INVESTIGATING FATIGUE AND COGNITIVE BIASES IN (PAST) CORONA PATIENTS

BACHELOR THESIS ASSIGNMENT

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Abstract

Background. Previous studies have investigated several symptoms of the new epidemic COVID-19. However, until now, there is not much research about the longer-persisting effects of it available. Yet, as the epidemic is increasingly taking place around the world, it is important to investigate post-COVID-19 syndromes. **Objective.** The goal of the current study was to investigate whether or to what extent (past) COVID-19 patients are suffering from fatigue symptoms. Furthermore, it was examined if (past) COVID-19 patients have developed a cognitive bias because of their fatigue. Lastly, the level of fatigue of the COVID-19 group was compared to a control group (e.g., healthy people). **Methods.** This study included an explorative research design using an online questionnaire survey and an online experimental design. Forty-five participants volunteered in the study; however, the final data included 34 responses due to incompleteness (Mean age= 31 years, range: 20-74 yrs.; 82 % women; 32,35 % experienced COVID-19 disease). The Fatigue Assessment Scale (FAS), and a self-developed questionnaire were used to measure the fatigue level in general and the fatigue level concerning a (past) COVID-19 disease. To measure the cognitive bias, an experiment consisting of two tasks were performed. In particular, the first task (e.g., the DOT probe) assessed an attentional bias, and the second task (e.g., implicit attention task (IAT)) determined the self-identity bias. Data were analysed by using IBM SPSS Statistics Version 25 (IBM Corp, 2017). **Results.** The results of a linear regression analysis revealed no significant correlation between fatigue and a (past) COVID-19 disease. However, respondents of the COVID-19 group have stated fatigue as one of the most often experienced symptoms. Furthermore, no significant difference in the variance in the FAS score between the COVID-19 group and the control group was found. Finally, due to technical difficulties, no conclusion about the development of a cognitive bias as a result of fatigue could be drawn. **Conclusion.** The current study provided evidence about a probable relationship between feelings of fatigue in relation to a (past) COVID-19 disease even though the linear regression has revealed this. Furthermore, it could be observed that also the control group (‘healthy people’) are affected with a substantial level of fatigue by the current situation. So, it can be concluded that the general population and not only the people who are suffering from COVID-19 are negatively influenced by the epidemic. The proposed outcomes need further investigation, preferably by replicating this study, to establish generalization.

Keywords. Questionnaire and experimental design, fatigue, (past) COVID-19 disease, cognitive bias

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Introduction

Coronavirus

Globally, there have been approximately 184,3 million confirmed cases of the infectious disease COVID-19 (WHO, 2021). Of them, around 3,9 million patients have died (WHO, 2020). Although most people suffering from COVID-19 have experienced a mild to moderate respiratory disease and often recovered without demanding any special treatment, the elderly, and people with an underlying medical problem like diabetes, cancer, or chronic respiratory disease are more likely for developing a severe progression of the illness (WHO, n.d.). To be precise, the effects of COVID-19 range from mild symptoms such as cough, fever, fatigue, nasal congestion, and alternative signals of upper respiratory tract infections to severe symptoms like pneumonia, lymphopenia, dyspnoea, or potential death (Velavan & Meyer, 2020).

On long-term effects or longer-persisting symptoms, on the other hand, information is lacking. This is mostly because COVID-19 is still a novel disease, and it has emerged quickly and abruptly. Specifically, there is a lack of information about the symptom history before the acute infection with COVID-19 and also limited information on the symptom severity (Carfi, Bernabei & Landi, 2020). Nevertheless, multiple studies have observed that especially fatigue and dyspnoea are frequently presented in (past) corona patients after their recovery (Mandal et al., 2020; Carfi, Bernabei &Landi, 2020). Particularly, 53% of the participants still report fatigue after their rehabilitation (Carfi, Bernabei & Landi, 2020). Moreover, as stated in another study, 35% of the outpatients and 87% of the hospitalised corona patients still experience symptoms like fatigue, dyspnoea, and neuropsychological symptoms after their recovery (Lamprecht, 2020).

Fatigue

Especially fatigue can have far-reaching implications for the individual and their quality of life. In healthy individuals, fatigue serves as a protection mechanism against mental and physical overload by releasing a desire to sleep or rest (Ryan et al.,2007). However, it becomes an issue, when the fatigue gets disproportional to the exertion level and it cannot be counteracted by a rest (Ryan et al., 2007). This fatigue can then turn into prolonged fatigue when the individual is feeling fatigued for at least one month or into chronic or persistent fatigue when it is persistent for more than six months (Lamprecht, 2020).

Fatigue cannot be summarized into one general definition due to its multi-dimensional nature and the subjectivity in experience and meaning (Shen, Barbera & Shapiro, 2006). Fatigue can be either physiological or psychological (Shen, Barbera & Shapiro, 2006). The former

means that the individual has lost their maximal force-generating capacity whenever a muscle is activated or that the person has functional organ failure. This can be induced by depletion of neurotransmitters, hormones, or by disproportionate energy consumption (Shen, Barbera & Shapiro, 2006). Psychological fatigue can be defined as a condition of tiredness related to diminished motivation. This type of fatigue is also associated with emotional experiences such as stress (Shen, Barbera & Shapiro, 2006).

Additionally, fatigue is often times the most important cause of disablement. It is often stated by individuals with poor health as one of their most significant symptoms (Shen, Barbera, & Shapiro, 2006). Moreover, several studies have reported a strong relationship between fatigue and physical and mental health. Inter alia, there is a high comorbidity with mental disorders like depression and anxiety (Williamson et al., 2005). Specifically, the more fatigued an individual feels, the lower is the perception of their health, which in turn also results in reduced well-being (Ryan & Federick, 1997).

Fatigue does not only have negative physical effects, but also cognitive impairments on the person concerned. Especially cognition is an important part since cognitive impairments can often be detected before the onset of symptoms that meet any diagnostic criteria (Bowie & Harvey, 2005). Regarding the impact of fatigue on cognitive components, it has been shown that fatigue constrains local processing and attention, as well as information retrieval (Palmer et al., 2014). Furthermore, it harms short-term memory and recall (Palmer et al., 2014). Patients with Chronic Fatigue Syndrome (CFS) also complain about a deterioration in constant attention and spatial working memory (Palmer et. Al., 2014). Fatigue is not only strongly comorbid to cognitive components, but there is also a significant correlation with other physical, psychological, and emotional symptoms, like stress, for instance. Specifically, it is often accompanied by a stress-avoidant coping strategy. Stress is not merely the consequence, but also a predictor of fatigue (Palmer et. Al., 2014). In other words, constant stress is also related to high levels of fatigue.

Considering (past)corona patients, it is often too early for a diagnosis with chronic fatigue syndrome since the symptoms must persist for at least 6 months and COVID-19 is a very new epidemic. Furthermore, feeling fatigued for over 6 months does not merely lead to a diagnosis with CFS. Thus, a diagnosis is just made, if other somatic indications or causes for the fatigue have been excluded (Afari & Buchwald, 2003). Nevertheless, it is still important to acknowledge and investigate the potential consequences of the reported fatigue because fatigue has several consequences, which ultimately lead to an impairment of different areas in life. Therefore, it is necessary to combat feelings of fatigue as early as possible.

Vitality

One way to prevent fatigue is by improving the vitality of the person concerned. Vitality can be characterized as the subjective feeling of being energetic and alive (Ryan & Federick, 1997). Moreover, it represents an important indicator of well-being due to the covariance with both psychological and physical circumstances (Ryan & Federick, 1997). In other words, physical pathologies or conditions that decrease personal energy and motivation can be reflected in a damaged sense of vitality.

Numerous studies have shown that more vital individuals often display higher levels of well-being. This became apparent because individuals felt more self-actualized and self-determined (Ryan & Federick, 1997; Niemiec et al., 2010). Moreover, they had higher self-esteem and demonstrated better physical and mental health. Furthermore, current studies have also indicated that subjective vitality was negatively correlated to somatic concerns to physical issues. Thus, vitality was higher in participants who reported better body functioning and self-efficacy and fewer physical concerns. A worse vitality was reported when the individuals perceived themselves as controlled by external forces. Furthermore, a greater level of self-motivation has also increased vitality (Ryan & Federick, 1997).

Lastly, epidemiological studies have found a significant correlation between physical activity, vitality, and fatigue. Particularly, people who are physically active in their free time have an approximately 40 % decreased risk of experiencing feelings of fatigue and low energy compared to the sedentary comparison group (Puetz et al., 2006). Therefore, all in all, the approach of increasing vitality and physical activity to counteract fatigue is considered to be particularly suitable and efficient since decreased levels of self-motivation and less perceived health can lead to severe damage to the well-being and the quality of life of individuals.

Cognitive Bias

Fatigue has been shown to be strongly correlated with vitality. Therefore, increasing the vitality of the patients is one intervention strategy to combat fatigue symptoms. However, it is not sufficient to just combat the fatigue itself since fatigue also impairs the cognitive functioning of individuals. So, to develop an effective intervention strategy, it is necessary to investigate and understand, inter alia, these underlying mechanisms and functions of fatigue preservation.

According to Leneart et al. (2018), there are four ways in which people learn to pay more attention to fatigue. The first dimension is the perceptual-cognitive bias, which suggests

that perceptual-cognitive concepts such as an attentional bias towards signals of fatigue can affect and hinder the processing of somatic information and ultimately the frequency and the severity of fatigue (Leneart et al., 2018) In other words, people who perceive somatic information as fatigue more often or more aversive than others will also encounter it more frequently and more intensely.

Second, another dimension is the sensitization and sustained arousal, which means that a frequently presented stimulus will lead to inflation in responding to this stimulus (Leneart et al., 2018). In other words, with the increasing frequency of the occurrence of fatigue signals, also the frequency of the responses grows. Thus, the sensitized response to that stimulus linked with fatigue might further increase an anticipatory fear or avoidance of it. So, associative learning and avoidance behaviour is also affected.

The third factor, namely fatigue catastrophizing, includes an excessive negative evaluation of a stimulus (Leneart et al., 2018). This exaggeration then leads to a rumination and enlargement of symptoms, which in turn might lead to high emotional distress. So, exaggerated attention plus a negative expectation will result in a greater experience of fatigue symptoms.

Generalization reflects the last dimension and can be explained based on prior learning (Leneart et al., 2018). It occurs when behavioural change is enhanced by a similar but simultaneously different stimulus involved in prior experience and learning. In other words, it means for example when a (past)corona patient has experienced fatigue during their hospitalization, they might also encounter tiredness during future hospital visits for different treatments. All in all, when comparing these four types of the learning process, it becomes apparent that they all have a cognitive component, such as biased attention towards the severity and frequency of symptoms, in common.

These cognitive mechanisms are also confirmed by numerous studies, which have indicated that people will develop an illness-representation, which are the common-sense beliefs about their disease (Hertel & Mathews, 2011; Jacobsen et al., 2004). This creates in turn a personal significance to the symptoms that might trigger further thoughts (e.g., potentially life-threatening consequences). Moreover, most of the patients with CFS associated their fatigue with physical circumstances or stress. Furthermore, they also believe that the symptoms of their tiredness are uncontrollable and serious. As a result, due to their negative thinking patterns, they shift their attention to negative cues and evaluate their symptoms as more severe (Hertel & Mathews, 2011). This information process bias then exacerbates the maintaining of these negative original beliefs.

In Addition to the information processing bias about fatigue and its manifestations, a bias about the self as a tired individual is also found, namely the self-identity bias. It can be elucidated with the fact that there is a shift of attention and an expansion of memory towards signs that are linked to the self. So, fatigue-related cues are more quickly processed when they are in congruence with the self-concepts (Hertel & Mathews, 2011).

All in all, when summarizing the results on fatigue, vitality, and the corresponding cognitive biases, it will be hypothesized that a cognitive change of (past)corona patients has to occur to increase vitality and simultaneously decrease the potential symptoms of fatigue. Particularly, fatigue schemata and learning processes need to be changed to promote a more self-motivated and more active lifestyle to combat further fatigue maintenance.

Cognitive Bias modification

To evoke a cognitive change, learning processes and self-concepts need to be analysed and changed. Cognitive Bias Modification (CBM) is one potential and promising intervention strategy. Generally, according to Koster, Fox, & McLeod (2009) CBM refers to "procedures designed to change particular styles of cognitive processing that are thought to contribute to undesirable emotional reactions or disorders, using systematic practice in an alternative processing style".

Thereby participants are requested to behave in ways contradictory to their biases. This exercise often includes repetitive tasks to manifest the newly learned approaches (Hertel & Mathews, 2011). Although studies have not yet evaluated the effectiveness of CBM in combating fatigue, it has already shown some successful effects in decreasing other psychological conditions e.g., depression, anxiety, etc. which also consists of cognitive components (Hertel & Mathews, 2011).

In conclusion, as beforementioned, CFS patients demonstrate not only an attentional bias towards health-damaging signs, but they also developed a schema of the self as a fatigued individual (Hertel & Mathews, 2011). Based on various studies, it is proven that these schemata are entrenched into the implicit framework, wherefore they should also treat it at that (implicit) level (Pincus & Morley, 2001; Ouimet et al., 2009). This is what CBM treatments are doing.

Aim of the study

Based on the previously mentioned proven relationship between fatigue and cognition, cognitive biases appear to play a role in the development and maintenance of other psychological conditions. It seems justified to study whether this applies also to fatigue in (past)corona patients. Therefore, this study aims at investigating post-syndromes of a COVID-19 disease. Thereby, the focus lies on whether or to what extent (past)corona patients are

suffering from fatigue or developing a cognitive bias (e.g., attentional and self-identity bias) after the infection of COVID-19. Furthermore, the level of fatigue of both groups will be compared and evaluated. Since COVID-19 is a rather new epidemic and due to the quick emergence, there is just limited information available about potential long-term impacts. Therefore, the study will be an exploratory research design.

Research questions and Hypothesis

1. How does fatigue impact the life of (past)corona patients?
    a. H1: Fatigue is positively correlated with a COVID-19 incidence
    b. H2: Fatigue negatively influences the quality of life of (past) corona patients
2. To what extent differ (past)corona patients and people who did not have suffered from COVID-19 in their level of fatigue (control group)?
    a. H3: (Past) Corona patients display higher levels of fatigue than the persons who did not have suffered from COVID-19
3. To what extent do (past)corona patients develop a cognitive bias after their infection?
    a. H4: (Past) corona patients have developed an attentional bias
    b. H5: (Past) corona patients have developed a self-identity bias

Methods

Participants

Participants were recruited using a snowball and convenience sampling method. The link to the online questionnaire was posted on the social media platform Instagram and Facebook of the researchers and was sent to friends, fellow students, and family members via Email or WhatsApp. Furthermore, family members and friends were asked to further forward it. The inclusion criteria were the following a) an existing internet connection for the use of the computer task and the survey and b) aged 18 years and older and c) sufficient level of English. Furthermore, to be classified as the experimental group, the participants must have suffered from COVID-19 during their lifetime. Participants in the control group did not have to possess any special characteristics except as they should not have suffered from COVID-19 during their life.

The total number of 42 responses had to be adjusted due to incomplete responses. Participants who did not complete at least 90% of the questionnaire were removed. Furthermore, one respondent who did not accept the existing conditions was deleted. Thus, the final data for the questionnaire included 34 participants. Eighty-two per cent (28) of the respondents were female and 18 % (6) were male. The age ranged from 20 years to 74 years. The resulting mean age was 30 years (Sd= 13,3). Furthermore, 20 participants came from

Germany, 9 from the Netherlands and 5 from other countries. Additionally, 94% of the respondents had a high school degree or equivalent and higher. Further, the living situations of the participants were equally split between all categories with the highest amount of them (26 %) living with their spouse or unmarried partner. In addition, 32,35 per cent of all respondents (n= 11) have suffered from a COVID-19 infection during their lifetime. Of which 2 people were suffering from it by the time of the survey.

Design and Data analysis

First, for this study, a questionnaire survey design and an experimental design was applied. Furthermore, the research consisted of a between-subject design. The participants were separated into two groups, namely the experimental and the control group, to identify and measure the correlation between the independent and the dependent variables. The dependent variables were fatigue and the development of a cognitive bias (self-identity bias and attentional bias). The independent variable was a (past) infection with COVID-19.

Secondly, a file from Qualtrics and Gorilla, together containing all the data, was compiled for IBM SPSS Statistics Version 25 (IBM Corp, 2017). Then the data were checked for potential faults such as incompleteness, resulting in a reduction of the user data (e.g., eight responses were removed). Afterwards, SPSS was used to further investigate the research questions and the connected hypotheses.

To get a general overview, descriptive statistics and general frequencies were analysed. Next, IBM SPSS Statistics Version 25 (IBM Corp, 2017) was used to compute the individual's sums of the Fatigue Assessment Scale. This was done to assess the different levels of fatigue. Hereby, two statistical analyses were separately executed (e.g., for all respondents and the respondents with a (past) infection with COVID-19). After that, IBM SPSS Statistics Version 25 (IBM Corp, 2017) was further used to measure the internal consistency and for executing a factor analysis. Afterwards, it was used for completing a linear regression analysis between the total score of the FAS (e.g., dependent variable) and a (past)COVID-19 disease (e.g., independent variable). Next, the answers to the open questions were compared and analysed by creating a table based on the individual answers Lastly, a t-test was executed to compare the means of both groups. The results of the cognitive bias tasks could neither be analysed nor evaluated due to technical problems with the platform Gorilla. Particularly, almost all participants (except three) could not perform the tasks due to a merging screen.

Material

An online questionnaire and two computer tasks were set up (Appendix A, B). First, the questionnaire was executed and uploaded on the website Qualtrics (Qualtrics, Provo, UT). It was provided in English to be distributed amongst different countries and ultimately to reach a higher number of participants. Qualtrics (Qualtrics, Provo, UT) was used to acquire information about the number of respondents, their demographics, and their answers to the survey. A consent form with a short introduction was also provided on the start page of the website. Moreover, the questionnaire consisted of 21 items in total and one scale measuring fatigue, namely the FAS. Furthermore, via open-end questions, Participants were asked about their experience of fatigue related to a corona disease. The other questions (e.g., the FAS and the descriptive data) used a closed format that was designed to measure the dependent variable fatigue and the demographics (age, gender, living situation, etc.).

With respect to the demographic statistics, participants had to enter their age in a text box. Thereby only full numbers ranging between 18 and 99 could be inserted. Next, participants were asked for their gender (female, male, other). Then, individuals were asked for their country of origin. Hereby, three possibilities were possible, namely Germany, Netherlands, and others. Thereafter, participants had to enter their highest level or school or degree. Thereby, they could choose one answer out of six possible answers (no high school diploma, high school degree or equivalent, Bachelor's degree, Master's degree, Doctorate, other). Lastly, individuals are asked about their living situation. Hereby, they could choose one answer from five possible answers (e.g., I live alone, I live with my spouse/unmarried partner I live with my parents/sibling/grandparents/child, I live with another relative, I live with non-relative).

Next, COVID-19 related information was measured via a self-made questionnaire. Thereby, information about the extent, influence, and period were of importance. Furthermore, questions regarding the experience of fatigue during their COVID-19 infection were asked. Hereby, the respondents needed to further elaborate on this experience. Fatigue was also measured via the Fatigue Assessment Scale (FAS). It was developed by Michielsen et al. (2003) and demonstrates high internal reliability of 0.90. The FAS is a 10-item scale, where five questions reflected physical fatigue (e.g., I am bothered with fatigue) and five questions mental fatigue (e.g., item3 & item6-9). The possible answers variegate from never (1) to always (5) on a 5-point-scale. The higher the total score of the FAS, the higher the fatigue level. Specifically, FAS scores between 10 and 21 reflect no fatigue (normal) and the scores between 22 and 50 indicated substantial fatigue. Furthermore, scores equal to or larger than 35 demonstrate extreme fatigue.

Secondly, both computer tasks aimed at measuring the second dependent variable, the cognitive bias. Specifically, the first task namely the DOT probe (Eysenck et al., 1987) assessed an attentional bias and the second task, the implicit association test (IAT) (Greenwald et al., 1998), measured a self-identity bias. The DOT probe consists of two stimuli that are presented at the same time on a computer screen. One stimulus is negative and associated with fatigue and the other one is positive and related to vitality (Appendix B). After the disappearance of both words from the screen, a probe, namely a dot in this study, appeared in the location of one word (e.g., in the upper or the downside). Furthermore, the respondents' reaction times to the stimuli were recorded. An attention bias is indicated by a faster reaction time to a negative stimulus associated with fatigue.

In the IAT, participants were asked to sort words into categories and/or pairs. These needed to be done as quickly as possible and with as few mistakes as possible (Goldring, & Strelan, 2016). Furthermore, it consisted of four categories, namely two attitude categories (e.g., fatigue and vitality) and two attributive categories (e.g., I and others). The categorization pace reflects the strengths of the (implicit) association (Greenwald, McGhee, & Schwartz, 1998). In other words, it shows the extent to which the respondent identify themselves rather with vitality or fatigue concepts. Words used for all categories were described in Appendix C. Both experiments were done using the Gorilla Experiment Builder (Gorilla.sc).

Procedure

Before the questionnaire and the computer tasks could be executed, participants had to consent to the conditions, that their participation is anonymous, confidential and that they are able to withdraw at any time without consequences. After that, the first section of the survey covering demographic data started.

The second section of the questionnaire measured whether the participant had suffered from COVID-19 or whether he/she was currently suffering from it (Appendix A). If the respondent already suffered from COVID-19, one question about the period of their disease followed. After that, questions about the extent, the influence on daily life, and the time frame of the COVID-19 infection took place. After that, any experiences with fatigue symptoms related to the COVID-19 infection were evaluated. Hereby, participants were asked about the extent/severity of their tiredness, and about the influence on their life. Furthermore, they were asked to describe the feeling of fatigue in their own words. If the person did not currently suffer from COVID-19, further questions about the disease were skipped and the person was transferred to the question about an occurrence of a past COVID-19 infection. If this question was answered with a yes, the same questions as for the occurrence of a current COVID-19

incidence were asked (e.g., period, extent, influence, experiences of fatigue, etc.). After the completion of this questions block, respondents were transferred to the next question block that reflected questions about fatigue in general (e.g., FAS). Respondents were also conveyed to it if no current and past COVID-19 infection took place.

After the completion of the FAS, respondents got automatically transferred to the experiments. So, the last section measured whether the participant has developed a cognitive bias. The first task, namely the Dot-Probe measured the attentional bias. Afterwards, the self-identity bias was measured via the Implicit association test (IAT). After both experiments were completed, participants have reached the end of the whole survey and a closing screen with a short acknowledgement appeared.

Results

Internal consistency and factor analysis

The scale measuring fatigue included ten items and showed a good internal consistency (Cronbach's alpha = .817). This means that all items were measuring the same construct, namely "fatigue". Furthermore, the Fatigue Assessment Scale demonstrated suitability for a factor analysis since the Kaiser-Meyer Olkin Test showed a good value of 0.711 (KMO values below 0.6 indicate an insufficient sampling) (Appendix D) Furthermore, the results of the Bartlett's Sphericity Test (p=.00) pointed out that the null hypothesis can be rejected. This means that the correlation matrix was not an identity matrix. Consequently, the variables were related and ideal for factor analysis. Moreover, the results displayed that the FAS measures just one overall construct since the communalities for all factors are above 0.4. Thus, no extraction must be done.

Relationship COVID-19 infection and fatigue

To answer the first research question *"How does fatigue impact the life of (past)corona patients"* a linear regression (Appendix E) was executed and the individual answers to the open-end questions were analysed (Appendix F). First, it was hypothesized that COVID-19 is positively correlated with fatigue. However, the results of the analysis have indicated a low degree of relation between both variables (R=.077). The total variation in the dependent variable (e.g., FAS score) explained by the independent variable (e.g., COVID-19 disease) was also low ($R^2 \sim .006$). Furthermore, this analysis was found to be not significant (P= .677, p> .05). This means that being diagnosed with COVID-19 did not predict fatigue in this sample.

Secondly, it was hypothesized that a (past) COVID-19 infection negatively influences the quality of life of the respondents. The quotes and answers to the open-end questions that were just answered by the COVID-19 group are provided in a table in Appendix E. The

outcomes have shown that there is not a usual period of how long a COVID-19 infection takes place. Particularly, the infection of the respondents varied from a minimum of one week to a maximum of 13 months. The most frequently mentioned period was 3 weeks (n=4). Furthermore, a difference in the influences of the infection on their daily life could be observed. Whereas 6 participants have mentioned no or just mild influences of COVID-19, the other 5 participants stated tiredness, bad concentration, stress and impairment of work and training (sport) performance as consequences.

Corresponding to the expectations, 8 out of 11 participants have indicated feelings of fatigue during or after their illness although not all of them have mentioned it as an influence by their selves in the prior question. The extent of it varied from 'not so much', indicated by two participants to ' a lot' or 'every day since' mentioned by the other 6 participants. So, the experience of fatigue differed from respondent to respondent. The different or subjective perception could also be seen in the description of fatigue. As fatigue was described by a lack of energy, no concentration/focus, emotionally unstable and not being able to do something. One respondent has stated: 'I am not able to do anything except for lying down. Feels like my brain isn't working properly (stuffed with cotton whool)'. So, it became clear that the fatigue caused by the infection negatively affected daily life. This finding was also confirmed by the respondents since they have indicated that this tiredness has negatively influenced their daily life, e.g., faster exhaustion, lower energy, and a need for taking choices were mentioned. Thus, it can be concluded that fatigue (due to a COVID-19 incidence) can impair daily life even though there are many different perceptions of it.

Fatigue Assessment scale

To answer the second research question *"To what extent differ (past)corona patients and people who did not have suffered from COVID-19 in their level of fatigue (control group)?"*, the total sum of the FAS was compared, and the mean difference computed. Hereby, it was hypothesized that the COVID-19 group will display higher FAS scores than the general population. The analysis of the FAS has shown that 20 out of the 42 respondents suffered from substantial fatigue when they have participated (scores between 22 and 35). Moreover, one participant even demonstrated extreme fatigue (sum=35). If only the respondents with a (past) COVID-19 infection will be considered, 6 out of 9 people suffer from substantial fatigue. Furthermore, the one participant, who has demonstrated extreme fatigue, was also infected with COVID-19 in the past. When comparing the total score of both groups, it becomes clear that the COVID-19 group has a slightly higher mean than the control group (see Appendix F). Nevertheless, the null hypothesis of Levene's test needs to be accepted ($p = .783$, $p > .05$). This

means that the variance in the FAS score of the COVID-19 group was not significantly different from that of the control group.

Experimental tasks

Due to insufficient and incomplete data, no results about a potential cognitive bias could be collected.

Discussion

The purpose of this exploratory study was to investigate whether or to what extent (past) corona patients are suffering from fatigue during or after their infection. Moreover, an association between fatigue and the development of a cognitive bias such as an attentional and self-identity bias was examined. Even though respondents have indicated fatigue as a symptom of COVID-19, the results in this study revealed no significant correlation between a COVID-19 disease and feelings of fatigue.

Against expectations, the first hypothesis: "Fatigue is positively correlated with a COVID-19 incidence" can be rejected since no linear relationship between both variables was found. Nevertheless, several respondents have stated feelings of fatigue concerning their infection. Furthermore, participants have mentioned that especially fatigue negatively influenced their daily life. This ranges from mild to severe impacts. Therefore, H2: Fatigue negatively influences the quality of life of (past) corona patients can be accepted. Communicated impacts were, inter alia, attention and focus problems, lack of energy, and emotional instability. One possible explanation for the different results might be that fatigue is something that everyone approaches at different levels and to a different extent in their daily life (Ryan et al.,2007). So, there is a high degree of subjectivity. Therefore, they might not have thought about fatigue as the first symptoms that come to their mind concerning their COVID-19 infection. Thus, they might underestimate their feelings of fatigue in relation to the COVID-19 even though they are present.

Another reason for the different results could also be the measurements themselves. It might be the case that the Fatigue Assessment Scale measures a different construct of fatigue than the self-made open questions. While the FAS tries to measure both physical and mental fatigue, the self-made questionnaire does not differentiate between these different types of fatigue. The questions were formulated more general. Therefore, the answers are based on their individual interpretations. So, subjectivity played again a huge role in the analysis. All in all, the research questions of 'How does fatigue impact the life of (past) corona patients' can only be partly answered since H1 can be rejected and H2 can be accepted. So, while fatigue is not

positively correlated with a COVID-19 infection, it still negatively influences most of the lives of the respondents.

Concerning the second research question: “To what extent differ (past)corona patients and people who did not have suffered from COVID-19 in their level of fatigue (control group)?” it can be said, that against expectations, no significant difference between both groups could be found. The mean of both, the control group, and the COVID-19 group demonstrate substantial levels of fatigue. One possible reason for these outcomes might be that the COVID-19 epidemic with all the regulations and rules already leads to a degradation of the health status since not only the people infected with COVID-19 are affected by this, but also the general population. Due to the COVID-19 epidemic, people feel more depressed, anxious, and stressed than prior (Javed et. Al, 2020). Furthermore, a change in the sleeping patterns was observed (Javed, et. Al.,2020). All these conditions might have already contributed to the growth of fatigue symptoms in the general population so that no significant difference between both groups could be detected. As a result, H3 needs to be rejected.

The third research question: To what extent do (past) corona patients develop a cognitive bias after their infection can neither be accepted nor rejected due to not predictable technical inconveniences. The results of the whole experiment were unsuitable. As a result, the hypotheses about the development of an attentional bias and self-identity bias (H4 & H5) correlated with a COVID-19 disease can also neither be rejected nor accepted. Thus, although the second research question and both corresponding hypotheses cannot be accepted by this study, these results should not be generalized. Research has shown that fatigue indeed impacts several cognitive components such as attention, memory, and local processing. So, it can be assumed that, as a result, a cognitive bias in form of an attentional bias or self-identity bias will be developed. Furthermore, multiple other studies have already indicated a correlation between feelings of fatigue and the development of a cognitive bias (Hertel & Mathews, 2011; Jacobsen et al., 2004). The results originate from a different sample, namely cancer patients, but several parallels can be assumed.

In addition, even though the experiments could not be analysed, it needs to be acknowledged that it is not clear if the respondents have already been suffered from fatigue before the execution of the surveys. Since just one-after measurement was included to answer RQ3. Thus, the development of a cognitive bias could also be a consequence of prior experiences of fatigue or the result of other somatic concerns.

All in all, even if the results of the regression analysis have shown that there is no relationship between the COVID-19 infection and fatigue, it is not possible to make a final

statement about the correlation because the survey had a couple of limitations. For the correct interpretation of the results, these limitations need to be addressed since they could have an impact on the validity, reliability, and ultimately on the results themselves.

Limitations

There are some limitations concerning the results of this study. First, there were some technical difficulties with both experiments. Specifically, when starting the second experiment, the text was merging. Thus, the participants could neither read the text properly nor finish the experiments. As a result, there was no sufficient data to analyse. The probable cause was the usage of smartphones for conducting the experiments. All participants, who could not read the text, performed the tasks on their mobile phones. Just three respondents successfully executed the experiment on the computer. So, it seems that Gorilla's technology has not been designed for phones. Therefore, future research should either a) consider running a pilot test on all potential devices (e.g., tablets, smartphones, and laptops) or b) concretely mention that the experiment needs to be executed via computer and laptop.

Secondly, in the current epidemic period, it is proven that most people in the general population are feeling more fatigue and depression than prior (*Got Pandemic Fatigue? COVID-19 Is Taking a Toll on Mental Health,* 2020). There were around 75,000 more people who were dying from alcohol misuse, suicide or drugs than would have expected prior. The reason for feeling depressed are for example the isolation from loved ones, unemployment, and economic uncertainty. Furthermore, the results of the analysis of the Fatigue Assessment Scale have shown that approximately 50% of all respondents have suffered from substantial fatigue (see Results). So, it can be concluded that the current situation and, respectively the epidemic period already leads to a deterioration of mental health (*Got Pandemic Fatigue? COVID-19 Is Taking a Toll on Mental Health,* 2020) or high levels of fatigue. This does not only declare the high FAS score, but it might also explain, why there was no significant difference in the variance in the FAS score of the COVID-19 group compared to the control group. In addition, a brief snapshot of the situation might not be sufficient to accurately measure fatigue. Environmental conditions or the prior situation before the infection should also be noted.

Thirdly, some respondents have indicated that their COVID-19 disease was a couple of months ago. As a result, it might be the case that they are not able to remember everything correctly. It is proven that the retrieval of past experiences can make these memories adaptable (Nash, 2018). In other words, the more often an event is restored, the more this memory will change. Furthermore, as aforementioned in the introduction, fatigue already constrains

information retrieval and local processing and attention. In more detail, the impaired memory and recall might also influence the correct reproduction of the past disease. Lastly, significant stress as a possible consequence of a disease can also lead to a repression of memories (Nash, 2018). Concluding, due to all the three beforementioned reasons a complete reproduction of the whole COVID-19 disease and its influences might be not possible. Thus, it can be the case that respondents did not properly remember the extent and the influences of their fatigue symptoms anymore. This means that the time frame between the COVID-19 infection and the measurement of it needs to be decreased to avoid memory issues and to ensure a good reliability.

Lastly, fatigue is often based and defined on primarily subjective experience (Brown, 1994). This means, inter alia, that a wide range of interpretations exists that has been related to fatigue, which could be also seen in the findings. Particularly, there is a huge difference in the perception and experience of fatigue. Thus, it makes it even harder to objectively measure fatigue. Generally, up to the present time, there is still no objective measurement of tiredness available. This means that fatigue is always examined through a subjective feeling and perception (Shen et al., 2006) and due to this subjectivity, it can never be examined in a fully objective way. For research, it means that it is always hard to compare the different feelings and perceptions since everyone defines the concept of fatigue differently. For the future, the measurement of fatigue needs to be further improved in order to measure fatigue as subjective as possible.

Future research

Suggestion for the future considers further investigation of the association of fatigue symptoms and a COVID-19 disease. Even though a significant correlation between fatigue and (past) COVID-19 illness was not found, most patients did indicate they suffered from fatigue during or after their infection. So, a further investigation is necessary. Moreover, participants have also indicated other (post)syndromes of COVID-19 (e.g., feelings of listlessness, depression). A COVID-19 infection and the epidemic, in general, might have much more side effects than prior presumed. Therefore, other syndromes next to fatigue should also be part of an examination, especially because there is just limited information available, and it is still a rather new epidemic. Often, longer-persisting effects have not yet been analysed properly even though infected patients have indicated them.

Secondly, as aforementioned the COVID-19 epidemic entails several other consequences. This does not concern only people infected with the COVID-19 virus. The

epidemic caused strict rules and restrictions of freedom. Therefore, the mental health of the general population is also affected, which was suggested by the results of this study. There was no significant difference in the level of fatigue between the control group and the COVID-19-group. This means that most of the 'healthy people' have already displayed substantial levels of fatigue. Thus, the next big challenge will be to deflate this mental health curve (*Got Pandemic Fatigue? COVID-19 Is Taking a Toll on Mental Health*, 2020. To be able to do this, further investigation of the consequences on a healthy individual is essential. This includes, inter alia, the analysis of fatigue and depression in the general population and the examination of environmental and external influences.

Next, several other studies have shown a correlation between fatigue and the development of a cognitive bias. In this study, the focus was just on the self-identity bias and the attentional bias due to technical requirements caused by the COVID-19 epidemic. The examination of other cognitive biases mostly required physical contact with the participants. For future research, it would be interesting and necessary to investigate other cognitive biases next to the before-mentioned ones (see Introduction). This is especially important since fatigue has shown to not only impair attention, and perception of oneself, it might also harm memory and information processing. Furthermore, treatment and interventions need to tackle all cognitive components to be efficient. Therefore, further cognitive biases (e.g., the development of an interpretational bias) should also be part of an examination. Additionally, to treat the symptoms of fatigue and the potentially resulting cognitive bias efficiently, an early diagnosis and treatment are necessary. Therefore, further, and deeper research of potential therapy possibilities and interventions is suggested. There are already promising results of the Cognitive Bias Modification to counteract some cognitive components of fatigue (see Introduction), but further research is indispensable since there are still some knowledge gaps associated with COVID-19.

References

Afari, N., & Buchwald, D. (2003). Chronic Fatigue Syndrome: A Review. *American Journal of Psychiatry*, *160*(2), 221–236. https://doi.org/10.1176/appi.ajp.160.2.221

Bowie, C. R., & Harvey, P. D. (2005). Cognition in Schizophrenia: Impairments, Determinants, and Functional Importance. *Psychiatric Clinics of North America*, *28*(3), 613–633. https://doi.org/10.1016/j.psc.2005.05.004

Brown I. D. (1994). Driver fatigue. *Human factors*, *36*(2), 298–314. https://doi.org/10.1177/001872089403600210

Carfì, A., Bernabei, R., Landi F. (2020). Persistent symptoms in patients after acute COVID-19. *JAMA. 324*(6):603–605. doi:10.1001/jama.2020.12603

Cowan, N. (2008). Chapter 20: What are the differences between long-term, short-term, and working memory? *Progress in Brain Research, 169*, 323-338. https://doi.org/10.1016/S0079-6123(07)00020-9

Eysenck, M. W., MacLeod, C., & Mathews, A. (1987). Cognitive functioning and anxiety. *Psychological Research*, *49*(2–3), 189–195. https://doi.org/10.1007/bf00308686

Got Pandemic Fatigue? COVID-19 is Taking a Toll on Mental Health. (2020, 21. Juli). University of Arizona News. Retrieved from https://news.arizona.edu/story/got-pandemic-fatigue-covid-19-taking-toll-mental-health-psychologist-says

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, *74*(6), 1464–1480. https://doi.org/10.1037/0022-3514.74.6.1464

Hertel, P., & Mathews, A. (2011). Cognitive Bias Modification Past Perspectives, Current Findings, and Future Applications. *Perspectives on Psychological Science*, *6,* 521-536. 10.1177/1745691611421205.

Jacobsen, P. B., Andrykowski, M. A., & Thors, C. L. (2004). Relationship of Catastrophizing to Fatigue Among Women Receiving Treatment for Breast Cancer. *Journal of Consulting and Clinical Psychology*, *72*(2), 355–361. https://doi.org/10.1037/0022-006x.72.2.355

Javed, B., Sarwer, A., Soto, E. B., & Mashwani, Z. U. (2020). The coronavirus (COVID-19) pandemic's impact on mental health. *The International journal of health planning and management*, *35*(5), 993–996. https://doi.org/10.1002/hpm.3008

Koster, E. H., Fox, E., & McLeod, C. (2009). Introduction to the Special Section on Bias Modification in Emotional Disorders. *Journal of Abnormal Psychology*, *118*(1), 1- 4. doi:10.1037/a0014379

Lamprecht, B. (2020) Gibt es ein Post-COVID-Syndrom? (Does the post-covid-syndrom exist, Trans.) *Pneumologe 17***,** 398–405.https://doi.org/10.1007/s10405-020-00347-0

Lenaert, B., Boddez, Y., Vlaeyen, J. W., & Van Heugten, C. M. (2018). Learning to feel tired: A learning trajectory towards chronic fatigue. *Behaviour Research and Therapy, 100*, 54-66. https://doi.org/10.1016/j.brat.2017.11.004

Mandal, S., Barnett, J., Brill, S. E., Brown, J. S., Denneny, E. K., Hare, S. S., Heightman, M., Hillman, T. E., Jacob, J., Jarvis, H. C., Lipman, M. C. I., Naidu, S. B., Nair, A., Porter, J. C., Tomlinson, G. S., & Hurst, J. R. (2020). 'Long-COVID': a cross-sectional study of persisting symptoms, biomarker and imaging abnormalities following hospitalisation for COVID-19. *Thorax, 76*(4), 396–398. https://doi.org/10.1136/thoraxjnl-2020-215818

Michielsen, H. J., De Vries, J., & Van Heck, G. L. (2003). Psychometric qualities of a brief self-rated fatigue measure. *Journal of Psychosomatic Research*, *54*(4), 345–352. https://doi.org/10.1016/s0022-3999(02)00392-6

Nash, R. (2018, December 17). *Are memories reliable? Expert explains how they change more than we realise*. The Conversation. https://theconversation.com/are-memories-reliable-expert-explains-how-they-change-more-than-we-realise-106461

Niemiec, C. P., Ryan, R. M., Patrick, H., Deci, E. L., Williams, G. C. (2010). The energization of health- behavior change: Examining the associations among autonomous self-regulation, subjective vitality, depressive symptoms, and tobacco abstinence. *The Journal of Positive Psychology, 5*(2), 122-138.

Ouimet, A. J., Gawronski, B., Dozois D. J. A. (2009). Cognitive vulnerability to anxiety: A review and an integrative model. *Clinical Psychology Review, 29* (6), 459-470

Palmer, L., Economou, P.; Cruz, D.; Abraham-Cook, S.; Huntington, J.; Maris, M.; … Maley, L. (2014). The Relationship Between Stress, Fatigue, and Cognitive Functioning. College Student Journal,47(2), 312-325. Retrieved from https://www.thefreelibrary.com/The+relationship+between+stress,+fatigue,+and+cognitive+functioning.-a0372252082

Pincus, T.,& Morley, S. (2001). Cognitive-Processing Bias in Chronic Pain: A review and integration. *Psychological Bulletin, 27*(5), 599-617

Puetz, T. W., O'Connor, P. J., & Dishman, R. K. (2006). Effects of chronic exercise on feelings of energy and fatigue: A quantitative synthesis. *Psychological Bulletin, 132*(6), 866–876. https://doi.org/10.1037/0033-2909.132.6.866

Ryan, J. L., Carroll, J. K., Ryan, E. P., Mustian, K. M., Fiscella, K., & Morrow, G. R. (2007). Mechanisms of Cancer-Related Fatigue. The Oncologist,12(1), 22-34. doi:10.1634/theoncologist.12-S1-22

Ryan, R. M., & Frederick, C. (1997). On Energy, Personality, and Health: Subjective Vitality as a Dynamic Reflection of Well-Being. Journal of Personality,65(3), 529-565. https://doi.org/10.1111/j.1467-6494.1997.tb00326.x

Shen, J., Barbera, J., & Shapiro, C. M. (2006). Distinguishing sleepiness and fatigue: focus on definition and measurement. *Sleep medicine reviews, 10*(1), 63–76. https://doi.org/10.1016/j.smrv.2005.05.004

Velavan, T. P., & Meyer, C. G. (2020). The COVID-19 epidemic. *Tropical medicine & international health : TM & IH, 25*(3), 278–280. https://doi.org/10.1111/tmi.13383

WHO (2021, July 7).*WHO Coronavirus Disease (COVID-19) Dashboard.* Retrieved from https://covid19.who.int/

WHO (n.d.) *Coronavirus*. Retrieved 2021, February 28, from https://www.who.int/health-topics/coronavirus/coronavirus#tab=tab_1,

Williamson, R.J., *et al.* (2005). The relationship of fatigue to mental and physical health in a community sample. *Soc Psychiatry Psychiatr Epidemiol 40***,** 126–132 (2005). https://doi.org/10.1007/s00127-005-0858-5

Appendix

Appendix A. Survey

Start of Block: Introduction

Intro1- consent Hi, thank you for participating in this project. My name is Theresa, and this study is part of my Bachelor thesis at the University of Twente.
You are invited to participate in this survey on experiences of fatigue in relation to COVID-19. The survey consists of two parts. The first one is about questions about your experiences with fatigue and second part involves two small tasks.
Before we begin, I would like to explain some aspects of the research and how I will handle the data. I am interested in your own personal experiences. This means that there are no right or wrong answers: you are the expert on this subject. I will first ensure that all your answers are anonymous: names, dates, and places will be removed. Additionally, you are able to withdraw from the study at any time. The questionnaire will take approximately 25 minutes. Furthermore, I believe there are no known risks associated with this research study. Do you consent to these terms and conditions?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Hi, thank you for participating in this project. My name is Theresa and this study is part of my... = No

Intro2- report If you wish to receive a report, please provide me with your mail address

_____

End of Block: Introduction

Start of Block: Demographics

Instruction Instructions
Please fill out the questionnaire as truthful as possible

Age How old are you?

_____

Gender What is your gender?

- Male (1)
- Female (2)
- Other (3)
- Prefer not to say (4)

Country What is your country of origin?

- Germany (1)
- Netherlands (2)
- Other (3)

education What is your highest degree or level of school you have completed?

- No high school diploma (1)
- High school degree of equivalent (Abitur) (2)
- Bachelor degree (3)
- Master degree (4)
- Doctorate (5)
- Other (6)

living What best describes your living situation?

- ○ I live alone (1)
- ○ I live with my spouse/ unmarried partner (2)
- ○ I live with my parents/ siblings /grandparents/ child (3)
- ○ I live with another relative (4)
- ○ I live with non-relative (5)

End of Block: Demographis

Start of Block: Corona

Q10 Are you currently diagnosed with COVID-19 ?

- ○ Yes (1)
- ○ No (2)

Skip To: Q12 If Are you currently diagnosed with COVID-19 ? = Yes
Skip To: Q11-diagnosed If Are you currently diagnosed with COVID-19 ? = No

Q12 How long are you suffering from it?

_____

Q18 How does COVID-19 influences you?

_____

Q21 Are you tired sometimes?

- ○ Yes (1)
- ○ No (2)

Skip To: Q22 If Are you tired sometimes? = Yes

Q22 How much do you suffer from being fatigue?

_____

Q23 How would you describe that feeling of tiredness?

_____

Q24 How does being tired influences your (daily) life ?

_____

Page Break

Q11-diagnosed Have you ever been diagnosed with COVID-19 in the past?

- ○ Yes / I think so (1)
- ○ No / I do not think so (2)

Skip To: Q12 when If Have you ever been diagnosed with COVID-19 in the past? = Yes / I think so

Skip To: End of Block If Have you ever been diagnosed with COVID-19 in the past? = No / I do not think so

Q12 when How long ago was that ?

_____

Q13period How long have you been suffering from it?

_____

Q25influences How does COVID-19 influenced you ?

_____

Q26 Thinking back at your corona illness. Have you been feeling tired sometimes?

- ○ Yes (1)
- ○ No (2)

Skip To: Q27 If Thinking back at your corona illness. Have you been feeling tired sometimes? = Yes

Q27 How much have you suffered from being tiredness

_____

Q28 How would you describe that feeling of tiredness ?

_____

Q29 How does being tired have influenced your (daily) life?

_____

End of Block: Corona

Start of Block: Fatigue

Q17 The following ten statements refer to how you usually feel. Per statement you can choose one out of five answer categories, varying from Never to Always. Please give an answer to each question, even if you do not have any complaints at the moment: Never,

Sometimes (about monthly or less); Regularly (about a few times a month); Often (about weekly) and Always (about every day)

	Never (1)	Sometimes (2)	Regularly (3)	Often (4)	Always (5)
I am bothered by fatigue (1)	○	○	○	○	○
I get tired very quickly (2)	○	○	○	○	○
I don't do much during the day (3)	○	○	○	○	○
I have enough energy for everyday life (4)	○	○	○	○	○
Physically, I feel exhausted (5)	○	○	○	○	○
I have problems to start things (6)	○	○	○	○	○
I have problems to think clearly (7)	○	○	○	○	○
I feel no desire to do anything (8)	○	○	○	○	○
Mentally, I feel exhausted (9)	○	○	○	○	○
When I am doing something, I can concentrate quite well (10)	○	○	○	○	○

End of Block: Fatigue

Start of Block: End

Q24 Thank you for participating in the first part. Next, you will be automatically directed to the second part, the computer tasks.

Before starting, I will give you a short instruction: For the first task, you must categorise the word, which appears in the middle, to either the left or the right category. Press the left arrow if it belongs to the left category (vital). Press the right arrow if it belongs to the right category (tired). For the second task, you will briefly see a plus in the middle of the screen. Afterwards, you will see two words related to vitality or fatigue. If the dot appears above, press the top arrow. If it appears below, press the bottom arrow.

In case of any questions or errors, feel free to contact t.s.westerburg@student.utwente.nl

End of Block: End

Appendix B.

Table 1

Wording list of Dot probe

Fatigue	Vitality
sluggish	attentive
jaded	strong
knackered	enterprising
lame	plans
tired	join
knocked out	feel like it
faint	motivated
tired	move
heavy	achieve
exhausted	commitment
problems	lively
slow	dedication
slack	attentive

powerless	vital
fatigue	energetic
tired	lively
fatigue	pressure
problems	dynamic
obstructive	healthy
hampering	vivacious
limited	active

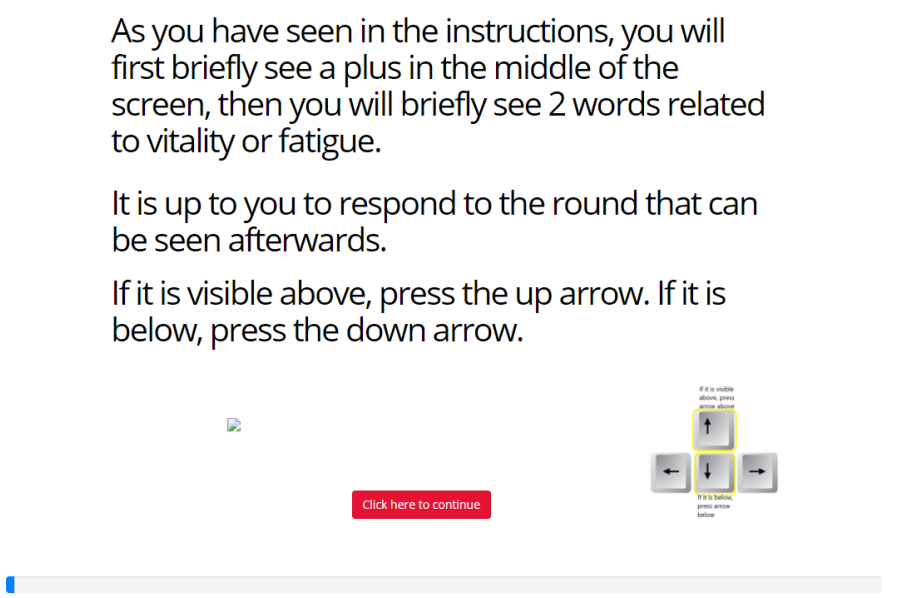

Figure 1. Screenshot of the DOT task

Appendix C

Table 2

Wording list of the IAT task

Words (Vital/Fatigue)	Pronouns
energetic	them
vivacious	other
fit	their
awake	others
active	you
alert	them
powerful	other
strong	their
quickly	others
vital	you
exhausted	self

slack	my
lethargic	me
sluggish	I
dull	myself
sleepy	self
powerless	my
tired	me
futile	I
tired	myself

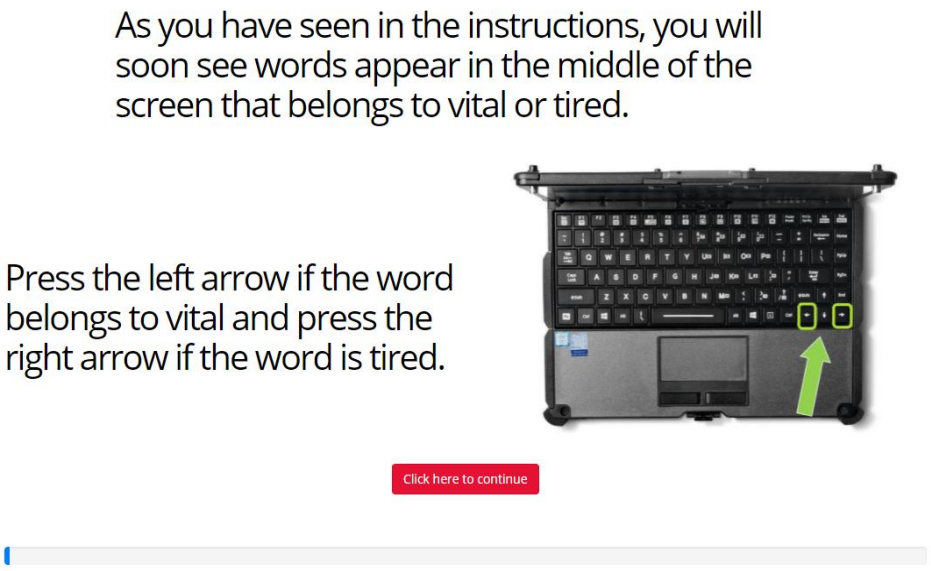

Figure 2. Screenshot of the IAT

Appendix D

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,711
Bartlett's Test of Sphericity	Approx. Chi-Square	96,182
	df	45
	Sig.	,000

Figure 3. Output of the KMO and Bartlett's Test

Appendix E

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	,077[a]	,006	-,027	6,06206	,006	,177	1	30	,677

a. Predictors: (Constant), Covid19

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6,510	1	6,510	,177	,677[b]
	Residual	1102,458	30	36,749		
	Total	1108,969	31			

a. Dependent Variable: SUM

b. Predictors: (Constant), Covid19

Figure 4. Outputs of the linear regression analysis

Appendix F

Participant	1	2	3	4	5	6	7	8	9	10	11
Period	3 weeks	3 weeks	13 months	5 months	3 weeks	7 days	3 weeks	2 weeks	1 week	6 weeks	1 week
Influences	Just mild one, with fever and headache	Online classes, Gyms closed (affects me in both ways - working and training)	At the Moment I have no impairment	Trouble breathing, tired, concentration problems, palpitations, bad condition/shape, muscle loss	It was a mild one with fever and headache	Physically it hasn't.	Online classes, Gyms closed (affects me in both ways - working and training)	Tired	It doesn‘t influenced me at the Moment	Being tired, stressed, have not so much power to do things, can’t concentrate well, feeling kind of dizzy	Like a flu
Tired	yes	no	yes	yes	Yes	no	no	Yes	Yes	Yes	Yes
Extent	Not so much	/	Diffenently, I sometimes sleep very badly and then I feel tired	A lot	Not so much	/	/	It is on and off but starting to wear off	I fehlt Tores as I was sick	A lot	Everyday since

Partcipant	1	2	3	4	5	6	7	8	9	10	11
Description of feeling	Hard to focus on a work which needs thinking for 10 days	/	I don’t know- normally	Not able to do anything except for lying down. Feels like my brain isn't working properly (stuffed with cotton whool)	I couldn’t focus on my work for 10 days			Lack of energy	Normal like ill,limp	Every morning I feel like waking up out of a grave. I’m deadly tired.	Wanting to sleep, no cencentration, emotionally unstable
Influences on daily life	Not a big influence, just a short delay for my work	/	It is exhausting to do my job and it is hard to concentrate	I have to make choices about what i want to do. E.g. working all day means i cannot go for a walk later.	Just a bit delay in my work	/	/	Less training and energy to play w my daughter	During my illness I want to stay in bed. all the day, because I was ill	Less concentration, have to do breaks in the afternoon	Started working for 4 hours a day, then 6 and now 8

Figure 5. Picture of the quotes from the qualitative part

Appendix G

Group Statistics

	Covid19	N	Mean	Std. Deviation	Std. Error Mean
SUM	1,00	8	24,7500	7,26538	2,56870
	2,00	24	23,7083	5,64515	1,15231

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SUM	Equal variances assumed	,077	,783	,421	30	,677	1,04167	2,47483	-4,01260	6,09594
	Equal variances not assumed			,370	9,978	,719	1,04167	2,81532	-5,23315	7,31648

Figure 6. Output of the T-test analysis