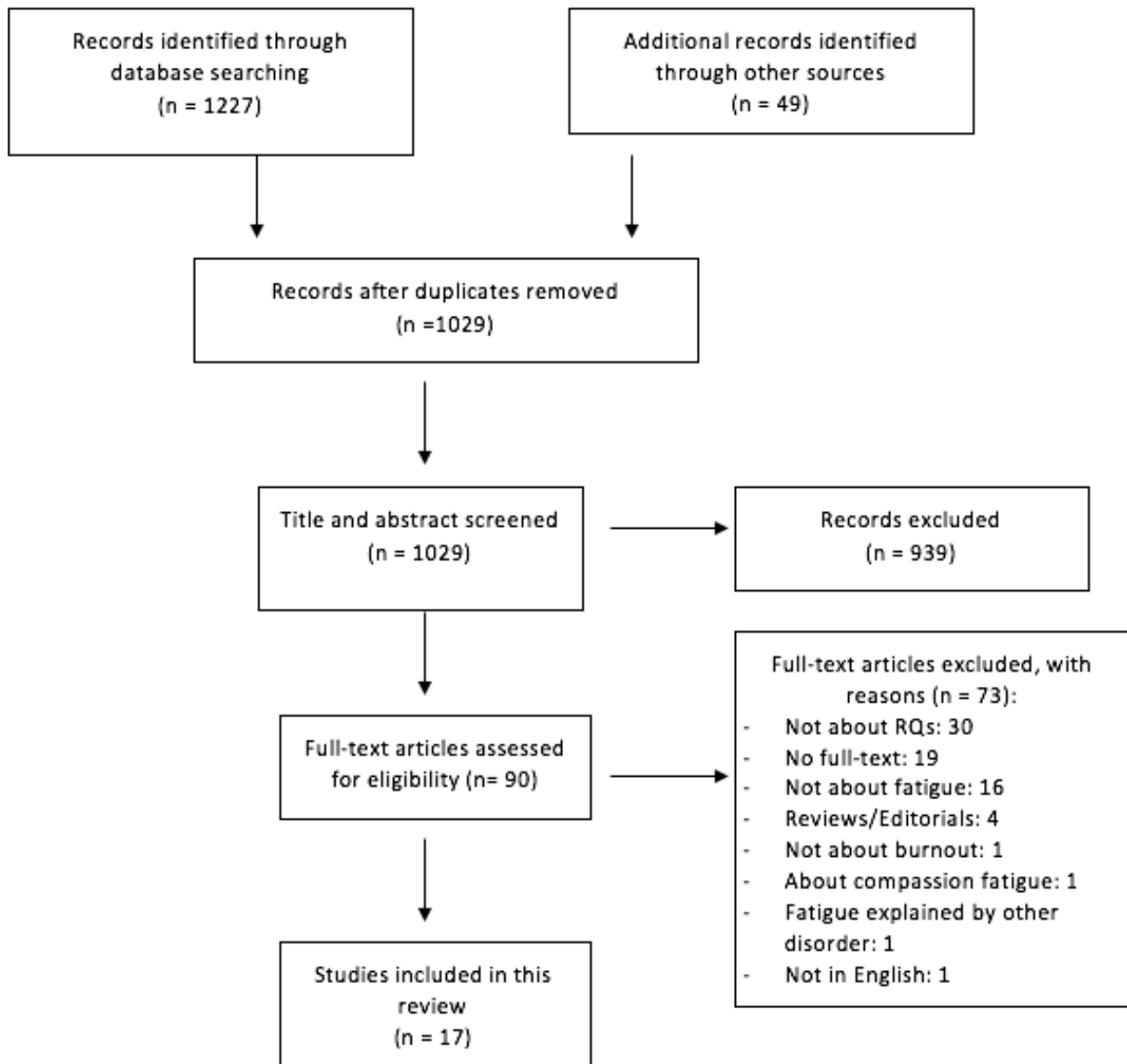


Figure 1: PRISMA-flowchart describing the literature-selection process (adapted from Moher, Liberati, Tetzlaff, & Altman, 2009)

Etiology

The first research question was to what extent is fatigue related to the etiology of burnout.

Nine articles were found that gave answers to this. In this section, articles about fatigue and sleeping problems are depicted together, because of the strong relationship between those concepts and the fact that sleeping problems induce fatigue (Armon, 2009; Söderström, Jeding, Ekstedt, Perski & Åkerstedt, 2012). For an overview over the aims and outcomes of all etiology-related articles, see Table 3.

When looking at the results of the literature-search, it becomes apparent that the articles, that were found, can be divided into several groups. Firstly, one group of articles found a bi-directional relationship between fatigue (and fatigue-related concepts) and the etiology of burnout (Armon, 2009; Armon, Shirom, Shapira & Melamed, 2008; Leone et al., 2009). Leone et al. (2009) did a prospective study with 11,710 participants and they demonstrated that fatigue at baseline was associated with a higher risk of burnout four years later, and that in turn, burnout at baseline was also associated with an increased risk of fatigue. This finding gets support from Armon et al. (2008), who discovered in their prospective study that insomnia at T_1 predicts burnout at T_2 and that burnout at T_1 in turn predicted insomnia at T_2 . Specifically, Armon et al. (2008) presumed that there is a vicious circle between insomnia, burnout and stress appraisal, which means that these three concepts are thought to have a negative, reciprocal relationship with each other. Furthermore, in another study, Armon (2009) found that insomnia and burnout predict each other even when correcting for other, possible mediating, factors. Leone et al. (2009) also hypothesized different ways in which fatigue and burnout could influence each other onsets. Fatigue, on the one hand, could gradually worsen until burnout, a condition that is centred around severe exhaustion, emerges. On the other hand, burnout, which is a specific and mostly work-related condition, could as suggested by Leone et al. (2009), spread out until it evolves into a general form of fatigue.

Secondly, another group of researchers studied the impact of fatigue (and fatigue-related concepts) on the etiology of burnout and found a unidirectional relationship between fatigue and the etiology of burnout (Brand et al., 2010; de Vos et al., 2016; Oldenburg, Jensen, Wegner, 2013; Söderström et al., 2012). Brand et al. (2010) revealed that sleep complaints increase the likelihood of developing burnout. This notion gets support from Oldenburg et al. (2012) who have proven that a too short sleep-duration predicts the onset of burnout, and by Söderström et al. (2012) who found that insufficient sleep is a risk-factor for burnout. Furthermore, de Vos et al. (2016) analysed burnout among 237 Dutch nursing

graduates with the help of a sequential development model. From this developmental perspective, they concluded that burnout begins with fatigue and ends with severe exhaustion and depersonalisation, the first and second burnout-dimension. Furthermore, it was discovered that the third dimension of burnout, personal accomplishment, develops independently of the other two dimensions.

Thirdly, Pagnin et al. (2014) looked at the relationship between day-time sleepiness and the onset of each dimension of burnout. They found a bi-directional relationship between day-time sleepiness and the exhaustion-dimension of burnout, but only a uni-directional relation between day-time sleepiness and, depersonalisation and efficacy was observed. The later results mean that day-time sleepiness affected, but was not affected by, depersonalisation and efficacy.

Lastly, Jansson-Fröjmark and Lindbloom (2010) found no relationship between insomnia and burnout. They examined if there is a bi-directional relationship between insomnia and burnout. In their study, insomnia was not related to incidence of burnout and burnout, in turn, was not related to incidence of insomnia.

Summary. When all aforementioned results are taken together, it can be said that almost all studies showed that fatigue and fatigue-related concepts were related to the etiology of burnout. In addition, most articles that investigated the reciprocal relationship between burnout and fatigue (and fatigue-related concepts) with regard to their etiology, demonstrated a bi-directional relationship between those concepts. Only one study analysed the reciprocal relationship between fatigue and burnout and found no relationship between them with regard to their etiology.

Table 3

Objectives and etiology-related outcomes of all articles

Authors	Objective	Etiology-related outcomes
Armon (2009)	To test whether there is an additive effect of burnout on subsequent changes in insomnia over and above the effect of the JDC-S model, and the reverse causation hypothesis expecting insomnia to have an additive effect on subsequent levels of burnout.	Insomnia is likely to predispose to burnout and burnout is likely to predispose to insomnia.
Armon et al. (2008)	To test the hypothesis that burnout and insomnia predict each other's incidence and intensification across time.	Burnout and insomnia recursively predict each other's development.
Brand et al. (2010)	To investigate the relation between burnout, depressive symptoms, satisfaction with life, and sleep complaints	Sleep complaints are positively related to burnout.
De Vos et al. (2016)	To investigate burnout among Dutch nursing graduates as a process by testing a sequential- developmental model	Burnout among early career nurses may be operationalized as a process that starts with fatigue as a result of strain and ends with severe exhaustion and depersonalization towards patients. Personal accomplishment develops relatively independently.
Jansson-Fröjmark & Lindblom (2010)	To investigate whether there is a bi-directional relationship between insomnia and burnout over the course of a year among individuals in the workforce	Insomnia and burnout are not bi-directionally related in the working population. Insomnia was not associated with the incidence of burnout and vice versa.
Leone et al. (2009)	To examine the temporal relationship between burnout and prolonged fatigue.	Burnout and fatigue significantly predict each other.
Oldenburg et al. (2013)	To investigate indicators of burnout.	Seafarers evaluating their sleep duration as too short had a significantly elevated burnout risk.
Pagnin et al. (2014)	To assess the mutual relationships between burnout and sleep disorders in students in the preclinical phase of medical school.	Emotional exhaustion and day-time sleepiness showed a mutual influence. Day-time sleepiness links uni-directionally with cynicism and academic self-efficacy. This indicates that sleep disturbances may promote the onset of burnout.
Söderström et al. (2012)	To identify risk factors for subsequent clinical burnout.	Insufficient sleep is a risk-factor for subsequent burnout. Insufficient sleep is an early warning sign for burnout.

Note. JDC-S model= Job demand control-support model.

Maintenance

The second research question was to what extent influences fatigue the maintenance of burnout. To answer this question, 9 studies were identified. As already done in the etiology-section, articles about fatigue and sleeping problems are depicted together, because of the strong relationship between those concepts and the fact that sleeping problems induce fatigue (Armon, 2009; Söderström et al., 2012). For an overview over the aims and outcomes of all maintenance-related articles, see Table 4.

When looking at the results regarding the extent to which fatigue influences the maintenance of burnout, a similar pattern emerges as already seen in the etiology-section. Firstly, several articles have shown that there is a bi-directional relationship between fatigue (and fatigue-related concepts) and burnout with regard to their maintenance (Armon et al., 2008; Leone et al., 2007; Leone et al., 2008; Leone et al., 2009). Armon et al. (2008), for example, showed that insomnia and burnout predict each other's intensification over time. Furthermore, three different studies by the same authors compared the courses and consequences (e.g., symptom persistence, absenteeism, etc.) of burnout, fatigue and both concepts together (Leone et al., 2007; Leone et al., 2008; Leone et al., 2009). Leone et al. (2007, 2008) compared in two different studies the course of pure burnout, pure fatigue, and having both conditions. They have found that having both conditions worsens the disorder-related consequences (e.g., psychological distress, persistence of symptoms, absenteeism, and general health). Furthermore, based on these results they suggested that burnout and fatigue might influence each other. In yet another study, Leone et al. (2009) looked at the temporal relationship between burnout and fatigue. They found that burnout and fatigue influence each other considerably and that when both conditions occur at the same time, it worsens the consequences. Furthermore, Leone and colleagues (2009) suggested that the relationship between burnout and fatigue was more like a 'downward spiral' than a 'vicious circle'. A 'vicious circle' would imply that only one condition would be active at a time and that they

alternate, which is not the case according to them. The metaphor of a 'downward spiral' is more fitting, according to Leone and colleagues (2009), because burnout and fatigue co-occur in time and they influence each other negatively.

Secondly, as the articles that were mentioned above, Jansson-Fröjmark & Lindbloom (2010) also investigated whether there was a reciprocal relationship between insomnia and burnout regarding their maintenance. In contrast to the articles by Leone et al. (2007, 2008, 2009) and Armon et al. (2008) and they found that insomnia only uni-directionally affected the exhaustion-dimension of burnout, but not burnout as a whole. According to their results, insomnia was not related to the persistence of depersonalization and professional efficacy, but insomnia increased the risk for persistence of the exhaustion-dimension of burnout by more than three times.

The third group of articles studied the relationship between fatigue (and fatigue-related concepts) and the maintenance of burnout only uni-directionally. The articles in this group demonstrated two things. The first finding was, that recovery from fatigue (and fatigue-related concepts) predicted return to work in burned out individuals (Ekstedt, Söderström and Åkerstedt, 2009; Sonnenschein, Sorbi, Verbraak, Schaufeli, Maas & van Doornen, 2008). Specifically, higher scores of fatigue (and fatigue-related concepts) were shown to have negative impact on the return to work, thereby lengthen the time it took for individuals to resume their work. The second finding was that sleep physiology (number of arousals, sleep fragmentation, sleep latency, sleep efficiency and sleep duration) was disturbed in burned out individuals (Ekstedt et al., 2009; Sonnenschein, Sorbi, van Doornen, Schaufeli & Maas, 2007; Vela-Bueno et al., 2008). These studies have shown that burned out individuals had recovered worse through sleep than healthy individuals.

Summary. When all results are taken together, it becomes apparent, that most articles have shown that fatigue (and fatigue related concept) were related to the maintenance of burnout. In addition, of the articles that have analysed the relationship between fatigue (and

fatigue-related concepts) and burnout reciprocally with regard to their maintenance and intensification, the majority also found a bi-directional relationship between those concepts. Only one study analysed the relationship reciprocally, but only found a uni-directional relationship with one dimension of burnout (the exhaustion dimension) and no relation with the other two dimensions.

Table 4
Objectives and maintenance-related outcomes of all studies

Authors	Aim	Maintenance-related Outcomes
Armon et al. (2008)	To test the hypothesis that burnout and insomnia predict each other's incidence and intensification across time.	Burnout and insomnia recursively predict each other's intensification over time.
Ekstedt et al. (2009)	To investigate the role of sleep physiology in recovery from burnout, in particular the relation between sleep and changes in fatigue and whether those changes would be related to return to work	Recovery from fatigue was the best predictor of return to work.
Jansson-Fröjmark & Lindblom (2010)	To investigate whether there is a bi-directional relationship between insomnia and burnout over the course of a year among individuals in the workforce	Insomnia and burnout are not bi-directionally related in the working population. But insomnia was demonstrated to increase the risk for the persistence of emotional exhaustion. Further, insomnia was not associated with the persistence of professional efficacy and cynicism,
Leone et al. (2007)	To examine similarities, overlap and differences between burnout and prolonged fatigue.	Having both conditions separately seems to be associated with worse outcomes than having only burnout, particularly in terms of health-related factors such as psychological distress and self-reported general health
Leone et al. (2008)	To assess and compare the course of burnout and prolonged fatigue in the working population	Patients that have burnout and fatigue have a less favourable course with regard to persistence and absenteeism than patients that have just burnout.
Leone et al. (2009)	To examine the temporal relationship between burnout and prolonged fatigue.	Burnout and fatigue influence each other in time. Co-occurrence tends to worsen outcomes.
Sonnenschein et al. (2007)	To examine recovery through sleep in relation to sleep quality, exhaustion, and depression in clinical burnout.	Impaired recovery through sleep may hamper recovery from burnout.
Sonnenschein et al. (2008)	To examine the extent to which symptom improvement and full return to work occurs among clinically burnt-out employees and what the influence of concurring sleep problems is with respect to health recovery.	Sleep disturbances hamper the symptom improvement and return to work.
Vela-Bueno et al. (2008)	To assess insomnia and sleep quality in primary care physicians with low and high burnout scores.	There is a clear relationship between disturbed sleep and burnout. Sleep might be a mechanism that can help to recover from burnout.

Treatment

The third research question was to what extent is the treatment of fatigue integrated in the common treatment of burnout. Two articles were found that answered this research question. Firstly, Meesters and Waslander (2009) analysed the effects of light treatment on burnout. Due to the fact that light treatment is used for the first time for the treatment of burnout and the fact that it is relatively unknown, it will be described in depth here. It is a form of therapy where participants are exposed to artificial bright light for 45 minutes. The conduction of the treatment took 22 days. It began on a Friday with 3 baseline days, followed by a treatment-session every workday and two rest days on the weekend. Afterwards, another 5 days of treatment with an intensity of one 45min session per day were conducted. After the last treatment day, the participants were monitored for 7 days. The authors focused their treatment on exhaustion, which is according to them the “most pronounced symptom of burnout” (p.2; Meesters & Waslander, 2009) and characterized by high levels of fatigue. Because light treatment is also used for the treatment of another fatigue-related disorder, seasonal affective disorder (SAD), Meesters and Waslander (2009) applied light treatment to burned-out individuals. They found some evidence that light treatment is effective in treating burnout-sufferers depending on the questionnaire with which burnout was measured. According to the UBOS, the Dutch version of the Maslach Burnout Inventory (Schaufeli & Van Dierendonck, 2000, as cited in Meesters & Waslander, 2009), there were no significant improvements. However, when burnout was measured with the BO-NKS (Burnout-Neurasthenie Klachten Schaal; Verbraak, Van de Griendt & Hoogduin, 2006, as cited in Meesters & Waslander, 2009), which is based on the diagnostic criteria of the ICD-10, there was a significant improvement after the light treatment.

Secondly, Ruwaard, Lange, Bouwman, Broeksteeg and Schrieken (2007) developed and tested an e-mail standardized cognitive behavioural treatment of work-stress. The treatment consists of seven phases. In the second phase, which was about relaxation,

participants who reported sleeping problems, also received information about sleep hygiene. Suggestions were given to not sleep during the day or too long during the night, to avoid stressful activities before bedtime or to not go to bed without being sleepy. Ruwaard and colleagues (2007) showed that this intervention significantly reduced exhaustion compared to a waiting-list control group. Furthermore, they reported that the participants had small to moderate improvements after the treatment on stress, exhaustion, anxiety and depression. After three years, the improvements of this intervention were large on the aforementioned outcome measures.

Summary. Two articles were found that integrate the treatment of fatigue in the treatment of burnout. Firstly, a light treatment was described, which was focused on improving exhaustion (Meesters & Waslander, 2009). After the treatment, one questionnaire that was used to measure burnout showed that it had an impact on burnout, but another questionnaire found no evidence for this. Secondly, an e-mail standardized cognitive behavioural treatment, including information on sleep hygiene, was identified (Ruwaard et al., 2007). The email-standardized approach as a whole, was shown to be effective in improving burnout symptoms.

Discussion

Etiology and Maintenance

This review focused on the relationship between fatigue and burnout, thereby it aimed to give an overview over the scarce literature relating those concepts. To analyse this relationship, three research questions were formulated. The main findings of these three research questions are described below.

The first research question was focused on the relationship between fatigue and the etiology of burnout. The majority of researchers agreed that fatigue and fatigue-related concepts (in the following only called fatigue) are related to the etiology of burnout (see for

example Leone et al., 2009). Only one study found no relationship between insomnia and the etiology of burnout (Jansson-Fröjmark & Lindbloom, 2010). The contrasting results could be explained by the questionnaire with which insomnia was measured in this study. Jansson-Fröjmark and Lindbloom (2010) developed their own questionnaire and although they claimed that the items of the newly developed questionnaire had sufficient psychometrical qualities, the author of the present research found no prove of that in the literature. Accordingly, these results should be treated with caution. Furthermore, fatigue did not only seem to be related to the etiology of burnout, but burnout also seemed to be related to the etiology of fatigue. In conclusion, these results indicate that there is a bi-directional relationship between fatigue and the etiology of burnout, which means that both concepts affect the onset of each other.

The second research question was to what extent does fatigue influence the maintenance of burnout. Here, the literature gave a similar picture, there was a high agreement amongst the articles that fatigue was related to the maintenance and intensification of burnout. The importance of fatigue in the maintenance of burnout was also highlighted by the fact, that the recovery from fatigue was proven to be the best predictor of returning to work in burned out individuals (Ekstedt et al., 2009). Furthermore, it was discovered that burnout was also related to the maintenance and intensification of fatigue. There was but one study that investigated the reciprocal relationship between insomnia and burnout, and found only a uni-directional relationship between insomnia and one direction of burnout, while the other two dimensions were shown to be unrelated (Jansson-Fröjmark & Lindbloom, 2010). Their results indicated that insomnia affected only the maintenance of the exhaustion-dimension of burnout. Due to the uncertain validity of the questionnaire they used, as already described in the etiology-section, the results should be treated cautiously. In summary, these results indicate, that there is a bi-directional relationship between fatigue and burnout with regard to their maintenance.

Integrated Model Illustrating the Relationship Between Fatigue and Burnout. When looking at the etiology- and maintenance-sections, it can be concluded, that there are some similarities between those sections. The main finding of the etiology-section was that there is a bi-directional relationship between fatigue and burnout with regard to etiology. This means that burnout and fatigue are related to the onset of each other. The main finding of the maintenance-section was very similar. Here, a bi-directional relationship was also found, which means that fatigue and burnout are related to the maintenance and intensification of each other. When those two findings are put together (see Figure 2), the relationship between fatigue and burnout can be described as a downward spiral. If an individual suffers from, for example burnout, burnout in turn increases the likelihood of the onset of fatigue. If an individual also suffers from fatigue, this then leads to an intensification of burnout-symptoms and so on. The co-occurrence of both conditions was further associated with worse consequences (general health, persistence of symptoms, absenteeism and psychological distress) than the occurrence of each condition apart.

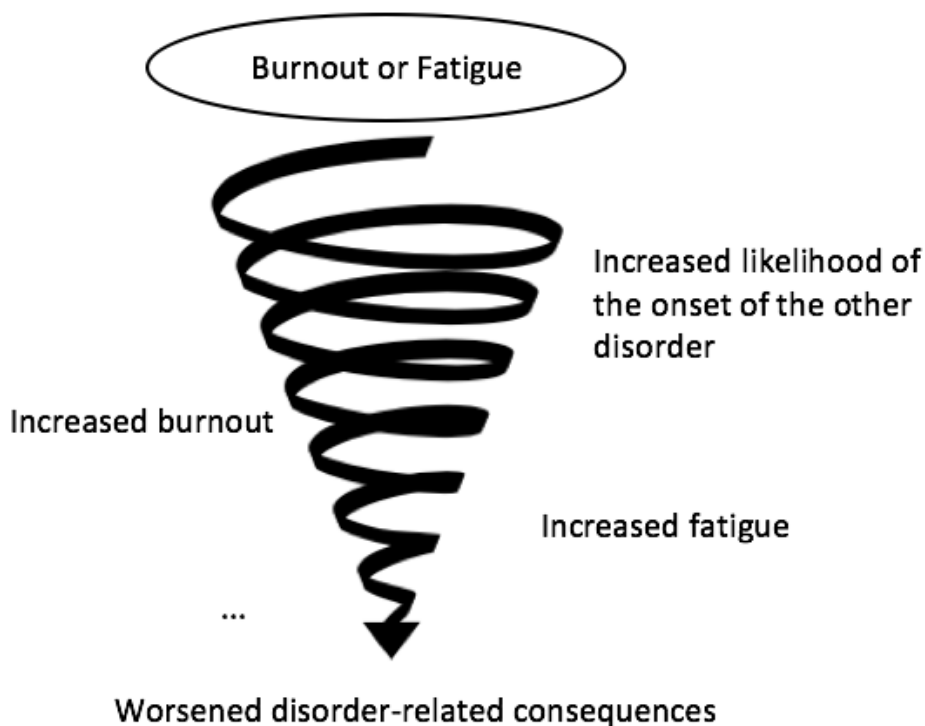


Figure 2. A model of the temporal relationship between burnout and fatigue

While the articles that were identified by the present research gave no information about the mechanism with which burnout and fatigue influence each other's maintenance, Leone et al. (2009) suggested two ways in which they could affect each other's onset. They suggested that burnout is a work-specific form of fatigue and that it could spread to other areas of life over time, thereby marking the onset of (general) fatigue. Fatigue, on the other hand, could influence the development of burnout by gradually accumulating to severe exhaustion. In this way, fatigue would lead to burnout, which is centred around severe exhaustion. These mechanisms could explain how burnout and fatigue influence each other's onset, but it is important to note that these mechanisms remain hypothetical and further proof for them is needed.

The main finding of the integrated model, namely that burnout and fatigue are bi-directionally related, was also found by Bakker and Costa (2014) and Saleh and Shapiro (2008). Both studies proposed models in which burnout and fatigue were interrelated. In addition, Bakker and Costa (2014) also hypothesized that the relation between fatigue and burnout can be described as a loss cycle, because having one condition is assumed to make individuals susceptible to losing even more resources, which hinders the regeneration from those concepts. This notion is in line with the finding of the present research that fatigue and burnout are bi-directionally related with regard to their maintenance. Nevertheless, there are also some differences between those models and the model developed in the present research. Firstly, the models by Bakker and Costa (2014) and Saleh and Shapiro (2008) also encompassed other constructs (e.g., daily job-demands, etc.), which means that they were not solely focusing on the relation between burnout and fatigue. Furthermore, both models did not depict the relationship between those concepts over time. Lastly, both models gave no information about the etiology or the consequences of those concepts as the model developed in the present research does.

In conclusion, it can be said that burnout and fatigue are bi-directionally related with regard to their etiology and maintenance. The co-occurrence of both conditions was further associated with worse consequences (e.g., general health, symptom persistence, etc.) than experiencing each condition apart. These findings were summarized in an integrated model of the temporal relationship between burnout and fatigue. Furthermore, the main finding of the model, namely the interrelatedness of burnout and fatigue, gets support from the literature.

Treatment

The third research question was to what extent is the treatment of fatigue integrated in the common treatment of burnout. Because only two articles were found that integrated the treatment of fatigue in the treatment of burnout (Meesters & Waslander, 2009; Ruwaard et al., 2007), and in the intervention by Ruwaard et al. (2009) the treatment of fatigue was only a small component of the whole intervention, it can be concluded that the treatment of fatigue is scarcely integrated in the treatment of burnout. More specifically, Meesters and Waslander (2009) were the first to apply light treatment to burnout victims and Ruwaard et al. (2007) developed one of the first internet-based burnout treatment-programmes. Both approaches cannot be described as common-approaches (Awa, Plaumann & Walter, 2010), thus, it can be said that the treatment of fatigue is not integrated in common approaches of treating burnout. Here, it is important to note that the findings that the treatment of fatigue is scarcely integrated in the treatment of burnout, and not integrated in the common approaches, do not mean that fatigue-levels are not affected by existing treatments. This research only concluded that there are only few methods that had directly targeted fatigue. The findings that the treatment of fatigue is scarcely integrated in the treatment of burnout and not integrated in the common-approaches of treating burnout, are partly in accordance with the study of West, Dyrbye, Erwin and Shanafelt (2016). West et al. (2016) did a systematic review about interventions to prevent and reduce physician burnout. They included 52 articles in their review, described the studies roughly and reported what the interventions were focused on.

Many interventions were focused on stress-management or mindfulness-based interventions, but West et al. (2016) found no studies that directly focused on treating fatigue-symptoms. Thus, while the present research and West et al. (2016) agree on the conclusion that the treatment of fatigue is not-well integrated in the treatment of burnout, they differ with regard to the number of identified articles: the present research had identified two articles that integrated the treatment of fatigue and West et al. (2016) found none.

There could be different explanations for the small number of studies that were found in the present research integrating the treatment of fatigue in the treatment of burnout, a disorder that has the feeling of exhaustion at its heart. Because the present research only included treatment-elements that were described as directly targeting burnout, and articles are bounded by limited space, it could be that some treatment-elements that targeted fatigue were falling through the net, simply because they were not described as doing so. Another reason could be that the chosen inclusion period in combination with the current paradigm of therapy may account for the small number of studies that were identified. Currently, a lot of research is done about mindfulness-based approaches and more specifically, about acceptance and commitment therapy (ACT). Accordingly, this research also found many articles that used these approaches (see for example, Brinkborg, Michanek, Hesser & Berglund, 2011; Goodman & Schorling, 2012; Krasner et al., 2009). Mindfulness can thereby be defined as being “fully present to one’s experience without judgement or resistance” (p.303; Cohen-Katz, Wiley, Capuano, Baker & Shapiro, 2004), and mindfulness-elements are used together with acceptance strategies in acceptance and commitment therapy (ACT; Cohen-Katz et al., 2004). The aim of ACT is to enhance the psychological flexibility of clients, which means to help them focus on the current situation, to not distance themselves from difficult feelings and to strive towards their own goals and aims (Hayes, 2004; Hayes, Luoma, Bond, Masuada & Lillis, 2006). Thus, mindfulness-based approaches in general and more specifically, ACT, do not focus on improving unpleasant feelings or symptoms, as for example, fatigue. In

conclusion, it could be that only a few articles targeted exhaustion, a prominent symptom of burnout, directly, because the current paradigm does not favour the treatment of fatigue-symptoms.

Furthermore, besides looking at the mere number of articles that integrated treatment-elements that were directly focused on fatigue in the treatment of burnout, it is also important to look at their effectiveness. Firstly, Meesters and Waslander (2009) used two different questionnaires to measure burnout as an outcome measure. According to one questionnaire, there was a significant difference between pre- and post-measure, according to the other one, there was none. Thus, the evidence about the effectiveness of the light treatment by Meesters and Waslander (2009) is inconclusive. Secondly, Ruwaard et al. (2007) developed an e-mail standardized cognitive behavioural therapy-treatment, which consisted of seven phases. Only one of those seven phases encompassed elements that were focused on treating fatigue. While the intervention by Ruwaard et al. (2007) as a whole was effective, it is not possible to determine whether the treatment of fatigue contributed to the effect of the intervention, because treating fatigue was only a small component of the intervention. In conclusion, it can be noted that fatigue is scarcely integrated in treatments of burnout, and not integrated in the common approaches of treating burnout. In addition, it cannot be concluded whether the existing approaches of treating fatigue in the treatment of burnout are effective.

Limitations

Despite general limitations of the chosen research method, as for example the selection bias or reporting bias (see Cuijpers, 2016), two specific limitations were found that have to be taken into account when looking at the results of this research.

Conceptualization and Definition of Burnout. One factor that limited the present research was that burnout is only vaguely conceptualized and defined (Bianchi et al., 2015; Maslach et al., 2001). As described in the introduction, while burnout is a recognized disorder and a lot of research was done analyzing it, there is still no clear definition of burnout, the

conceptual foundation of burnout has been criticized (Bianchi et al., 2015), and it is not integrated as a distinct diagnose in the two major classification systems for mental disorders (ICD-10 and DSM-5; Bianchi et al., 2015; Keijsers et al., 2011). Instead of a definition, the three dimensions of the MBI are used synonymously with the concept of burnout. It became apparent in this literature review, that some researchers used other questionnaires to measure burnout than the MBI, for example the Shirom-Melamed Burnout Questionnaire (SMBQ; Söderström et al., 2012; Vela-Bueno et al. 2008) or the Shirom-Melamed Burnout Measure (SMBM; Armon, 2009; Armon et al., 2008). The SMBQ is a later version of the SMBM and both questionnaires share one important characteristic: they conceptualize burnout differently than the MBI. According to the definition by Melamed, Shirom, Toker, Berliner and Shapira (2006), which acted as a conceptual foundation of the SMBM and SMBQ, burnout consists of emotional exhaustion, physical fatigue and cognitive weariness. Thus, by using another questionnaire, they also used a different definition of burnout, therefore, in a strict sense, they also measured a different concept. The resulting ambiguities are enhanced by the fact that not every study in this article had defined burnout before analyzing it (see for example Vela-Bueno et al., 2008).

Conceptualization and Definition of Fatigue. Besides burnout, fatigue has also some conceptual flaws that are relevant for the present research. A central problem of fatigue is, that it is only loosely defined and different studies use different definitions (Dolan & Kudrna, 2015; Phillips, 2015). This vagueness was also reflected by the variety of measuring instruments used by studies in this literature review. In total 12 different ways of measuring fatigue were used and it is beyond the scope of the present research to analyse the differences between those instruments. Furthermore, there is also another limitation that is especially important for the third research question: it was difficult to distinguish between treatment-elements that affected fatigue and ones that did not. It could be possible, that a lot of other treatment-elements also had an impact on fatigue, but were not found, because this research

focused explicitly on treatment-elements that were described as being aimed at decreasing fatigue. Lastly, when looking at the included articles of the present research, it can be concluded that it might have been useful to include the term ‘insomnia’ as fatigue-related term in the list of search terms, because of the strong relation to fatigue and many related articles.

Impact on the Research. In summary, it can be said that there remain ambiguities regarding the conceptualization, definition and measurement of burnout and fatigue. On the other hand, these flaws have to be put into perspective. As has been shown by the present research, there was a high agreement between studies that used different conceptualizations of burnout while researching the relationship between burnout and fatigue. This consensus put the conceptual flaws into perspective and may even add weight to the implications made by the present research, because it did not matter which exact conceptualization was used, the relationship was nevertheless observable in most studies.

Implications

The present research gave an overview over the existing literature about fatigue and burnout. Furthermore, it also added knowledge by laying new connections and developing a model of the temporal relationship between the two concepts. This model and its consequences can further be utilized in several ways. When looking at the results of this research, it becomes apparent that there is a discrepancy between what ought to be done and what is currently done. On the one hand, the results of the etiology- and maintenance-sections indicate that fatigue has a strong impact on burnout. Fatigue influences etiology, maintenance and intensification of burnout negatively. Accordingly, this strongly suggests that the treatment of fatigue should be incorporated in the treatment of burnout. On the other hand, the results of the treatment-section show that not much is done to integrate the treatment of fatigue in the treatment of burnout. Thus, an implication for the practice is to change this and to focus more on treating fatigue in the treatment of burnout. This implication also gets support from the

treatment-protocol for burnout of the GGZ, the Dutch Association of Mental Health and Addictive Care, who also advised to treat fatigue in the treatment of burnout and to implement treatment-elements that focus on it (Keijsers et al., 2011).

While to the knowledge of the researcher no well-established and effective approaches for treating fatigue in the treatment of burnout are known, different approaches could be of value. When looking at the treatment of fatigue integrated in the treatment of other disorders (e.g., CFS, depression, generalized anxiety disorder), it becomes apparent that cognitive behavioral therapy (CBT) and graded exercise therapy (GET) are among the most promising approaches (Carney, Moss, Lachowski, & Atwood, 2014; Dugas et al., 2003; Dritsa, Da Costa, Dupuis, Lowensteyn, & Khalifé, 2008; Larun, Brurberg, Odgaard-Jensen, & Price, 2016; Ridsdale, Darbishire, & Seed, 2004; White et al., 2011). A CBT-treatment focuses on addressing unhelpful and dysfunctional fatigue-related beliefs, such as ‘being active only decreases my energy level’ with the help of, for example, behavioral experiments (Yancey & Thomas, 2012). GET has a slightly different focus; here, a baseline of physical activity is established. Then the activity is being incrementally increased (longer duration in which the patient is being active or an increase in the intensity) to improve the energy level. In addition, the two treatment-approaches of the present research, psycho-educative information about sleep hygiene (Ruwaard et al., 2007) and light treatment (Meesters & Waslander, 2009) may also be useful. Furthermore, this review has shown that sleeping problems have a strong relationship with fatigue (see for example Armon, 2009). Thus, it could be helpful to develop an intervention that does not only give psycho-educative information about sleep hygiene, but actively targets sleeping problems. In conclusion, a lot of approaches could be of value for treating fatigue in the treatment of burnout, but further research should establish their effectiveness by, for example, testing those approaches in a factorial design.

In addition to the establishment of the effectiveness, further research should aim to define burnout and fatigue more precisely. As already described in the Limitation-section,

both concepts remain ambiguous and this hinders research about those concepts (Bianchi et al., 2015; Dolan & Kudrna, 2015; Maslach et al., 2001). When looking at burnout, the literature does not seem to be in line with regard to what exactly can be described as burnout, which means that they do not agree on a definition for burnout. Thus, a first step could be to go back again to the roots of this disorder and look at the symptoms of burnout with the help of clinical observations. Clinical observations could then provide empirical evidence for the question out of which dimensions burnout consists. When this is clear, a further step could be to compare the symptomatology of burnout with other disorders (e.g., depression) to make sure that there is no significant overlap, which could indicate that burnout is no distinct disorders. This procedure would improve the conceptualization of burnout by grounding it in empirical research, which was for example criticized as a flaw of the MBI-based definition. (Bianchi et al., 2015), and differentiating it clearly from other disorders.

Conclusion

This research showed that fatigue is related to the etiology and maintenance of burnout. In addition, it was also found that burnout in turn is related to the etiology and maintenance of fatigue. Lastly, it was discovered that the treatment of fatigue is scarcely integrated in the treatment of burnout and not integrated in the common approaches of treating burnout, because only two articles were found that treated fatigue in the treatment of burnout and both treatments were not common approaches for treating burnout. When these results are taken together, they indicate on the one hand that fatigue has a strong impact on burnout, and on the other hand, that not much is done to treat fatigue in the treatment of burnout. Thus, the present research concludes that it might be helpful to integrate the treatment of fatigue more in the treatment of burnout and suggests different approaches that could be of value to do so. Because no effective and well-established method was found yet, further research should focus on analysing the effectiveness of the proposed approaches. In addition, future research

should also try to define burnout and fatigue more clearly, because of their conceptual ambiguities that hinder research.

References

- Aaronson, L. S., Pallikkathayil, L., & Crighton, F. (2003). A qualitative investigation of fatigue among healthy working adults. *Western Journal of Nursing Research*, 25(4), 419-433. doi:10.1177/0193945903025004007
- Ahola, K. (2007). *Occupational burnout and health*. Helsinki: Finnish Institute of Occupational Health. doi:10138/19788
- *Armon, G. (2009). Do burnout and insomnia predict each other's levels of change over time independently of the job demand control–support (JDC–S) model?. *Stress and Health*, 25(4), 333-342. doi:10.1002/smi.1266
- *Armon, G., Shirom, A., Shapira, I., & Melamed, S. (2008). On the nature of burnout–insomnia relationships: A prospective study of employed adults. *Journal of Psychosomatic Research*, 65(1), 5-12. doi:10.1016/j.jpsychores.2008.01.012
- Avlund, K. (2010). Fatigue in older adults: an early indicator of the aging process?. *Aging clinical and experimental research*, 22(2), 100-115. doi:10.1007/BF03324782
- Avlund, K., Rantanen, T., & Schroll, M. (2006). Tiredness and subsequent disability in older adults: The role of walking limitations. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 61(11), 1201-1205. doi:10.1093/gerona/61.11.1201
- Awa, W. L., Plaumann, M., & Walter, U. (2010). Burnout prevention: a review of intervention programs. *Patient education and counseling*, 78(2), 184-190. doi:10.1016/j.pec.2009.04.008
- Bakker, A. B., & Costa, P. L. (2014). Chronic job burnout and daily functioning: A theoretical analysis. *Burnout Research*, 1(3), 112-119. doi:10.1016/j.burn.2014.04.003
- Bakker, A. B., Demerouti, E., & Sanz-Vergel, A. I. (2014). Burnout and work engagement: The JD–R approach. *Annu. Rev. Organ. Psychol. Organ. Behav.*, 1(1), 389-411. doi:10.1146/annurev-orgpsych-031413-091235

- Bakker, A. B., Schaufeli, W. B., Demerouti, E., Janssen, P. P., Van Der Hulst, R., & Brouwer, J. (2000). Using equity theory to examine the difference between burnout and depression. *Anxiety, Stress, and Coping, 13*, 244-268.
doi:10.1080/10615800008549265
- Balch, C. M., Freischlag, J. A., & Shanafelt, T. D. (2009). Stress and burnout among surgeons: understanding and managing the syndrome and avoiding the adverse consequences. *Archives of surgery, 144*(4), 371-376. doi:10.1001/archsurg.2008.575
- Bianchi, R., Boffy, C., Hingray, C., Truchot, D., & Laurent, E. (2013). Comparative symptomatology of burnout and depression. *Journal of Health Psychology, 18*(6), 782-787. doi:10.1177/1359105313481079
- Bianchi, R., Schonfeld, I. S., & Laurent, E. (2015). Is it time to consider the “burnout syndrome” a distinct illness?. *Frontiers in public health, 3*.
doi:10.3389/fpubh.2015.00158
- *Brand, S., Beck, J., Hatzinger, M., Harbaugh, A., Ruch, W., & Holsboer-Trachsler, E. (2010). Associations between satisfaction with life, burnout-related emotional and physical exhaustion, and sleep complaints. *The World Journal of Biological Psychiatry, 11*(5), 744-754. doi:10.3109/15622971003624205
- Brinkborg, H., Michanek, J., Hesser, H., & Berglund, G. (2011). Acceptance and commitment therapy for the treatment of stress among social workers: A randomized controlled trial. *Behaviour research and therapy, 49*(6), 389-398.
doi:10.1016/j.brat.2011.03.009M
- Brisson, R., & Bianchi, R. (2017). Stranger things: on the upside down world of burnout research. *Academic Psychiatry, 41*(2), 200-201. doi: 10.1007/s40596-016-0619-7
- Carney, C. E., Moss, T. G., Lachowski, A. M., & Atwood, M. E. (2014). Understanding mental and physical fatigue complaints in those with depression and

- insomnia. *Behavioral sleep medicine*, 12(4), 272-289
doi:10.1080/15402002.2013.801345
- Cohen-Katz, J., Wiley, S. D., Capuano, T., Baker, D. M., & Shapiro, S. (2004). The effects of mindfulness-based stress reduction on nurse stress and burnout: A quantitative and qualitative study. *Holistic nursing practice*, 18(6), 302-308. doi:10.1097/00004650-200411000-00006
- Collier, R. (2010). DSM revision surrounded by controversy. *Canadian Medical Association Journal*, 182(1), 16-17. doi:10.1503/cmaj.109-3108
- Cuijpers, P. (2016). *Meta-analyses in mental health research. A practical guide*. Retrieved from <https://www.researchgate.net/>
- Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands-resources model of burnout. *Journal of Applied psychology*, 86(3), 499.
doi:10.1037/0021-9010.86.3.499
- *De Vos, J. A., Brouwers, A., Schoot, T., Pat-El, R., Verboon, P., & Näring, G. (2016). Early career burnout among Dutch nurses: A process captured in a Rasch model. *Burnout research*, 3(3), 55-62. doi:10.1016/j.burn.2016.06.001
- Dolan, P., & Kudrna, L. (2015). More years, less yawns: fresh evidence on tiredness by age and other factors. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 70(4), 576-580. doi:10.1093/geronb/gbt118
- Dugas, M. J., Ladouceur, R., Léger, E., Freeston, M. H., Langolis, F., Provencher, M. D., & Boisvert, J. M. (2003). Group cognitive-behavioral therapy for generalized anxiety disorder: Treatment outcome and long-term follow-up. *Journal of consulting and clinical psychology*, 71(4), 821. doi:10.1037/0022-006X.71.4.821
- Dritsa, M., Da Costa, D., Dupuis, G., Lowensteyn, I., & Khalifé, S. (2008). Effects of a home-based exercise intervention on fatigue in postpartum depressed women: results of a

randomized controlled trial. *Annals of Behavioral Medicine*, 35(2), 179-187.

doi:10.1007/s12160-008-9020-4

Dyrbye, L. N., Massie, F. S., Eacker, A., Harper, W., Power, D., Durning, S. J., ... & Shanafelt, T. D. (2010). Relationship between burnout and professional conduct and attitudes among US medical students. *Jama*, 304(11), 1173-1180.

doi:10.1001/jama.2010.1318

Dyrbye, L. N., West, C. P., Satele, D., Boone, S., Tan, L., Sloan, J., & Shanafelt, T. D. (2014). Burnout among US medical students, residents, and early career physicians relative to the general US population. *Academic Medicine*, 89(3), 443-451.

doi:10.1097/ACM.000000000000134

Ekman, A., Petersen, I., Mänty, M., Christensen, K., & Avlund, K. (2013). Fatigue, general health, and ischemic heart disease in older adults. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 68(3), 279-285.

doi:10.1093/gerona/gls180

*Ekstedt, M., Söderström, M., & Åkerstedt, T. (2009). Sleep physiology in recovery from burnout. *Biological psychology*, 82(3), 267-273. doi:10.1016/j.biopsycho.2009.08.006

Goodman, M. J., & Schorling, J. B. (2012). A mindfulness course decreases burnout and improves well-being among healthcare providers. *The International Journal of Psychiatry in Medicine*, 43(2), 119-128. doi:10.2190/PM.43.2.b

Graff, L. A., Vincent, N., Walker, J. R., Clara, I., Carr, R., Ediger, J., ... & Bernstein, C. N. (2011). A population-based study of fatigue and sleep difficulties in inflammatory bowel disease. *Inflammatory bowel diseases*, 17(9), 1882-1889.

doi:10.1002/ibd.21580

Hakanen, J. J., & Schaufeli, W. B. (2012). Do burnout and work engagement predict depressive symptoms and life satisfaction? A three-wave seven-year prospective study. *Journal of affective disorders*, 141(2), 415-424. doi:10.1016/j.jad.2012.02.043

- Hayes, S. C. (2004). Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies. *Behavior therapy, 35*(4), 639-665. doi:10.1016/S0005-7894(04)80013-3
- Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour research and therapy, 44*(1), 1-25. doi:10.1016/j.brat.2005.06.006
- Heinemann, L. V., & Heinemann, T. (2017). Burnout Research: Emergence and Scientific Investigation of a Contested Diagnosis. *SAGE Open, 7*(1), 1-12 doi:10.1177/2158244017697154
- Hjollund, N. H., Andersen, J. H., & Bech, P. (2007). Assessment of fatigue in chronic disease: a bibliographic study of fatigue measurement scales. *Health and Quality of life Outcomes, 5*(1), 12. doi:10.1186/1477-7525-5-12
- Hooper, C., Craig, J., Janvrin, D. R., Wetsel, M. A., & Reimels, E. (2010). Compassion satisfaction, burnout, and compassion fatigue among emergency nurses compared with nurses in other selected inpatient specialties. *Journal of emergency nursing, 36*(5), 420-427. doi:10.1016/j.jen.2009.11.027
- Huibers, M. J. H., Beurskens, A. J. H. M., Prins, J. B., Kant, I. J., Bazelmans, E., Van Schayck, C. P., ... & Bleijenberg, G. (2003). Fatigue, burnout, and chronic fatigue syndrome among employees on sick leave: do attributions make the difference?. *Occupational and environmental medicine, 60*(suppl 1), i26-i31. doi:10.1136/oem.60.suppl_1.i26
- *Jansson-Fröjmark, M., & Lindblom, K. (2010). Is there a bidirectional link between insomnia and burnout? A prospective study in the Swedish workforce. *International journal of behavioral medicine, 17*(4), 306-313. doi:10.1007/s12529-010-9107-8
- Kant, I. J., Bültmann, U., Schröer, K. A. P., Beurskens, A. J. H. M., Van Amelsvoort, L. G. P. M., & Swaen, G. M. H. (2003). An epidemiological approach to study fatigue in the

- working population: the Maastricht Cohort Study. *Occupational and Environmental Medicine*, 60(suppl 1), i32-i39. doi:10.1136/oem.60.suppl_1.i32
- Keijsers, G.P.J., Vossen, C.J.C., Kriens, S., & Boelaars, V.A.J.M. (2011). Protocollaire behandeling van patiënten met burn-out: Modulaire behandeling. In G.P.J. Keijsers, A. Van Minnen, & C.A.L. Hoogduin (Eds.), *Protocollaire behandelingen voor volwassenen met psychische klachten 2* (pp. 225-295). Amsterdam: Boom.
- Krasner, M. S., Epstein, R. M., Beckman, H., Suchman, A. L., Chapman, B., Mooney, C. J., & Quill, T. E. (2009). Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *Jama*, 302(12), 1284-1293. doi:10.1001/jama.2009.1384
- Kristensen, T. S., Borritz, M., Villadsen, E., & Christensen, K. B. (2005). The Copenhagen Burnout Inventory: A new tool for the assessment of burnout. *Work & Stress*, 19(3), 192-207. doi:10.1080/02678370500297720
- Larun, L., Brurberg, K. G., Odgaard-Jensen, J., & Price, J. R. (2016). Exercise therapy for chronic fatigue syndrome. *Cochrane Database Syst Rev*, 6. doi:10.1002/14651858.CD003200.pub5
- *Leone, S. S., Huibers, M. J., Knottnerus, J. A., & Kant, I. J. (2007). Similarities, overlap and differences between burnout and prolonged fatigue in the working population. *Qjm*, 100(10), 617-627. doi:10.1093/qjmed/hcm073
- *Leone, S. S., Huibers, M. J., Knottnerus, J. A., & Kant, I. (2008). A comparison of the course of burnout and prolonged fatigue: A 4-year prospective cohort study. *Journal of psychosomatic research*, 65(1), 31-38. doi: 10.1016/j.jpsychores.2008.03.018
- *Leone, S. S., Huibers, M. J., Knottnerus, J. A., & Kant, I. (2009). The temporal relationship between burnout and prolonged fatigue: a 4-year prospective cohort study. *Stress and health*, 25(4), 365-374. doi:10.1002/smi.1280

- Lerdal, A., Wahl, A. K., Rustoen, T., Hanestad, B. R., & Moum, T. (2005). Fatigue in the general population: a translation and test of the psychometric properties of the Norwegian version of the fatigue severity scale. *Scandinavian Journal of Public Health*, 33(2), 123-130. doi:10.1080/14034940410028406
- Leiter, M. P., & Durup, J. (1994). The discriminant validity of burnout and depression: A confirmatory factor analytic study. *Anxiety, stress, and coping*, 7(4), 357-373. doi:10.1080/10615809408249357
- Linzer, M., Levine, R., Meltzer, D., Poplau, S., Warde, C., & West, C. P. (2014). 10 bold steps to prevent burnout in general internal medicine. *Journal of general internal medicine*, 29(1), 18-20. doi:10.1007/s11606-013-2597-8
- Maslach, C., Jackson, S. E., & Leiter, M. P. (1997). Maslach burnout inventory. *Evaluating stress: A book of resources*, 3, 191-218. Retrieved from <https://www.researchgate.net>
- Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual review of psychology*, 52(1), 397-422. doi:10.1146/annurev.psych.52.1.397
- *Meesters, Y., & Waslander, M. (2010). Burnout and light treatment. *Stress and health*, 26(1), 13-20. doi:10.1002/smi.1250
- Melamed, S., Shirom, A., Toker, S., Berliner, S., & Shapira, I. (2006). Burnout and risk of cardiovascular disease: evidence, possible causal paths, and promising research directions. *Psychological bulletin*, 132(3), 327. doi:10.1037/0033-2909.132.3.327
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Prisma Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine*, 6(7), e1000097. doi:10.1371/journal.pmed.1000097
- *Oldenburg, M., Jensen, H. J., & Wegner, R. (2013). Burnout syndrome in seafarers in the merchant marine service. *International archives of occupational and environmental health*, 86(4), 407-416. doi:10.1007/s00420-012-0771-7

- *Pagnin, D., de Queiroz, V., Carvalho, Y. T. M. S., Dutra, A. S. S., Amaral, M. B., & Queiroz, T. T. (2014). The relation between burnout and sleep disorders in medical students. *Academic Psychiatry, 38*(4), 438-444. doi:10.1007/s40596-014-0093-z
- Phillips, R. O. (2015). A review of definitions of fatigue—And a step towards a whole definition. *Transportation research part F: traffic psychology and behaviour, 29*, 48-56. doi:10.1016/j.trf.2015.01.003
- Ridsdale, L., Darbishire, L., & Seed, P. T. (2004). Is graded exercise better than cognitive behaviour therapy for fatigue? A UK randomized trial in primary care. *Psychological medicine, 34*(1), 37-49. doi:10.1017/S0033291703001247
- *Ruwaard, J., Lange, A., Bouwman, M., Broeksteeg, J., & Schrieken, B. (2007). E-Mailed standardized cognitive behavioural treatment of work-related stress: A randomized controlled trial. *Cognitive behaviour therapy, 36*(3), 179-192. doi:10.1080/16506070701381863
- Saleh, P., & Shapiro, C. M. (2008). Disturbed sleep and burnout: Implications for long-term health. *Journal of psychosomatic research, 65*(1), 1-3. doi:10.1016/j.jpsychores.2008.05.028
- Schaufeli, W. B. (2007). Burn-out in discussie – De stand van zaken. *De Psycholoog, 10*, 534-540. Retrieved from <http://wilmarschaufeli.nl>
- Schaufeli, W. B., Bakker, A. B., & Van Rhenen, W. (2009). How changes in job demands and resources predict burnout, work engagement, and sickness absenteeism. *Journal of Organizational behavior, 30*(7), 893-917. doi:10.1002/job.595
- Schaufeli, W. B., Leiter, M. P., & Maslach, C. (2009). Burnout: 35 years of research and practice. *Career development international, 14*(3), 204-220. doi:10.1108/13620430910966406

- Schaufeli, W. B., & Taris, T. W. (2005). The conceptualization and measurement of burnout: Common ground and worlds apart. *Work & Stress, 19*(3), 256-262.
doi:10.1080/02678370500385913
- Shanafelt, T.D., & Dyrbye, L. (2012). Oncologist burnout: causes, consequences, and responses. *Journal of Clinical Oncology, 30*(11), 1235-1241.
doi:10.1200/JCO.2011.39.7380
- *Söderström, M., Jeding, K., Ekstedt, M., Perski, A., & Åkerstedt, T. (2012). Insufficient sleep predicts clinical burnout. *Journal of occupational health psychology, 17*(2), 175.
doi:10.1037/a0027518
- *Sonnenschein, M., Sorbi, M. J., van Doornen, L. J., Schaufeli, W. B., & Maas, C. J. (2007). Evidence that impaired sleep recovery may complicate burnout improvement independently of depressive mood. *Journal of psychosomatic research, 62*(4), 487-494.
doi:10.1016/j.jpsychores.2006.11.011
- *Sonnenschein, M., Sorbi, M. J., Verbraak, M. J., Schaufeli, W. B., Maas, C. J., & van Doornen, L. J. (2008). Influence of sleep on symptom improvement and return to work in clinical burnout. *Scandinavian journal of work, environment & health, 23*-32.
doi:10.5271/sjweh.1195
- Van't Leven, M., Zielhuis, G. A., van der Meer, J. W., Verbeek, A. L., & Bleijenberg, G. (2009). Fatigue and chronic fatigue syndrome-like complaints in the general population. *European journal of public health, 20*(3), 251-257.
doi:10.1093/eurpub/ckp113
- *Vela-Bueno, A., Moreno-Jiménez, B., Rodríguez-Muñoz, A., Olavarrieta-Bernardino, S., Fernández-Mendoza, J., De la Cruz-Troca, J. J., ... & Vgontzas, A. N. (2008). Insomnia and sleep quality among primary care physicians with low and high burnout levels. *Journal of psychosomatic research, 64*(4), 435-442.
doi:10.1016/j.jpsychores.2007.10.014

- Vestergaard, S., Nayfield, S. G., Patel, K. V., Eldadah, B., Cesari, M., Ferrucci, L., ... & Guralnik, J. M. (2009). Fatigue in a representative population of older persons and its association with functional impairment, functional limitation, and disability. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, 64(1), 76-82. doi:10.1093/gerona/gln017
- Von Känel, R. (2008). Das Burnout-Syndrom: eine medizinische Perspektive. *Praxis*, 97(9), 477-487. doi:10.1024/1661-8157.97.9.477
- Watt, T., Groenvold, M., Bjorner, J. B., Noerholm, V., Rasmussen, N. A., & Bech, P. (2000). Fatigue in the Danish general population. Influence of sociodemographic factors and disease. *Journal of epidemiology and community health*, 54(11), 827-833. doi:10.1136/jech.54.11.827
- West, C. P., Dyrbye, L. N., Erwin, P. J., & Shanafelt, T. D. (2016). Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. *The Lancet*, 388(10057), 2272-2281. doi:10.1016/S0140-6736(16)31279-X
- West, C. P., Shanafelt, T. D., & Kolars, J. C. (2011). Quality of life, burnout, educational debt, and medical knowledge among internal medicine residents. *Jama*, 306(9), 952-960. doi:10.1001/jama.2011.1247
- West, C. P., Tan, A. D., Habermann, T. M., Sloan, J. A., & Shanafelt, T. D. (2009). Association of resident fatigue and distress with perceived medical errors. *Jama*, 302(12), 1294-1300. doi:10.1001/jama.2009.1389
- Yancey, J. R., & Thomas, S. M. (2012). Chronic fatigue syndrome: diagnosis and treatment. *Am Fam Physician*, 86(8), 741-746. Retrieved from www.aafp.org/afp
- Zengarini, E., Ruggiero, C., Pérez-Zepeda, M. U., Hoogendijk, E. O., Vellas, B., Mecocci, P., & Cesari, M. (2015). Fatigue: Relevance and implications in the aging population. *Experimental gerontology*, 70, 78-83. doi:10.1016/j.exger.2015.07.011

Appendix

Study characteristics of all included studies

Authors	Year	Location	Objective	Study population	Sample size	Study design	Mesurement-instruments
Armon	2009	Tel-Aviv (Israel)	To test whether there is an additive effect of burnout on subsequent changes in insomnia over and above the effect of the JDC-S model, and the reverse causation hypothesis expecting insomnia to have an additive effect on subsequent levels of burnout	Healthy employees attending the Center for Periodic Health Examinations of the Tel-Aviv Sourasky Medical Center for a routine health examination	N= 3235	Observational study – Prospective longitudinal design; T ₁ -T ₂ (18months apart) - Ordinary Least Squares (OLS) regressions analysis	SMBM (burnout) AIS-5 (insomnia)
Armon et al.	2008	Tel-Aviv (Israel)	To test the hypothesis that burnout and insomnia predict each other's incidence and intensification across time.	Healthy employees attending the Center for Periodic Health Examinations of the Tel-Aviv Sourasky Medical Center for routine health examination	N= 1356	Observational study – Prospective design; T ₁ -T ₂ (18 months apart) – Logistic regression-analysis	SMBM (burnout) Slightly modified AIS-5 (insomnia)
Brand et al.	2010	/	To investigate the relation between burnout, depressive symptoms, satisfaction with life, and sleep complaints	/	N= 2231	Observational study – Cross-sectional design – Pearson's r-analyses. exploratory factor analysis (EFA), confirmatory factor analysis (CFA), structure equation modeling (SEM)	Tedium Scale (burnout) Insomnia Severity Index (insomnia)

Authors	Year	Location	Objective	Study population	Sample size	Study design	Measurement-instruments
De Vos et al.	2016	Provinces Limburg en Gelderland (Netherlands)	To investigate burnout as a process by testing a sequential-developmental model	Dutch nursing graduates, that had to work at an internship at least six month prior, had to work in a nursing setting throughout the period of this study and that had a max. work experience of 3 years	N= 237	Observational study – Cross-sectional design – Rasch measurement model	MBI-HSS (burnout)
Ekstedt et al.	2009	Stockholm (Sweden)	To investigate the role of sleep physiology in recovery from burnout, in particular the relation between sleep and changes in fatigue and whether those changes would be related to return to work	White-collar workers on long-term sick leave (>3 months) due to a burnout related diagnosis and healthy controls	N= 39	Treatment study – Quasi-experimental design; T ₁ -T ₂ (6-12 months apart) – repeated measures analysis of variance (ANOVA), stepwise regression analysis, logistic regression analysis, Pearson's r correlation coefficients	Polysomnigraphy, sleep index, SQI, sleep and wake diary (sleep) SMBQ (burnout)
Jansson-Fröjmark & Lindblom	2010	Örebro (Sweden)	To investigate whether there is a bi-directional relationship between insomnia and burnout over the course of a year among individuals in the workforce	Individuals between 20-60 that were employed and returned the baseline-questionnaire and the 1-year follow-up questionnaire	N= 1258	Observational study – Cross-sectional and prospective design; T ₁ -T ₂ (1 year apart)– Pearson's r, logistic regression analysis	Items from the Basic Nordic Sleep Questionnaire and the Upsala Sleep Inventory (insomnia) MBI-GS (burnout)
Leone et al.	2007	Netherlands	To examine similarities, overlap and differences between burnout and prolonged fatigue	Participants at baseline of the Maastricht Cohort Study on Fatigue at Work (MCS) were included	N= 11739	Observational study – Cross-sectional design – principal component analysis, Pearson's r correlations, Kruska-Wallis test	CIS (fatigue) MBI-GS (burnout)

Authors	Year	Location	Objective	Study population	Sample size	Study design	Measurement-instruments
Leone et al.	2008	Netherlands	To assess and compare the course of burnout and prolonged fatigue in the working population	Participants who had data on burnout and prolonged fatigue at all four measurement-time points were included in this study	N= 1207	Observational study – Prospective cohort design; T ₁ -T ₂ (4 years apart) – independent t-test, chi-square-tests, Kruskal-Wallis test, logistic regression analysis	CIS (fatigue) MBI-GS (burnout)
Leone et al.	2009	Netherlands	To examine the temporal relationship between burnout and prolonged fatigue Four-year prospective follow-up data from the Maastricht Cohort Study were used for this study	Participants that did not have one of the following chronic conditions that might explain fatigue complaints: cerebrovascular accidents, liver dysfunction, diabetes mellitus, hyperthyroidism or cancer	N= 11710	Observational study – (4-year) prospective cohort design; T ₁ -T ₂ (4 years apart) – Cox-regression analyses, generalized estimating equation (GEE), multi-nominal regression analysis	CIS (fatigue) MBI-GS (burnout)
Meesters & Waslander	2009	/	To research the effects of light treatment in burnout sufferers.	Participants with the diagnose of burnout	N= 30	Treatment study – quasi-experimental design; T ₁ -T ₂ -T ₃ -T ₄ -T ₅ (only T ₁ and T ₅ were included in the analysis; 22days apart) – repeated measured analysis of variance (ANOVA)	SFQ (fatigue) UBOS, BO-NKS (particularly exhaustion)
Oldenburg et al.	2013	Germany	To investigate indicators of burnout	Seafarers that attended a medical examination by the German Statutory Accident Insurance Institution for Seafaring to test their fitness.	N= 224	Observational study – Cross-sectional design – Kruskal-Wallis test, Pearson's r	MBI (burnout) ESS (daytime-sleepiness)

Authors	Year	Location	Objective	Study population	Sample size	Study design	Measurement-instruments
Pagnin et al.	2014	Niterói (Brazil)	To assess the mutual relationships between burnout and sleep disorders in students in the preclinical phase of medical school	Second year medical students	N= 127	Observational study – Cross-sectional design – Hierarchical logistic regression analysis	MBI-SS (burnout) PSQI, ESS (sleep quality and daytime-sleepiness)
Ruwaard et al.	2007	Netherlands	To assess the effects of a 7-week standardized cognitive behavioral treatment of work-related stress conducted via e-mail	Respondents to a newspaper article above 18, without a heightened risk of dissociation, psychosis or suicidal ideation, that were no drug abuser	N=239	Treatment-study – Randomized controlled trial (RCT); T ₁ -T ₂ (7 weeks apart)-T ₃ (3 years apart) – one-way analyses of covariance (ANCOVAs), Fisher's exact tests, repeated measure analyses of variance (ANOVAs)	MBI-GS (burnout)
Söderström et al.	2012	Sweden	To identify risk factors for subsequent clinical burnout	Individuals that filled in a baseline questionnaire at an IT-company in Sweden and sought help for burnout during a 2-year period	N= 15	Observational study – cohort design; T ₁ -T ₂ (T ₂ = whenever participants sought treatment; max. 2 years apart) – univariate logistic regression analyses, binary correlation analyses, multiple hierarchical logistic regression analysis	SMBQ (burnout) KSQ (sleep)
Sonnenschein et al.	2007	Netherlands	To examine recovery through sleep in relation to sleep quality, exhaustion, and depression in clinical burnout.	Burnt-out employees on extended sick-leave	N=100	Observational study – Prospective design T ₁ -T ₂ (2 weeks apart) – Multilevel regression modeling,	MBI-GS, (burnout) Electronic diary, CIS (sleep, fatigue)

Authors	Year	Location	Objective	Study population	Sample size	Study design	Measurement-instruments
Sonnenschein et al.	2008	Netherlands	To examine the extent to which symptom improvement and full return to work occurs among clinically burnt-out employees and what the influence of concurring sleep problems is with respect to health recovery	Burnt-out employees on extended sick-leave	N= 99	Observational study – Prospective design; T ₁ -T ₂ (6 months apart)– Multilevel regression modeling	MBI-GS, (burnout) Electronic diary, CIS (sleep, fatigue)
Vela-Bueno et al.	2008	Madrid (Spain)	To assess insomnia and sleep quality in primary care physicians with low and high burnout scores	Primary care physicians from multiple medical centres in Madrid	N= 240 physicians	Observational study – Cross-sectional design – chi-square test, <i>t</i> -test for continuous variables, Multivariate analysis of covariance (MANCOVA)	MBI, PBM, shortened version of the SMBQ (burnout) PSQI, self-made insomnia questionnaire (sleep quality and insomnia)

Note. JDC-S model= Job demand control-support model.; SMBM= Shirom-Melamed Burnout Measure; AIS-5= Brief Athens Insomnia Scale; MBI-HSS= Maslach Burnout Inventory-Human Services Survey; SQI= Karolinska Sleep Quality Index; SMBQ= Shirom-Melamed Burnout Questionnaire; MBI-GS= Maslach Burnout Inventory-General Survey; CIS= Checklist Individual Strength; SFQ= Shortened Fatigue Questionnaire; BO-NKS= Burnout-Neurasthenia Complaints Scale; UBOS= Utrechtse BurnOut Schaal; MBI= Maslach Burnout Inventory; ESS= Epworth Sleepiness Scale (ESS); MBI-SS= Maslach Burnout Inventory-Student Survey; PSQI= Pittsburgh Sleep Quality Index; KSQ= Karolinska Sleep Questionnaire; PBM= Pines Burnout Measure