Investigating the Relationships Between Fatigue, Mood and Subjective Cognitive

Decline in Long Covid

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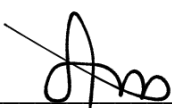
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7 January 2022

Word Count: 7967

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Abstract

People around the world have reported experiencing symptoms after the acute phase of COVID-19, now termed "long Covid". Long Covid is generally defined as the experience of symptoms after the acute phase of a COVID-19 infection that is not caused by other illnesses. This study aimed to investigate the correlations of fatigue, depression, and anxiety with subjective cognitive decline, concerns for multicollinearity, and predictive power using regression. Participants were recruited using two separate online surveys, in a quantitative and quasi-experimental design. 73 participants' data from the Fatigue Severity Scale (FSS), Modified Fatigue Impact Scale (MFIS), Cognitive Failures Questionnaire (CFQ), Beck Depression Inventory-II (BDI-II), and Beck Anxiety Inventory (BAI) were used in the study. Low to moderate correlations were found in the long Covid group for fatigue, depression, and anxiety with subjective cognitive decline. Only anxiety was significantly positively correlated with subjective cognitive decline in the control group. There were no concerns for multicollinearity. Regression models made to predict subjective cognitive decline in the long Covid group found that only MFIS scores produced significant models. No variables for regression were significant in the control group. The study concluded that, in the long Covid group, there were substantial correlations between all variables, no concerns for multicollinearity, and MFIS scores could potentially be used to predict subjective cognitive decline in long Covid. Future studies should consider including more participants, using objective measures of cognition, and controlling for environmental variables with in-person testing.

Keywords: Anxiety, Depression, Fatigue, Long Covid, Subjective Cognitive Decline

Many people across the globe who have progressed beyond the typical recovery period of COVID-19 (Kingstone et al., 2020) are reporting symptoms of a post-viral syndrome affecting activities of daily living (Graham et al., 2021; Kamal et al., 2020; Ortelli et al., 2021). This experience has been termed "long Covid" (Ladds et al., 2020; Taribagil et al., 2021) and the literature estimates a prevalence of 10% to 87% (Kingstone et al., 2020; Ladds et al., 2020; Nature Medicine, 2020). A wide range of long Covid symptoms have been reported, such as headaches, depression, numbness, anosmia, myalgia, fatigue, sleep difficulties, and anxiety, to name a few (Graham et al., 2021; Huang et al., 2021; Kingstone et al., 2020). Physical and neuropsychological aspects are reported to persist beyond the four-week acute phase of the COVID-19 infection but there is variation in how patients are experiencing these persistent symptoms (Ladds et al., 2020; Nalbandian et al., 2021; Taribagil et al., 2021). Differences in presentation lie in the duration, type of symptoms experienced by patients and severity (Graham et al., 2021; Ladds et al., 2020; Mendelson et al., 2020).

Nevertheless, several studies suggest that there does not seem to be a straightforward link between the severity of COVID-19 infection and likelihood to develop long Covid (Graham et al., 2021; Huang et al., 2021; Kingstone et al., 2020; Ladds et al., 2020). Furthermore, these symptoms have been reported at a variety of time periods after the post-acute phase of COVID-19, up to 12 months later (Graham et al., 2021; Huang et al., 2021; Kingstone et al., 2020). Despite these vagaries, a cluster of symptoms that are neuropsychological in nature, including fatigue, depression, anxiety, and cognitive decline, are a reoccurring theme in reports of long Covid (Graham et al., 2021; Huang et al., 2021; Kingstone et al., 2020). The recurrence of these symptoms raises an interesting question about their relationship to long Covid, and with each other. However, some of these

symptoms are subjective, and have not yet been thoroughly investigated to determine their objective neuropsychological basis.

Neuropsychological Symptoms in Long Covid

Fatigue, depression, and anxiety are being reported most frequently in long Covid (Graham et al., 2021; Huang et al., 2021; Kingstone et al., 2020). No clear, underlying physiological basis of these neuropsychological aspects has been identified, whether symptoms arise from distinct neuropathological mechanisms or whether they derive from a singular cause. A predominant theory is that in more severe COVID-19 cases, neuroinflammation because of a "cytokine storm" produces neurological disturbances which may account for lasting neuropsychological aspects of long Covid (Kamal et al., 2020; Ladds et al., 2020; Rudroff et al., 2020; Versace et al., 2021). Impairment in GABAergic neural activity could further underlie the symptoms that are being observed in long Covid sufferers (Rudroff et al., 2020; Versace et al., 2021). Evidence has shown that GABAergic abnormalities are associated with neuropsychological aspects such as depression and cognitive decline (Sanacora et al., 2000; Xu & Wong, 2018). However, this theory does not account for long Covid sufferers who did not experience a severe COVID-19 infection, as shown by inconsistent long Covid prevalence compared to COVID-19 severity (Graham et al., 2021; Kingstone et al., 2020; Negrini et al., 2021; Townsend et al., 2020).

One major issue that might hamper efforts to uncover the etiological basis of neuropsychological symptoms is that many symptoms remain poorly characterised (Gaber, 2021; Graham et al., 2021; Huang et al., 2021; Kingstone et al., 2020; Wilson et al., 2020). For example, the term "fatigue" has been applied heterogeneously and as an umbrella term, making it difficult to ascertain if they are linked to affective or cognitive factors, or issues related to physical or mental energy (Ortelli et al., 2021).

Another factor that further complicates our understanding of the neuropsychological profile of long Covid are references to 'brain fog' as a discrete symptom. Long Covid sufferers frequently report cognitive deficits as "brain fog" (Boldrini et al., 2021; Nordvig & Noble, 2021; Theoharides et al., 2021). The term "brain fog" encapsulates fatigue, depression, and cognitive decline, particularly in terms of the experience of confusion and decreased concentration (Boldrini et al., 2021; Stefano et al., 2021). This presents similarly to the cognitive deficits reported in other post-viral conditions (Theoharides et al., 2021). Brain fog is theorised to be related to neuroinflammation, but this does not account for patients who experienced mild COVID-19 infections (Negrini et al., 2021; Townsend et al., 2020). Although brain fog is frequently reported, it remains poorly understood in terms of the established medical and neuropsychological nomenclature. It may be the case that "brain fog" is synonymous with cognitive decline, and describes the same or similar set of symptoms. Further investigation into the neuropsychological aspects of "brain fog" in long Covid will allow better understanding of the use of the term in long Covid sufferers.

Thus, despite the increasing literature, it remains unclear how neuropsychological symptoms in long Covid overlap and interact with one another. For instance, based on prior research (Palmer, 2013) it is possible that long Covid symptoms of increased negative affect and fatigue are facilitating an experience of cognitive decline in some individuals. Existing studies from the depression literature show that depression and cognition are neurologically linked, and that cognition is negatively affected by high levels of depression (McDermott & Ebmeier, 2009; Papazacharias & Nardini, 2012). In fact, the term 'pseudo-dementia' is used to describe severely depressed patients who are manifesting memory and attention problems (Brown, 2005). Similarly, many studies show that high levels of anxiety are detrimental to working memory (Maloney et al., 2014).

While these links between neuropsychological symptoms have been investigated in other literature, the etiology of long Covid is further complicated by the current context: it is not entirely understood how the pandemic environment interacts with and exacerbates neuropsychological aspects of long Covid (Adams-Prassl et al., 2020; Gaber, 2021). Reports have indicated a decline in psychological domains of fatigue, affect (in relation to depression), and cognition, throughout the population as a result of the pandemic (Troyer et al., 2020). Concerns such as fear of death and illness, and the effects of social isolation have been reported to impact mental health outcomes such as fatigue, depression, and anxiety in people regardless of their long Covid status (Carvalho et al., 2020; Troyer et al., 2020). The neuropsychological aspects of long Covid may therefore result as a function of both environmental and physiological factors. Furthermore, people without long Covid may experience neuropsychological symptoms as a result of the environment too (Gaber, 2021; Troyer et al., 2020). However, growing evidence suggests that COVID-19 infection both triggers and worsens these neuropsychological aspects (Mendelson et al., 2020; Sher, 2021).

Thus, the question of whether subjective cognitive decline can be explained by interactions between other neuropsychological long Covid symptoms or whether it arises independently is particularly concerning as the latter may imply a degree of long neurological damage. Furthermore, a decline in cognition is likely to substantially impact long Covid sufferers' ability to return to full occupational functioning. Another key gap in our understanding of long Covid is whether or not neuropsychological symptoms of long Covid exacerbate one another or whether disturbances in mood are able to predict reports of subjective cognitive decline. Since fatigue, depression, and anxiety have been reported to negatively impact cognition in other illnesses (Small et al., 2019; Vearncombe et al., 2009), it is important to investigate how they contribute to cognitive decline in long Covid sufferers, as the literature has not sufficiently investigated this.

In better understanding the cause of - and relationships between - the neuropsychological aspects of long Covid and cognitive decline, we may facilitate the development of effective treatment measures, deepen our understanding of long Covid, and direct future research.

Rationale and Objective

There is uncertainty surrounding how or why the neuropsychological aspects arise, and whether or not they constitute distinct or overlapping phenomena. Furthermore, it remains unclear how the neuropsychological aspects of long Covid interact and overlap with subjective cognitive decline. The study aimed at investigating if fatigue, depression, and anxiety scores are predictive of scores on subjective cognitive decline measures in a long Covid sample. It is important to ascertain whether or not cognitive deficits are secondary to fatigue, depression, and anxiety, or whether they represent a distinct category of symptoms in their own right. To determine this, a correlational study was conducted.

Methods

Aims, Research Questions, and Hypotheses

This study aimed to investigate correlations between the neuropsychological aspects of long Covid, and to investigate whether fatigue, depression, or anxiety predicted subjective cognitive decline. There were four research questions. Does fatigue, depression, and/or anxiety have a significant correlation with subjective cognitive decline? Are there concerns of multicollinearity between fatigue, depression, and anxiety? Can the neuropsychological aspects of long Covid be used to predict cognitive decline using regression? Lastly, are findings in long Covid participants significantly different from findings from the control data?

There are four hypotheses proposed for these four research questions. All neuropsychological aspects will be substantially correlated with subjective cognitive decline.

There will not be any concerns for multicollinearity between fatigue, depression, and anxiety. The control data will show that the correlation between fatigue, depression, anxiety, and subjective cognitive decline is not substantial in control participants, and that they cannot be used to make an effective regression model. A satisfactory prediction model for subjective cognitive decline using regression can be created from at least one of the neuropsychological aspects of long Covid as the predictor variable.

A substantial correlation will constitute a correlation coefficient of 0.2 or higher, signalling a possible relationship and warranting further investigation. In relation to multicollinearity, although there is some overlap in these neuropsychological aspects, the measures used gauge completely separate neuropsychological aspects.

Design

This study adopted a quantitative approach with a mixed-methods design. Utilising a control group, it employed both quasi-experimental and correlational statistical analyses. Scores were correlated with one another to investigate whether there is a relationship between fatigue, depression, anxiety, and subjective cognitive decline. The study conducted the same analysis on the control data and compared the results.

This study is quasi-experimental, with a long Covid group and a control group without random assignment. The labelling of participants as "control" participants is not to identify that these participants are not exposed to an intervention, but rather to signal that they do not report symptoms of long Covid. Results from the long Covid participant group were compared to results from the control group to determine whether or not symptoms are a result of COVID-19 sequelae. Data collection took place between June 2021 and December 2021 and was administered online to South Africans, using purposive sampling.

Participants

Participants were purposively sampled. The study was advertised (Appendix A) on several online platforms likely to be frequented by people with long Covid. This included COVID-19 support forums, social media channels and the UCT Vula portal. Additionally, the study was advertised in post-COVID clinics at Groote Schuur Hospital (Cape Town, South Africa) and Alberlito Hospital (Durban, South Africa).

According to a power analysis with power = 0.8, alpha = 0.05, and a hypothesised effect size of 0.5, 64 participants per group was projected for this study. A medium effect size was adopted as it assumes a null hypothesis: that long Covid participants and control participants will perform similarly on the measures administered (Cohen, 1998). Male, female and non-binary participants were recruited for this study. Participants were between the ages of 18 and 60 and were included on the basis that they are physically stable. The study aimed to establish a high degree of diversity within participants in terms of race, socioeconomic status and other demographic characteristics. As COVID-19 (and subsequently long Covid) has affected the entire population, it is important to strive for participants representing the population at large. This would allow for results to have greater generalisability.

There are three exclusion criteria for this study. First, participants needed to be between the ages of 18 and 60 years. Taking ethical considerations into account, only adults are included in the study. Additionally, those over the age of 60 were excluded to avoid confounding results with age-related cognitive decline (Barnes, 2015). Second, participants who are currently infected with COVID-19 were excluded. Since this study focuses on post-COVID-19 outcomes, it is not relevant to include those who are currently infected. Third, participants were excluded if they have a history of neuropathological damage (such as from a stroke, aneurysm or haemorrhage) or cognitive and developmental impairment (such as

autism or fetal alcohol spectrum disorder). Long Covid refers to symptoms that are a consequence of damage that cannot be clearly attributed to an already existing condition.

Long Covid Group

Participants who have had a COVID-19 infection answered an online questionnaire (Appendix I). The questionnaire asked participants to confirm they have had a confirmed COVID-19 diagnosis, the method of testing, time period of infection, and if they were hospitalised. The questionnaire also contained a question asking participants if they believe they are currently experiencing long Covid. Those who indicated no were excluded from the study, and their data was not used in the data analysis. This is because there is no way to definitively diagnose long Covid using self-report measures.

Control Group

Participants who have not had a confirmed COVID-19 diagnosis answered an online questionnaire (Appendix J). The questionnaire was largely the same, except the questions regarding a COVID-19 infection. Notably, while control participants had not been infected with COVID-19, they have still been exposed to the strenuous conditions of the COVID-19 pandemic.

Procedure

Data collection was conducted by Madeleine Ashton (MA) and Arjun Maharaj (AM) under the supervision of Donné Minné (DM), Mark Solms (MS) and Altay Yüce Turan (AYT). The data for this study is sourced from AYT's online data collection procedure that gathers self-report and psychometric data on people who potentially have long Covid. Data was collected using an online software called "SoGoSurvey".

The link to an online questionnaire was built into the advertisements for the study, as well as distributed by those working on the study. The questionnaire screened participants elibigle for the study and collected demographic data. An adapted informed consent form was

built into this questionnaire. Additionally, this questionnaire asked participants to indicate symptoms relevant to the neuropsychological aspects of long Covid and cognition by adapting measures of fatigue and mental health.

Instruments

The measures used in this study were adapted from existing measures of subjective cognitive performance, fatigue, depression, and anxiety.

Cognitive Assessment

Subjective cognitive decline was assessed in this study using the Cognitive Failures Questionnaire (CFQ) (Appendix G) (Broadbent et al., 1982). The measure includes 25 questions rated on a 5-point scale from 0 to 4. Questions include mistakes that may be caused by failings in cognition, such as forgetting tasks, confusing directions, and losing concentration (Broadbent et al., 1982). The maximum possible score on the CFQ is 100 (Broadbent et al., 1982). In the CFQ, Rast et al. (2009) found three factors measuring forgetfulness, distractibility, and false triggering. Many researchers have agreed that the CFQ has reliable and valid factors (Wallace, 2004).

Fatigue Assessment

Both the Modified Fatigue Impact Scale (MFIS, Appendix D) (Larson, 2013; Learmonth et al., 2013; Ritvo et al., 1997) and the Fatigue Severity Scale (FSS, Appendix C) (Krupp et al., 1989; Learmonth et al., 2013) were included in the questionnaire. Both have been used to measure fatigue in long Covid and have been recommended for further research (Friedberg & Jason, 1998; LaChapelle & Finlayson, 1998; Ortelli et al., 2021). In the MFIS, participants answer 21 questions, scoring each on a 5-point scale, rated 0 to 4 (Larson, 2013; Learmonth et al., 2013). MFIS scores can range from 0 to 84 (Larson, 2013; Learmonth et al., 2013). In the FSS, participants answer 7 questions, scoring each on a 7-point scale, rates 1 to 7. FSS scores can range from 9 to 63 (Learmonth et al., 2013).

Depression Assessment

The Beck Depression Inventory II (BDI-II, Appendix E) was utilised (Beck et al., 1996). The BDI-II contains 21 questions on a four-point scale for most questions, each rated 0 to 3 (Beck et al., 1996). Two questions further differentiate between "a" and "b" options for scoring options of 1, 2, and 3 (Beck et al., 1996). However, the weighting of each option remains the same, with "a" and "b" only indicating if the symptom is an increase or reduction of a specific behaviour (Beck et al., 1996). BDI-II scores can range from 0 to 63 (Beck et al., 1996). In this study, scores on the BDI-II are simply referred to as "BDI score". An advantage of using this is that the BDI has been validated for use in the South African context (Makhubela & Mashegoane, 2015).

Anxiety Assessment

This study used the Beck Anxiety Inventory (BAI, Appendix F) (Beck et al., 1988; Viljoen et al., 2020). The BAI consists of 21 questions listing common symptoms of anxiety, rated on a 4-point scale, ranging from 0 to 3 (Beck et al., 1988). BAI scores can range from 0 to 63 (Beck et al., 1988). Scores of 21 and below are considered to indicate low anxiety, between 22 and 35 indicate moderate anxiety, and 36 and above indicate concerning levels of anxiety (Beck et al., 1988).

Data Analysis

Data collected from the study was analysed using correlation and regression in RStudio. Once data was collected it was stored digitally in a password protected folder. Data was saved in such a way that the participant's identity remained protected. An online software called "SoGoSurvey" was used to collect data, and the data was then exported electronically into an excel format and loaded into RStudio. Once the data was prepared, it was read into RStudio, "cleaned" and sorted in a way most conducive to data analysis (Wickham & Grolemund, 2017).

The data analysis report includes a table outlining participant demographics (Table 1). Thereafter, a "skim" function was run on the data to provide a concise overview of the format of the data (Wickham & Grolemund, 2017). No missing values were detected, and thus imputation was not necessary.

Descriptive statistics were calculated and presented in a table (Table 2). The data was transformed in such a way that it fits the four assumptions of multiple regression: linearity, homoscedasticity, independence, and normality, without compromising the integrity of the data (Tredoux & Durrheim, 2002). Correlations were investigated by transforming the data into a correlation matrix using the "cor()" function, and then representing the correlations between each relevant variable in a correlation heat map using the "cor.plot()" function (Tredoux & Durrheim, 2002; Wickham & Grolemund, 2017).

A linear model was then run for the long Covid group using FSS scores, MFIS scores, BDI scores, and BAI scores as predictors, and change in CFQ scores as the predicted value. Using a linear model allowed for an evaluation of predictive power of each variable, and to identify which were significant. The results then informed decisions on which predictor variables to include in subsequent models. Based on the results of the first model, adjustments were made, and another linear model was run, if necessary, until the most efficient model was reached (Tredoux & Durrheim, 2002). This analysis investigated whether or not fatigue, depression, and anxiety are predictive of subjective cognitive decline in long Covid.

A linear model of the neuropsychological aspects of long Covid participants was then be compared with a linear model of the neuropsychological aspects of participants that do not have long Covid. The same procedure was followed for the linear regression detailed above. By comparing the output of each respective linear model, it was demonstrated how symptoms

fatigue, depression, anxiety, and subjective cognitive decline differed between participants with and without long Covid.

Ethical Considerations

Ethical approval was granted by the University of Cape Town and UCT's Health Sciences Ethics committee (REF 482/2021) (Appendix H). Participants were only included in the study once they had given consent through signing the informed consent form (Appendix B). This form serves several functions as outlined by Kazdin (1992). In addition to providing participants with an overview of the study and its purposes, the informed consent form described the procedures of the study, it discloses the potential risks and benefits of participating in the study and it informed participants of potential costs and economic considerations (such as time taken and transport costs). Additionally, the informed consent form detailed to the participants what information was kept confidential and how, what alternatives to participate in the study are, and that their participation is voluntary.

Risks and Benefits to Participants

Performance on the measures within this study did not constitute grounds for diagnosing participants, and so participants were reminded that participating in the study is not for the purposes of diagnosing them clinically. Results and recordings were stored in a password protected folder that requires two-factor authentication to be accessed. Data was be saved in such a way that participants' identities are protected.

Filling out the questionnaire does involve risks for the participants. The questionnaire asks questions about the participant's physical and mental state, as well as potentially difficult topics, such as suicidality, emotional strain, and stress. Furthermore, questions about difficulties experienced due to long Covid may lead to the participant recalling traumatic memories or reliving trauma. Lastly, the length of the questionnaire and the time it takes to fill out may have been taxing for the participant, especially those that are experiencing

fatigue due to long Covid. These risks were outlined in the informed consent form, and to lower the likelihood of potential harm arising from participation in the study, information concerning mental health resources and mental health advocacy groups were added to the informed consent form, as well as on the multiple "break pages" throughout the questionnaire.

Participants may benefit from this research in three ways. Firstly, this research has the potential to facilitate a deeper understanding of long Covid and, therefore, the development of more effective treatment solutions for people experiencing long Covid. As this study contributes to the research of long Covid, and may deepen our understanding of it and direct future research, participants are directly involved in this process. Therefore, participants have directly influenced the improvement of understanding towards, and effective treatment of, long Covid. Secondly, as long Covid has been difficult to characterise, the results of this study can provide participants with the opportunity to have their symptoms validated and recognised (Kingstone et al., 2020). Thirdly, participation in the study could provide some relief to participants as it informs participants that their symptoms are being investigated.

Results

84 participants were recruited from the post-covid infection survey. 2 (2.38%) participants were excluded as they had not had a confirmed diagnosis of COVID-19 and confirmed that they had never been infected with COVID-19. As such, they were not eligible for the long Covid group. A further 30 (35.71%) participants were excluded as they indicated they did not believe they were experiencing long Covid, and as such were not eligible for the long Covid group. The remaining 52 participants' data were used in the data analysis. No participants from the control group were excluded, and all 21 participants' data were used in the analysis. This resulted in 73 total participants. Neither group had enough participants to reach statistical power. Participants were sent a follow-up email after they completed the

survey, containing all relevant information about the study and details for resources available to them. There was no missing data for the relevant variables. As such, no participants were excluded based on missing data values.

Table 1 summarises the demographic data collected from participants. This includes age, gender, level of education, employment status, place of residence, monthly household income, and home language. The mean age for participants in the control group was 26.5 years, and 36.8 years in the long Covid group. The minimum and maximum age values of 18 years and 59 years illustrate that all participants were over the age of 18 years, and under the age of 60 years. The results show that the distribution of age is skewed towards younger participants, reflecting that most participants were from the University of Cape Town.

Table 1

Sample Characteristics

	Control Group (N=21)	Long Covid Group (N=52)	Overall (N=73)
Age (Years)			
Mean (SD)	26.5 (10.1)	36.8 (14.2)	33.8 (13.9)
Median [Min, Max]	23.0 [18.0, 57.0]	40.0 [18.0, 59.0]	26.0 [18.0, 59.0]
Gender			
Female	12 (57.1%)	36 (69.2%)	48 (65.8%)
Male	8 (38.1%)	16 (30.8%)	24 (32.9%)
Non-Binary	1 (4.8%)	0 (0%)	1 (1.4%)
Education			
Completed or enrolled for a postgraduate degree	13 (61.9%)	19 (36.5%)	32 (43.8%)
Completed or enrolled for an undergraduate degree	4 (19.0%)	24 (46.2%)	28 (38.4%)
High School (Grades 8-12)	3 (14.3%)	6 (11.5%)	9 (12.3%)
Technical course or diploma equivalent	1 (4.8%)	3 (5.8%)	4 (5.5%)
Currently Employed			
No	13 (61.9%)	22 (42.3%)	35 (47.9%)
Yes	8 (38.1%)	30 (57.7%)	38 (52.1%)

	Control Group (N=21)	Long Covid Group (N=52)	Overall (N=73)
Place of Residence			
Cape Town	19 (90.5%)	35 (67.3%)	54 (74.0%)
Other	2 (9.5%)	17 (32.7%)	19 (26.0%)
Monthly Household Income			
R0 - R1600	2 (9.5%)	3 (5.8%)	5 (6.8%)
R1600 - R7500	3 (14.3%)	8 (15.4%)	11 (15.1%)
R7500 - R17000	1 (4.8%)	4 (7.7%)	5 (6.8%)
R17000 - R30000	3 (14.3%)	13 (25.0%)	16 (21.9%)
R30000 - R60000	7 (33.3%)	9 (17.3%)	16 (21.9%)
R60000+	5 (23.8%)	15 (28.8%)	20 (27.4%)
Home Language			
English	17 (81.0%)	42 (80.8%)	59 (80.8%)
isiXhosa	1 (4.8%)	1 (1.9%)	2 (2.7%)
Other (Please specify): Chinese	3 (14.3%)	0 (0%)	3 (4.1%)
Afrikaans	0 (0%)	2 (3.8%)	2 (2.7%)
isiZulu	0 (0%)	2 (3.8%)	2 (2.7%)
Other (Please specify): French	0 (0%)	1 (1.9%)	1 (1.4%)
Sotho	0 (0%)	2 (3.8%)	2 (2.7%)
Tswana	0 (0%)	2 (3.8%)	2 (2.7%)

Both groups show that majority of the participants were female. In the control group, the majority of participants were either enrolled in or had completed their postgraduate degrees (61.9%). However, in the long Covid group, majority of the participants were enrolled in or had completed their undergraduate degrees (46.2%). This further illustrated that most participants were university students. Employment status showed 52.1% of participants were employed, and 47.9% were not. However, this does not differentiate between full-time and part-time jobs. Majority of the participants indicated that they were living in cape town (74.0%). Monthly household income varied across all brackets, with the modal bracket being

R60000+ (27.4%). Lastly, the most spoken home language amongst participants was English (80.8%). The sample characteristics suggest that generalisability to the population is low, as data is skewed towards young, English speaking university students living in Cape town, with a medium to high monthly household income.

Table 2

Descriptive Data

	Control Group (N=21)	Long Covid Group (N=52)	Overall (N=73)
FSS Score			
Mean (SD)	33.6 (10.8)	45.8 (13.0)	42.3 (13.5)
Median [Min, Max]	33.0 [16.0, 60.0]	46.0 [16.0, 63.0]	42.0 [16.0, 63.0]
MFIS Score			
Mean (SD)	30.9 (13.5)	54.9 (15.8)	48.0 (18.6)
Median [Min, Max]	30.0 [7.00, 56.0]	56.5 [20.0, 81.0]	50.0 [7.00, 81.0]
BDI Score			
Mean (SD)	11.7 (10.3)	24.8 (11.3)	21.0 (12.5)
Median [Min, Max]	11.0 [0, 46.0]	24.5 [1.00, 54.0]	21.0 [0, 54.0]
BAI Score			
Mean (SD)	8.57 (8.70)	23.1 (13.5)	18.9 (13.9)
Median [Min, Max]	5.00 [0, 27.0]	23.0 [1.00, 53.0]	19.0 [0, 53.0]
Change in CFQ Score			
Mean (SD)	2.90 (11.1)	20.1 (20.0)	15.1 (19.5)
Median [Min, Max]	0 [-10.0, 40.0]	16.0 [-8.00, 74.0]	9.00 [-10.0, 74.0]

Note. FSS = Fatigue Severity Scale; MFIS = Modified Fatigue Impact Scale; BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; CFQ = Cognitive Failures Questionnaire.

Fatigue severity scores had an overall mean of 42.3, which is considerably high with a maximum achievable score of 63 in the FSS measure. The long Covid group had an average score of 45.8, while the control group had an average of 33.6. The minimum FSS score across both groups was 16, maximum scores as high as 60 and 63 in the control group and long Covid group, respectively. MFIS scores show a similar trend, with an overall average of 48.0 on a measure with a maximum score of 84. The long Covid group had an average of 54.9,

while the control group had an average of 30.9, substantially lower. The long Covid group had a maximum score of 81. BDI scores had an overall mean of 21.0, which is considerably low with a maximum achievable score of 63 in the measure. The long Covid group had an average score of 24.8, while the control group had an average of 11.7. BAI scores had an overall mean of 18.9, which is considerably low with a maximum achievable score of 63 in the measure. The long Covid group had an average score of 23.1, while the control group had an average of 8.57, which is considerably lower. Change in CFQ scores had an overall mean of 15.1, which is considerably low with a maximum achievable score of 100 in the measure. The long Covid group had an average score of 20.1, while the control group had an average of 2.90, which is considerably lower. Interestingly, this is the only measure that has a minimum value that is negative, representing an increase in cognitive functioning after the participant's COVID-19 infection. The maximum score in the long Covid group is also concerningly high, at 74.0.

These findings show that the long Covid group had a higher mean, standard deviation, minimum value, and maximum value in every single measure. Thus, while the long Covid group had higher scores on average, were also more widely distributed. There is only one exception: a tie for the minimum value in FSS score (16). These findings are consistent with the findings of previous literature, showing it is likely that COVID-19 infections increase the severity of symptoms.

Analysis of Correlations

Five variables were used in data analysis for inferential statistics: FSS scores, MFIS scores, BDI scores, BAI scores, and change in CFQ scores. The change in CFQ scores was calculated as the CFQ score after a COVID-19 infection minus the estimated CFQ score before a COVID-19 infection. A correlation matrix was run in RStudio for all five variables,

specifically looking at the correlations that the first four variables had with change in CFQ score. Separate correlation matrixes were run for the long Covid group and the Control group.

Data from the long Covid group showed the following correlations: MFIS score to change in CFQ = 0.62; FSS score to change in CFQ = 0.38; BDI score to change in CFQ = 0.22; BAI score to change in CFQ = 0.26. All variables had a low or moderate positive correlation with change in CFQ, with the two highest correlations occurring from both fatigue measures. These findings suggest that an increase in each variable is likely to increase the change in CFQ score, implying a relationship between the variables. It also indicates that fatigue may have a particularly strong relationship with subjective cognitive decline. However, MFIS has a much higher correlation than FSS, implying that they measure different aspects of fatigue. All variables were investigated for multicollinearity using variance inflation factors (VIF), showing satisfactorily low VIF scores. Therefore, there is no concern that there is significant overlap in what each variable measures (Tredoux & Durrheim, 2002).

The control group correlations showed the following: FSS score to Change in CFQ = -0.28; MFIS score to change in CFQ = -0.03; BDI score to change in CFQ = 0.08; BAI score to change in CFQ = 0.23. Only the BAI score showed a low positive correlation with change in CFQ scores.

Overall, results from correlation analyses provide support that there are relationships present between fatigue, depression, anxiety, and subjective cognitive decline in the long Covid group. However, some of these relationships are weak, and bordering an indication of no relationship (correlation coefficient < 0.2). Both fatigue measures have especially high correlations to subjective cognitive decline when compared to depression and anxiety scores, showing a higher likelihood that a relationship exists. These findings are in line with the previous literature (Palmer, 2013).

Analysis Using Regression

Suitable regression models for both groups were made to further investigate the possible existence of relationships between variables, and the predictive powers of those variables for subjective cognitive decline. First, multiple regression was used for the long Covid group to predict change in CFQ scores using FSS scores, MFIS scores, BDI scores, and BAI scores as predictor variables. The model explained a total of 36.92% of variance within CFQ scores ($R^2 = 0.4187$; Adjusted $R^2 = 0.3692$). The p-value of the F-statistic was 3.152e-05, which is significant, meaning at least one predictor variable in the model is significant. These results suggest that an effective regression model is possible, but needs further refinement by removing ineffective variables. Further investigation into the p-values of each predictor variable showed the following: FSS score = 0.48; MFIS score = 5.56e-05; BDI score = 0.17; BAI score = 0.84. Only MFIS scores had a significant p-value (< 0.05), and therefore is the only predictor variable that is significant in the model.

Following this, a new regression model was created to predict change in CFQ scores using only MFIS scores. The model explained 37.48% of variance ($R^2 = 0.3871$; Adjusted $R^2 = 0.3748$). The p-value of the F-statistic also remained significant at 8.488e-07, as well as the p-value of MFIS scores at 8.49e-07. The estimate for MFIS scores is 0.79, CI [0.51, 1.07]. However, the model had a high error rate of 0.79, implying that the model may not be as competent as the R squared value suggests, as real values are quite far from the model's predicted scores. The results indicate that MFIS scores can be used to predict subjective cognitive decline with low to moderate accuracy. It is possible that, in the current sample of long Covid participants, fatigue may be driving the experience of subjective cognitive decline.

The same analysis was conducted for the control group, using all four variables as predictor variables to predict change in CFQ scores. The model explained less than 0.01% of

variance (R^2 = 0.1323; Adjusted R^2 = -0.08467). The p-value of the F-statistic was insignificant (0.66), meaning none of the predictor variables in the control group model were significant. Further investigation into the p-values of each predictor variable showed the following: FSS score = 0.38; MFIS score =0.76; BDI score = 0.88; BAI score = 0.53. None of the predictor variables had a significant p-value (< 0.05), and therefore strengthens the above finding from the F-statistic. Due to this finding, no further analysis was conducted on the data from the control group.

In sum, findings from regression analyses suggested that there is a weak but significant relationship between MFIS scores, which can be used to predict subjective cognitive decline with low accuracy. Comparison between the regression models of the long Covid group and the control group are difficult due to the low sample size in both groups.

Discussion

The relationships between neuropsychological variables in long Covid are poorly understood, impeding our understanding of the etiology of long Covid. In order to address this issue, the current study aimed to investigate four research questions. The research questions aimed to investigate correlations between variables, concerns for multicollinearity, prediction of subjective cognitive decline using regression, and outcomes of control data using the same analyses. The study demonstrated that there are significant correlations between fatigue, depression, and anxiety with subjective cognitive decline in long Covid, with low correlation for FSS scores, BDI scores, and BAI scores, and a moderate correlation for MFIS scores. Therefore, the study demonstrates a substantial correlation (correlation coefficient > 0.2) between each neuropsychological aspect and subjective cognitive decline, implying the existence of relationships between the variables. The study also demonstrates that there are no concerns for multicollinearity between fatigue, depression, and anxiety, meaning the variables do not significantly overlap in what they measure. These findings are

consistent with previous literature, showing correlations between fatigue, depression, anxiety, and cognitive decline (Maloney et al., 2014; McDermott & Ebmeier, 2009; Palmer, 2013; Papazacharias & Nadrini, 2012).

Findings from the regression analyses suggests that a considerable amount of the variance in subjective cognitive decline can be explained by the contribution of fatigue, specifically MFIS scores. The final regression model to predict subjective cognitive decline was able to account for 37.48% of variance. However, the high error rate (0.79) is concerning, because there is high variability between actual results and predicted results (Tredoux & Durrheim, 2002). This is consistent with findings in the literature, which have established a relationship between fatigue and cognitive decline (Palmer, 2013). The regression model was significant with fatigue, depression, and anxiety present, but only MFIS scores were significant. With the removal of all variables except MFIS scores, the model fit increased, demonstrating the most efficient model exists when FSS scores, BDI scores, and BAI scores were absent. Thus, MFIS scores alone were the best measure to predict subjective cognitive decline. These results differ from the findings in the literature, which suggest a relationship between the variables (Maloney et al., 2014; McDermott & Ebmeier, 2009; Papazacharias & Nadrini, 2012). This may suggest a different relationship between variables exist in long Covid compared to previous literature. Further investigation is needed to fully understand why this is the case.

Lastly, the results indicate there is a substantial difference in the data between the long Covid group and the control group, as the control group data is shown to have sufficient differences from the long Covid group data. There is a substantial difference in means between the groups. The correlations across all neuropsychological aspects and subjective cognitive decline were much lower in the control group, and the control group data could not be used to make an effective regression model with any number of predictor variables.

However, this should be interpreted cautiously, as the sample size for the control group was not statistically significant.

The results of the study support all four hypotheses proposed in the study. The correlations between fatigue (on both measures), depression, and anxiety with subjective cognitive decline suggests that there is a specific relationship between each neuropsychological aspect and subjective cognitive decline. Furthermore, the lack of a matching substantial correlation between each neuropsychological aspect of long Covid and subjective cognitive decline in the control data could be interpreted as supporting the theory that there is an existing relationship. That in this study, multicollinearity was not found to be a cause for concern is an unusual finding, as previous literature speculated there may be overlap, particularly between fatigue and depression (Rudroff et al., 2020). The lack of significant correlations in the control group data, as well as the inability to create an effective regression model for predicting subjective cognitive decline using the control group data, both support the theory that the findings from the long Covid group data is due to long Covid, and not some other external variable. However, more rigorous research should be conducted as the study's control group was smaller than ideal. A qualitative study focusing on in-depth differences between long Covid participants and control participants may sufficiently investigate this. Notably, control group participants have been exposed to many strenuous conditions in the pandemic, yet even so, the control group data did not show substantial correlations. This may imply that the relationship between neuropsychological aspects of long Covid and subjective cognitive decline is a result of long Covid. Lastly, development of an effective regression model for predicting subjective cognitive decline shows the importance of further research into the relationships between neuropsychological symptoms of long Covid. This may be the first step in establishing a causal link between the two aspects, and directing future research towards a deeper understanding of long Covid.

The finding that FSS scores were not significant and MFIS scores were, while both measure fatigue levels, is highly interesting. Further investigation into this may improve our understanding of long Covid. It is perhaps possible that the two measures test different aspects of fatigue, or have varying levels of sensitivity. For example, a study by Amtmann et al. (2012) found that the FSS was equally as effective as the MFIS in measuring moderate levels of fatigue. However, the MFIS was more precise in the measurement of both low and high levels of fatigue, with the drawback of taking longer to complete (Amtmann et al., 2012). It is also suggested that the MFIS is better suited towards measuring cognitive fatigue than the FSS (Amtmann et al., 2012). This may explain the findings of this study, as it is reasonable to believe cognitive fatigue and cognitive decline will correlate more than physical fatigue and cognitive decline.

Limitations

The study had many limitations. All measures used were self-report measures. This raises concerns about the reliability of the data. Data may have been affected by individual response styles, which can cause some variation in self-report measures (Tempelaar et al., 2020). Second, testing was not in a controlled environment. As such, many uncontrolled external variables in the participant's environment may have affected their responses. Reduction of environmental factors may increase reliability. Third, data collection was heavily affected by the COVID-19 pandemic, which caused delays in data collection, and reduced the number of participants recruited for the study. Fourth, the low number of participants and low diversity in participant demographics is an issue. A power analysis indicated that at least 64 participants would be needed for each group. This was not reached for the long Covid group (N = 52), nor for the control group (N = 21). Thus, the total number of participants was too low, reducing generalisability to the population. The lack of diversity in place of residence and household languages (as shown in Table 1) also presents issues for

generalisability. Lastly, the study was unable to test cognition objectively, and therefore subjective data had to be relied upon. Since participants were excluded from the long Covid group if they indicated they did not believe they were experiencing long Covid, the use of objective data would eliminate this reason for exclusion, allowing for more participants. Objective data would also allow for the elimination of participant bias, specifically response style, which would eliminate possible confounding variables (Tempelaar et al., 2020).

Despite these limitations, the study did manage to achieve many of its goals, finding substantial evidence for relationships between the neuropsychological aspects of long Covid and subjective cognitive decline. The long Covid group had enough participants to achieve statistical power, and the control group allowed for the limitation of the impact of some confounding variables. The study is also easily replicable in more favourable circumstances, allowing for more rigorous research.

Recommendations

Future research into this field should consider recruiting a larger number of participants to increase generalisability to the population, and using a blinded experimental design to infer causation instead of just causation. The measures used in this study are self-report by nature. The reliability of self-report measures in new pandemic conditions is not fully understood, and thus further investigation into the reliability of these data collection methods in pandemic conditions would help to strengthen the findings of future studies. Furthermore, in-person testing for participants would help reduce external factors affecting participant responses. A longer data collection period, and more safeguards against disruptions in data collection from the COVID-19 pandemic would also ensure a better quality of data collected.

Further investigation into the relationships between fatigue, mood, and cognitive decline is needed. This could be done by conducting an analysis of the three factors within

the CFQ: forgetfulness, distractibility, and false triggering (Broadbent et al., 1982), and how they correlate with the neuropsychological aspects of long Covid. Future studies could conduct more detailed analyses of MFIS scores by utilising its subscales of physical, cognitive, and psychosocial fatigue (Larson, 2013; Learmonth et al., 2013). While this study showed the significance of MFIS scores, it only used the overall MFIS score. Future studies could also conduct a qualitative analysis of the participants' subjective experience to investigate the relationships between neuropsychological symptoms that psychometric measures do not reflect. Lastly, as the study has shown, there was a significant difference between FSS scores and MFIS scores. This difference between the two measures of fatigue warrants further research into what causes the difference, and may be a path to deeper understanding of the relationship between fatigue and cognitive decline in long Covid.

Conclusion

This study aimed to investigate the relationships between the neuropsychological aspects of long Covid in a self-report long Covid sample. Based on a quantitative approach using quasi-experimental and correlational methods, analysis of the data from self-report measures shows that there are significant relationships between the neuropsychological aspects of long Covid. Fatigue, depression, and anxiety all have a substantial correlation with subjective cognitive decline. Furthermore, there were no concerns for multicollinearity, and only MFIS scores were significant in a regression model to predict subjective cognitive decline. Despite the control group's small sample size, the fact that similar correlations between fatigue and cognitive decline were not found emphasises that long Covid participants are experiencing something unique to them, and most likely due to long Covid. These results suggest that there may be a relationship between fatigue and subjective cognitive decline caused by long Covid.

The study was affected by many limitations, such as low number of participants, disruption from the COVID-19 pandemic, and reliance on self-report measures. The number of participants were not high enough to achieve statistical power, which weakens the strength of the study's results. Further research is needed to deepen our understanding of long Covid, and to increase our knowledge of the relationship between its neuropsychological aspects. Future studies would benefit from recruiting a larger number of participants, using objective, in-person measures, and collecting data over a longer period of time.

This study produced new knowledge on the relationships between the neuropsychological aspects of long Covid, and showed a significant relationship between fatigue and subjective cognitive decline using regression. While the study did not achieve statistical power, the results suggest a relationship exists, and this leads to further understanding of long Covid, and may direct future research. This study also provided a benefit to participants, by validating their experience of long Covid symptoms, and informing them that their symptoms are being investigated. Deepening our understanding of long Covid is key to developing therapeutic regimes for those experiencing long Covid, and this study has contributed to that process.

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Appendices

Appendix A

Recruitment Advertisement

DID YOU RECOVER FROM COVID? HAVE YOU STILL NOT RECOVERED FROM COVID?

We need you!

We are a research group based at UCT, looking into 'long COVID', a term describing how some people continue to present with symptoms, long after the usual COVID infection time period.

Participants must:
- Be between 18 and 60 years of age
- Be living in South Africa
- NOT Be currently diagnosed with any cognitive or developmental impairment, central nervous system disease, neurological damage, or other neuropathy

Please follow this link to participate in the survey:
https://docs.google.com/forms/u/2/d/1QeI2AmlaG2PKPcBhzmqPulZCy09nfuSGMbScA5RysbY/printform

Contact us at: longcoviduct@gmail.com
OR send a message to Altay (084 244 0044), Maddy, (072 044 9220), or Arjun (076 150 8206)

Appendix B

Informed Consent Form

> *Participant Information Sheet and Informed Consent Form*

This Informed Consent Form is for those who are invited to participate in research on the psychological symptoms of long COVID

Name of Organization: University of Cape Town (UCT)
Names of Study leaders: M Ashton (UCT), A Maharaj (UCT), A Y Turan (UCT), Prof M Solms (UCT), Dr D Minné (CPUT)
Name of Project proposal: A Study Investigating the Role of Fatigue and Depression in the Experience of Cognitive Disturbances in Long Covid Sufferers

The Informed Consent Form has two sections:
- **Information Sheet (to share information about the research with you)**
- **Certificate of Consent (for signatures if you agree to take part)**

You will be given a copy of the full Informed Consent Form

Section I: Information Sheet

Introduction
We are a team of researchers studying the long-term effects of the COVID-19 Virus. This form gives you information about the study and what kinds of questions and activities you will be requested to respond to and perform. There may be some words that you do not understand. Please ask the researcher with you to stop as you go through the information and they will take time to explain it. If you have questions later, please ask any member of the study team present here today.

Purpose of the research
The purpose of this research is to characterise and investigate the psychological symptoms that long COVID patients present with. The data generated from this study will allow healthcare practitioners and family members to improve the rehabilitation, care, and support for those who still suffer from the effects of COVID long after the projected recovery period.

Type of Research Intervention
This research involves an electronic questionnaire recording your demographic information and severity of initial COVID infection. An administrator will then request you to complete a series of cognitive assessments, which will be a mixture of mental exercises and pen-and-paper tasks, which will need you to listen and respond to various questions. Finally, you will be requested to answer a series of questionnaires on how you are feeling. There will be a break between each of the aforementioned exercises

Participant selection
To participate in this study, we are inviting adults who meet the following criteria:
- are between 18 and 60 years of age
- had a confirmed diagnosis of COVID-19
- experiencing issues with fatigue, after recovery period of COVID
- have attended a post-COVID clinic or other professional medical institute due to fatigue issues
- have not been diagnosed with neuropathy, neurological disorders, central nervous system disorders, developmental disorders, or cognitive disorders.

Section II: Certificate of Consent

Declaration by study participant:

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked to have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research. I may choose to leave this study at any time and shall not be penalised or prejudiced in any way. I may be asked to leave the study before it has finished if the study doctor or study leader feels it is in my best interest or if I do not follow the study plan as agreed to.

Print Name of Participant_____
Signature of Participant _____
Date _____ **Place**_____

Signature of witness_____

Declaration by investigator:

I declare that I have explained the information in this document to the study participants and encourage them to ask questions and took adequate time to answer them. I am satisfied that he/she adequately understands all aspects of the research study as discussed above. I did/did not use an interpreter. (If an interpreter is used the interpreter must sign the declaration below).

Print Name of Investigator_____
Signature of Investigator _____
Date _____ **Place**_____

Signature of witness_____

Declaration by interpreter:

I declare that I assisted the investigator to explain the information in this document to the participant using the language medium of Afrikaans/Xhosa. We encouraged him/her to ask questions and took adequate time to answer them. I conveyed a factual correct version of what was related to me. I am satisfied that the participant fully understands the content of this information and informed consent document and has had all his/her questions satisfactorily answered.

Print Name of Interpreter_____
Signature of Interpreter _____
Date _____ **Place**_____
Signature of witness_____

Thumb print of participant

Appendix C

Fatigue Severity Scale (FSS) (adapted from Krupp et al., 1989)

Date: _____   Participant Number: ____

Read and Circle a Number	Strongly Disagree -> Strongly Agree
1. My motivation is lower when I am fatigued.	1, 2, 3, 4, 5, 6, 7
2. Exercise brings on my fatigue.	1, 2, 3, 4, 5, 6, 7
3. I am easily fatigued.	1, 2, 3, 4, 5, 6, 7
4. Fatigue interferes with my physical functioning.	1, 2, 3, 4, 5, 6, 7
5. Fatigue causes frequent problems for me.	1, 2, 3, 4, 5, 6, 7
6. My fatigue prevents sustained physical functioning.	1, 2, 3, 4, 5, 6, 7
7. Fatigue interferes with carrying out certain duties and responsibilities.	1, 2, 3, 4, 5, 6, 7
8. Fatigue is among my most disabling symptoms.	1, 2, 3, 4, 5, 6, 7
9. Fatigue interferes with my work, family, or social life	1, 2, 3, 4, 5, 6, 7

The FSS is a questionnaire that measures your fatigue levels. It consists of nine statements that refer to the experience you may have with fatigue. Please read each statement, consider if it applies to you, and then circle a number from 1 to 7 according to how accurately you believe it describes your fatigue over the past seven days, and the extent that you agree or disagree with the statement's description of your fatigue. A low value (for example, 1) reflects strong disagreement, whereas a high value (e.g., 7) reflects strong agreement. You must circle a number for every statement.

The Fatigue Severity Scale Key:

A Summated score lower than 36 suggests that the respondent may not suffer from fatigue.

A summated score of 36 and higher suggests that the respondent may require an evaluation by a physician.

Appendix D

Modified Fatigue Impact Scale (adapted from Ritvo et al., 1997, and
https://www.sralab.org/rehabilitation-measures/modified-fatigue-impact-scale)

The MFIS is a questionnaire designed to evaluate how your fatigue has affected your experience. Please read the statements, and then circle the number which best reflects how regularly fatigue has impacted you in this way, over the past four weeks. If you require assistance with writing your response, inform the administrator of the appropriate number. It is required to answer every question. If unsure of which answer to select, base your final choice of which one best describes your experience. Please inform the administrator if you do not understand any aspects of the statements.

Because of my fatigue during the past 4 weeks:

		Never	Rarely	Sometimes	Often	Almost
18.	My thinking has been slowed down.	0	1	2	3	4
19.	I have had trouble concentrating.	0	1	2	3	4
20.	I have limited my physical activities.	0	1	2	3	4
21.	I have needed to rest more often or for longer periods.	0	1	2	3	4
5.	I have been forgetful.	0	1	2	3	4
6.	I have had to pace myself in my physical activities.	0	1	2	3	4
7.	I have been less motivated to do anything that requires physical effort.	0	1	2	3	4
8.	I have been less motivated to participate in social activities.	0	1	2	3	4
9.	I have been limited in my ability to do things away from home.	0	1	2	3	4
10.	I have trouble maintaining physical effort for long periods.	0	1	2	3	4
11.	I have had difficulty making decisions.	0	1	2	3	4
12.	I have been less motivated to do anything that requires thinking	0	1	2	3	4
13.	My muscles have felt weak	0	1	2	3	4
14.	I have been physically uncomfortable.	0	1	2	3	4
15.	I have had trouble finishing tasks that require thinking.	0	1	2	3	4
16.	I have had difficulty organizing my thoughts when doing things at home or at work.	0	1	2	3	4
17.	I have been less able to complete tasks that require physical effort.	0	1	2	3	4

Instructions for Scoring the MFIS

Items on the MFIS can be aggregated into three subscales (physical, cognitive, and psychosocial), as well as into a total MFIS score. All items are scaled so that higher scores indicate a greater impact of fatigue on a person's activities.

Physical Subscale

This scale can range from 0 to 36. It is computed by adding raw scores on the following items: 4+6+7+10+13+14+17+20+21

Cognitive Subscale

This scale can range from 0 to 40. It is computed by adding raw scores on the following items: 1+2+3+5+11+12+15+16+18+19

Psychosocial Subscale

This scale can range from 0 to 8. It is computed by adding raw scores on the following items: 8+9

Total MFIS Score

The total MFIS score can range from 0 to 84. It is computed by adding scores on the physical, cognitive, and psychosocial subscales.

Appendix E

Beck Depression Inventory-II (adapted from Beck et al., 1996)

This questionnaire has 21 groups of statements. Please read each statement carefully, before selecting out the one statement in each group which most appropriately describes the way you've felt over the past two weeks, including today. If multiple statements apply to your experience, pick the one that has the highest number in the relevant group. Do not choose multiple answers for any group, including item 16 (sleep pattern changes), or item 18 (Changes in Appetite)

1. **Sadness**

   0. I do not feel sad.

   1. I feel sad much of the time.

   2. I am sad all the time.

   3. I am so sad or unhappy that I can't stand it.

2. **Pessimism**

   0. I am not discouraged about my future.

   1. I feel more discouraged about my future than I used to.

   2. I do not expect things to work out for me.

   3. I feel my future is hopeless and will only get work

3. **Past Failure**

   0. I do not feel like a failure.

   1. I have failed more than I should have.

   2. As I look back, I see a lot of failures.

   3. I feel I am a total failure as a person.

4. **Loss of Pleasure**

   0. I get as much pleasure as I ever did from the things I enjoy.

   1. I don't enjoy things as much as I used to.

   2. I get very little pleasure from the things I used to enjoy.

   3. I can't get any pleasure from the things I used to enjoy.

5. **Guilty Feelings**

   0. I don't feel particularly guilty.

   1. I feel guilty over many things I have done or should have done.

2. I feel quite guilty most of the time.

3.I feel guilty all of the time.

6. Punishment Feelings

0. I don't feel I am being punished.

1.I feel I may be punished.

2.I expect to be punished.

3.I feel I am being punished.

7. Self-Dislike

0.I feel the same about myself as ever.

1.I have lost confidence in myself.

2.I am disappointed in myself.

3.I dislike myself.

8. Self-Criticalness

0. I don't criticize or blame myself more than usual.

1. I am more critical of myself than I used to be.

2. I criticize myself for all of my faults.

3.I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes

0. I don't have any thoughts of killing myself.

1. I have thoughts of killing myself, but I would not carry them out.

2.I would like to kill myself.

3.I would kill myself if I had the chance.

10. Crying

0.I don't cry anymore than I used to.

1.I cry more than I used to.

2.I cry over every little thing.

3.I feel like crying, but I can't.

11. Agitation

0.I am no more restless or wound up than usual

1.I feel more restless or wound up than usual.

2.I am so restless or agitated, it's hard to stay still.

3.I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

0.I have not lost interest in other people or activities.

1. I am less interested in other people or things than before.

2. I have lost most of my interest in other people or things.

3. It's hard to get interested in anything.

13. Indecisiveness

0.I make decisions about as well as ever.

1.I find it more difficult to make decisions than usual.

 2.I have much greater difficulty in making decisions than I used to.

3.I have trouble making any decisions.

14. Worthlessness

0.I do not feel I am worthless.

1. I don't consider myself as worthwhile and useful as I used to.

2.I feel more worthless as compared to others.

3.I feel utterly worthless.

15. Loss of Energy

0.I have as much energy as ever.

1.I have less energy than I used to have.

2.I don't have enough energy to do very much.

3.I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

0.I have not experienced any change in my sleeping.

1a I sleep somewhat more than usual.

1b I sleep somewhat less than usual.

2a I sleep a lot more than usual.

2b I sleep a lot less than usual.

3a I sleep most of the day.

3b I wake up 1-2 hours early and can't get back to sleep.

17. Irritability

0.I am not more irritable than usual.

1.I am more irritable than usual.

 2.I am much more irritable than usual.

3.I am irritable all the time.

18. Changes in Appetite

0.I have not experienced any change in my appetite.

1a My appetite is somewhat less than usual.

1b My appetite is somewhat greater than usual.

2a My appetite is much less than before.

2b My appetite is much greater than usual.

3a I have no appetite at all.

3b I crave food all the time.

19. Concentration Difficulty

0.I can concentrate as well as ever.

1.I can't concentrate as well as usual.

2.It's hard to keep my mind on anything for very long.

3. I find I can't concentrate on anything

20. Tiredness or Fatigue

0.I am no more tired or fatigued than usual.

1.I get more tired or fatigued more easily than usual.

2.I am too tired or fatigued to do a lot of the things I used to do.

3.I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

0.I have not noticed any recent change in my interest in sex.

1.I am less interested in sex than I used to be.

2.I am much less interested in sex now.

3.I have lost interest in sex completely.

Total Score: ___

Appendix F

Beck Anxiety Inventory (adapted from Beck et al., 1988)

This questionnaire is designed to measure how you've been feeling over the past week, including today. Please rate how much you have been bothered by each symptom, on a 4-point scale where 0 represents *Not at all,* to 3 representing, *Severely -I could barely stand it.*

Item	Rating			
1.) Numbness or tingling	0	1	2	3
2.) Hands trembling	0	1	2	3
3.) Feeling hot	0	1	2	3
4.) Shaky	0	1	2	3
5.) Wobbliness in legs	0	1	2	3
6.) Fear of losing control	0	1	2	3
7.) Unable to relax	0	1	2	3
8.) Difficulty breathing	0	1	2	3
9.) Fear of the worst happening	0	1	2	3
10.) Fear of dying	0	1	2	3
11.) Dizzy or lightheaded	0	1	2	3
12.) Scared	0	1	2	3
13.) Heart pounding or racing	0	1	2	3

14.) Indigestion or discomfort in abdomen	0	1	2	3
15.) Unsteady	0	1	2	3
16.) Faint	0	1	2	3
17.) Terrified	0	1	2	3
18.) Flushed	0	1	2	3
19.) Nervous	0	1	2	3
20.) Sweating (not due to heat)	0	1	2	3
21.) Feelings of choking	0	1	2	3

Appendix G

Cognitive Failures Questionnaire (adapted from Broadbent et al., 1982)

The following questions are about minor mistakes which everyone makes from time to time, but some of which happen more often than others.

We want to know how often these things have happened to you *in the past 6 months.*

Please use the following scale:

0	1	2	3	4
Never	Very Rarely	Occasionally	Quite Often	Very Often

		Rating
1.	Do you read something and find you haven't been thinking about it and must read it again?	
2.	Do you find you forget why you went from one part of the house to the other?	
3.	Do you fail to notice signposts on the road?	
4.	Do you find you confuse right and left when giving directions?	
5.	Do you bump into people?	
6.	Do you find you forget whether you've turned off a light or a fire or locked the door?	
7.	Do you fail to listen to people's names when you are meeting them?	
8.	Do you say something and realize afterwards that it might be taken as insulting?	
9.	Do you fail to hear people speaking to you when you are doing something else?	
10.	Do you lose your temper and regret it?	
11.	Do you leave important letters unanswered for days?	

12.	Do you find you forget which way to turn on a road you know well but rarely use?	
13.	Do you fail to see what you want in a supermarket (although it's there)?	
14.	Do you find yourself suddenly wondering whether you've used a word correctly?	
15.	Do you have trouble making up your mind?	
16.	Do you find you forget appointments?	
17.	Do you forget where you put something like a newspaper or a book?	
18.	Do you find you accidentally throw away the thing you want and keep what you meant to throw away -- as in the example of throwing away the matchbox and putting the used match in your pocket?	
19.	Do you daydream when you ought to be listening to something?	
20.	Do you find you forget people's names?	
21.	Do you start doing one thing at home and get distracted into doing something else (unintentionally)?	
22.	Do you find you can't quite remember something although it's "on the tip of your tongue"?	
23.	Do you find you forget what you came to the shops to buy?	
24.	Do you drop things?	
25.	Do you find you can't think of anything to say?	

Scoring the Scale

The CFQ was developed by Broadbent et al. (1982) -- yes, the same Broadbent who proposed the filter theory of attention -- to assess the frequency with which people experienced cognitive failures, such as absent-mindedness, in everyday life -- slips and errors of perception, memory, and motor functioning. The most straightforward way to score the scale is simply to sum up the ratings of the 25 individual items, yielding a score from 0-100.

Scores on the scale predict episodes of absent-mindedness in both the laboratory and everyday life, including slow performance on focused attention tasks, traffic and work accidents, and forgetting to save one's data on the computer.

A study by Rast et al. (2008) indicates that the CFQ items load on three different factors. Summing scores across the relevant items will yield subscale scores representing these dimensions of forgetfulness:

◆**Forgetfulness** (Items 1, 2, 5, 7, 17, 20, 22, and 23): "a tendency to let go from one's mind something known or planned, for example, names, intentions, appointments, and words".
◆**Distractibility** (Items 8, 9, 10, 11, 14, 19, 21, and 25): "mainly in social situations or interactions with other people such as being absentminded or easily disturbed in one's focused attention".
◆**False Triggering** (Items 2, 3, 5, 6, 12, 18, 23, and 24): "interrupted processing of sequences of cognitive and motor actions".

Appendix H

Ethics Approval Letter

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

01 October 2021

HREC REF: 482/2021

Prof M Solms
Department of Psychology
PD Hahn Building-UCT
Email: Mark.solms@uct.ac.za
Student: Trnalt001@myuct.ac.za

Dear Prof Solms

PROJECT TITLE: A MIXED METHODS INVESTIGATION OF THE MENTAL ASPECTS OF POST-COVID/LONG COVID FATIGUE (MASTER'S DEGREE - MR ALTAY TURAN)

Thank you for your response letter, addressing the issues raised by the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020: 06 July 2020 & 01 July 2021.

Approval is granted for one year until the 30 October 2022.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Mr Altay Turan will also be involved in this study.

Please quote the HREC REF 482/2021 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE
HREC/REF 482/2021sa

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies
to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical
Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for
Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice
(ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of
the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines.
The Human Research Ethics Committee granting this approval is in compliance with the ICH
Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95)
and FDA Code Federal Regulation Part 50, 56 and 312.

Appendix I

Long Covid Group Questionnaire

* Required Information

Long Covid Online Questionnaire: Consent Form

We are a team of researchers studying the long-term effects of the COVID-19 Virus. The overall purpose of this research is to characterise the mental aspects of fatigue that those with Long Covid present with. This questionnaire seeks to collect important data about your fatigue, emotional state, cognitive levels and understand whether you may have Long Covid symptoms. All mandatory questions only require you to select an option or one-word answer. Additionally, this survey will assess your eligibility for a second phase of research.

It should take a maximum of 35 minutes to complete and it is likely you will finish far sooner. We have inserted break pages between sections for your convenience. You may use these break pages as an opportunity to take a break, or take a break at any point during the survey; as long as you keep the browser tab open, and return to the survey within an hour your data will be retained.

There are risks involved with the questionnaire, as there are questions on mental health that will ask about suicidality, emotional strain, and stress. There are also questions on your overall physical and mental state. Additionally, there are optional open-ended questions where we ask about your Long Covid experience, which may lead to recalling traumatic memories. We have left our email contact at the bottom of this consent form; please email us if you experience distress while answering this questionnaire. We have also inserted links and contacts for mental health advocacy groups that can provide counselling at the end of this form and throughout the questionnaire.

This questionnaire will record some important data for this study, including your demographic information. Additionally, we will need your contact details to send you a de-briefing email, and so that we can recruit you for the second phase of the study if eligible. None of this information will be disclosed to any person outside of this study. At study completion, records shall also be stored in a two-factor authenticated drive, only accessible to researchers.

In the next few days after you complete the survey, you will receive a de-briefing email thanking you for your participation, with a list of support contacts and a reiteration of the rationale of the study, and an invite to participate in the next phase of research if eligible. If you do submit a response on this survey, you will also receive an aggregation of the research findings early next year once the findings have been analysed. After this point, your contact information shall be removed from our database.

To start the survey, please give your consent below, and confirm that you meet the eligibility criteria. This is not binding - you may choose to stop the questionnaire at any time. The next section will then record biographic and

demographic information before beginning the questionnaire. If any of this is unclear, please contact us at the email addresses listed below.
Thank you for your time.

Best
Altay Yuce Turan
Donné Minné
Madeleine Ashton
Arjun Maharaj

Email Contacts:

donneminne.za@gmail.com - Dr Donné Minné

trnalt001@myuct.ac.za - Altay Yuce Turan

Mental Health Referrals:

If you are needing a referral to a psychologist, psychiatrist or support group, we encourage you to call The South African Depression and Anxiety Group (SADAG) on 011 234 4837 or 0800 20 50 26 and speak to a trained counsellor who can assist you further. Or alternatively email Zane on zane@sadag.org

You are also encouraged to email one of the Principal Investigators in this study, Dr Donné Minné, who is a registered neuropsychologist with the HPCSA and who will be able to provide you with a consultation should you be requiring one.

Donneminne.za@gmail.com

(PS 0150380)We would also like to draw your attention to a number of other mental health support resources available to you:

Dr Reddy's Help Line
0800 21 22 23

Cipla 24hr Mental Health Helpline
0800 456 789

Pharmadynamics Police &Trauma Line
0800 20 50 26

Adcock Ingram Depression and Anxiety Helpline
0800 70 80 90

ADHD Helpline
0800 55 44 33

Department of Social Development Substance Abuse Line 24hr helpline
0800 12 13 14
SMS 32312

Suicide Crisis Line
0800 567 567

SADAG Mental Health Line
011 234 4837

Akeso Psychiatric Response Unit 24 Hour
0861 435 787

Cipla Whatsapp Chat Line
(9am-4pm, 7 days a week)
076 882 2775

24 hour Healthcare Workers Care Network Helpline
0800 21 21 21
SMS 43001

NPOWERSA Helpline
0800 515 515
SMS 43010

For affordable counselling, please contact the Counselling Hub

021 462-3902 (landline) or 067 235-0019 (mobile)

For non-appointment enquiries please email info@counsellinghub.org.za

* 1. I confirm that I... (Select all that apply)

☐ Am between the age of 18 and 60 years old

☐ Had a confirmed diagnosis of COVID-19

☐ Am not currently diagnosed with neuropathy, neurological disorders, central nervous system disorders, developmental disorders or cognitive disorders

* 2. I am not currently diagnosed with neuropathy, neurological disorders, central nervous system disorders, developmental disorders or cognitive disorders. Examples of such diagnoses include but are not limited to a diagnosis of: Alzheimer's disease, dementia, brain damage (caused either by a stroke or a traumatic head injury), intellectual disabilities, autism, a recent diagnosis of Major Depressive Disorder, fetal alcohol syndrome, or epilepsy. (Select one option)

☐ Yes

* 3. I have read the above, and I agree to my data and contact information being recorded for the purposes of this study (Select one option)

☐ Yes

☐ No

Biographic Information

* 4. What is your full (legal) name?
   (First name(s) Surname)

_____

5. What is your student number, if applicable? (Necessary for UCT SRPP)

_____

* 6. What is your phone number?

_____

* 7. What is your e-mail address?

_____

* 8. Do you know what test confirmed your COVID-19 diagnosis? (Select one option)

☐ Nose swab

☐ Laboratory test (serotology)

☐ Other (Please specify) _____

* 9. Are you currently taking any of the following medications? (Check all that apply)

☐ I am not taking any medication

☐ Antidepressants (e.g. Zoloft, Prozac, Sarafem, Celexa, Paxil, Brisdelle, Pexeva, Lexapro, Luvox, Viibryd)

☐ Anti-anxiety medication (e.g. Alzam, Azor, Xanax, Zopax, Lexotan)

☐ Allergy medication (e.g. antihistamines)

☐ Blood pressure medication

☐ Other (Please specify) _____

Demographic Information

This section of the questionnaire records some important demographic information - please answer to the best of your ability. All data is strictly confidential.

* **10. How old are you?**

---

* **11. Which of the following best describes your gender? (Select one option)**

☐ Female

☐ Male

☐ Non-Binary

☐ Other (Please specify) _____

* **12. What level of education have you received? (Choose the highest level you have received) (Select one option)**

☐ Preparatory School (Grades 1-7)

☐ High School (Grades 8-12)

☐ Completed or enrolled for an undergraduate degree

☐ Completed or enrolled for a postgraduate degree

☐ Technical course or diploma equivalent

* **13. Are you currently employed? (Select one option)**

☐ Yes

☐ No

* **14. Where do you live? (Select one option)**

☐ Cape Town

☐ Other (Please specify) _____

* 15. What is your estimated monthly household income? (Select one option)

- R0 - R1600
- R1600 - R7500
- R7500 - R17000
- R17000 - R30000
- R30000 - R60000
- R60000+

* 16. What is your home language (Select one option)

- Afrikaans
- English
- isiXhosa
- isiZulu
- Ndebele
- Pedi
- Sotho
- Swati
- Tsonga
- Tswana
- Venda
- Other (Please specify) _____

17. Which languages are you fluent in?

- Afrikaans
- English
- isiXhosa
- isiZulu
- Ndebele
- Pedi
- Sotho
- Swati
- Tsonga
- Tswana
- Venda

☐ Other (Please specify) _____

* **18. Would you like to continue? The next questions will ask about your fatigue and cognition. Keep in mind that you can leave the tab open and return to the survey within an hour and your data will be saved.**

   You are under no obligation to continue if you do not want to. We appreciate your participation.

   (Select one option)

   yes

If you are experiencing any distress while answering the questionnaire, please contact the researchers at the email addresses listed below:

Donné Minné Donneminne.za@gmail.com

Altay Turan trnalt001@myuct.ac.za

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Fatigue Screening Part One

**Please read the statement, and select the most appropriate response.
The first test consists of nine statements that refer to the experience you may
have with fatigue.**

**Please read each statement, consider if it applies to you, and then circle a number
from 1 to 7 according to how accurately you believe it describes your fatigue over
the past seven days, and the extent that you agree or disagree with the
statement's description of your fatigue. A low value (for example, 1) reflects
strong disagreement, whereas a high value (e.g., 7) reflects strong agreement.
You must circle a number for every statement.**

**1 represents strongly disagree, and 7 represents strongly
agree**

19. Select only one answer per question.

	1 (Strongly Disagree)	2	3	4	5	6	7 (Strongly Agree)
*(a) My motivation is lower when I am fatigued.	☐	☐	☐	☐	☐	☐	☐
*(b) Exercise brings on my fatigue.	☐	☐	☐	☐	☐	☐	☐
*(c) I am easily fatigued.	☐	☐	☐	☐	☐	☐	☐
*(d) Fatigue interferes with my physical functioning.	☐	☐	☐	☐	☐	☐	☐
*(e) Fatigue causes frequent problems for me.	☐	☐	☐	☐	☐	☐	☐
*(f) My fatigue prevents sustained physical functioning.	☐	☐	☐	☐	☐	☐	☐
*(g) Fatigue interferes with carrying out certain duties and responsibilities.	☐	☐	☐	☐	☐	☐	☐
*(h) Fatigue is among my most disabling symptoms.	☐	☐	☐	☐	☐	☐	☐
*(i) Fatigue interferes with my work, family or social life.	☐	☐	☐	☐	☐	☐	☐

Fatigue Screening Part Two

**20. The MFIS (Modified Fatigue Impact Scale) is a questionnaire designed to evaluate
how fatigue has affected your experience. Please read the statements, and then
circle the number which best reflects how regularly fatigue has impacted you in
this way, over the past four weeks. Please select ONE response per row**

	Never	Rarely	Sometimes	Often	Almost Always
*(a) I have been less alert.	☐	☐	☐	☐	☐
*(b) I have had difficulty paying attention for long periods of time.	☐	☐	☐	☐	☐
*(c) I have been unable to think clearly.	☐	☐	☐	☐	☐
*(d) I have been clumsy and uncoordinated.	☐	☐	☐	☐	☐
*(e) I have been forgetful.	☐	☐	☐	☐	☐
*(f) I have had to pace myself in my physical activities.	☐	☐	☐	☐	☐
*(g) I have been less motivated to do anything that requires physical effort.	☐	☐	☐	☐	☐
*(h) I have been less motivated to participate in social activities.	☐	☐	☐	☐	☐
*(i) I have been limited in my ability to do things away from home.	☐	☐	☐	☐	☐
*(j) I have trouble maintaining physical effort for long periods.	☐	☐	☐	☐	☐
*(k) I have had difficulty making decisions.	☐	☐	☐	☐	☐
*(l) I have been less motivated to do anything that requires thinking.	☐	☐	☐	☐	☐
*(m) My muscles have felt weak.	☐	☐	☐	☐	☐
*(n) I have been physically uncomfortable.	☐	☐	☐	☐	☐
*(o) I have had trouble finishing tasks that require thinking.	☐	☐	☐	☐	☐
*(p) I have had difficulty organizing my thoughts when doing things at home or at work.	☐	☐	☐	☐	☐
*(q) I have been less able to complete tasks that require physical effort.	☐	☐	☐	☐	☐
*(r) My thinking has been slowed down.	☐	☐	☐	☐	☐
*(s) I have had trouble concentrating.	☐	☐	☐	☐	☐
*(t) I have limited my physical activities.	☐	☐	☐	☐	☐
*(u) I have needed to rest more often or for longer periods.	☐	☐	☐	☐	☐

Cognitive Assessment Part One

The following questions are about minor mistakes which everyone makes from time to time, but some of which happen more often than others.

We would like you to estimate how often these things happened to you *before and after your COVID-19 infection*.

Please use the following scale:

Never – 0
Very Rarely – 1
Occasionally – 2
Quite Often – 3
Very Often – 4

21. Rating Before COVID-19 Infection

	0 (Never)	1 (Very Rarely)	2 (Occasionally)	3 (Quite Often)	4 (Very Often)
*(a) Do you read something and find you haven't been thinking about it and must read it again?					
*(b) Do you find you forget why you went from one part of the house to the other?					
*(c) Do you fail to notice signposts on the road?					
*(d) Do you find you confuse right and left when giving directions?					
*(e) Do you bump into people?					
*(f) Do you find you forget whether you've turned off a light or a fire or locked the door?					
*(g) Do you fail to listen to people's names when you are meeting them?					
*(h) Do you say something and realize afterwards that it might be taken as insulting?					
*(i) Do you fail to hear people speaking to you when you are doing something else?					
*(j) Do you lose your temper and regret it?					
*(k) Do you leave important letters unanswered for days?					
*(l) Do you find you forget which way to turn on a road you know well but rarely use?					
*(m) Do you fail to see what you want in a supermarket (although it's there)?					

	0	1	2	3	4
*(n) Do you find yourself suddenly wondering whether you've used a word correctly?	☐	☐	☐	☐	☐
*(o) Do you have trouble making up your mind?	☐	☐	☐	☐	☐
*(p) Do you find you forget appointments?	☐	☐	☐	☐	☐
*(q) Do you forget where you put something like a newspaper or a book?	☐	☐	☐	☐	☐
*(r) Do you find you accidentally throw away the thing you want and keep what you meant to throw away -- as in the example of throwing away the matchbox and putting the used match in your pocket?	☐	☐	☐	☐	☐
*(s) Do you daydream when you ought to be listening to something?	☐	☐	☐	☐	☐
*(t) Do you find you forget people's names?	☐	☐	☐	☐	☐
*(u) Do you start doing one thing at home and get distracted into doing something else (unintentionally)?	☐	☐	☐	☐	☐
*(v) Do you find you can't quite remember something although it's "on the tip of your tongue"?	☐	☐	☐	☐	☐
*(w) Do you find you forget what you came to the shops to buy?	☐	☐	☐	☐	☐
*(x) Do you drop things?	☐	☐	☐	☐	☐
*(y) Do you find you can't think of anything to say?	☐	☐	☐	☐	☐

22. Rating After COVID-19 Infection

	0 (Never)	1 (Very Rarely)	2 (Occasionally)	3 (Quite Often)	4 (Very Often)
*(a) Do you read something and find you haven't been thinking about it and must read it again?	☐	☐	☐	☐	☐
*(b) Do you find you forget why you went from one part of the house to the other?	☐	☐	☐	☐	☐
*(c) Do you fail to notice signposts on the road?	☐	☐	☐	☐	☐
*(d) Do you find you confuse right and left when giving directions?	☐	☐	☐	☐	☐
*(e) Do you bump into people?	☐	☐	☐	☐	☐
*(f) Do you find you forget whether you've turned off a light or a fire or locked the door?	☐	☐	☐	☐	☐

*(g) Do you fail to listen to people's names when you are meeting them?

*(h) Do you say something and realize afterwards that it might be taken as insulting?

*(i) Do you fail to hear people speaking to you when you are doing something else?

*(j) Do you lose your temper and regret it?

*(k) Do you leave important letters unanswered for days?

*(l) Do you find you forget which way to turn on a road you know well but rarely use?

*(m) Do you fail to see what you want in a supermarket (although it's there)?

*(n) Do you find yourself suddenly wondering whether you've used a word correctly?

*(o) Do you have trouble making up your mind?

*(p) Do you find you forget appointments?

*(q) Do you forget where you put something like a newspaper or a book?

*(r) Do you find you accidentally throw away the thing you want and keep what you meant to throw away -- as in the example of throwing away the matchbox and putting the used match in your pocket?

*(s) Do you daydream when you ought to be listening to something?

*(t) Do you find you forget people's names?

*(u) Do you start doing one thing at home and get distracted into doing something else (unintentionally)?

*(v) Do you find you can't quite remember something although it's "on the tip of your tongue"?

*(w) Do you find you forget what you came to the shops to buy?

*(x) Do you drop things?

*(y) Do you find you can't think of anything to say?

* 23. Would you like to continue?

      The next questions will ask about your emotion and mood. We remind you that you can leave the tab open and return to the survey as there is no time limit.

      You are under no obligation to continue if you do not want to. We appreciate your participation.

      (Select one option)

Yes

If you are experiencing any distress while answering, please contact the researchers at the email addresses listed below:

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Emotional Assessment Part One

This questionnaire has 21 groups of statements. Please read each statement carefully, before selecting out the one statement in each group which most appropriately describes the way you've felt over the past two weeks, including today. If multiple statements apply to your experience, pick the one that has the highest number in the relevant group. Do not choose multiple answers for any group, including item 16 (sleep pattern changes), or item 18 (Changes in Appetite).

* **24. Sadness (Select one option)**

0. I do not feel sad.

1. I feel sad much of the time.

2. I am sad all the time.

3. I am so sad or unhappy that I can't stand it.

* **25. Pessimism (Select one option)**

0. I am not discouraged about my future.

1. I feel more discouraged about my future than I used to.

2. I do not expect things to work out for me.

3. I feel my future is hopeless and will only get worse.

* **26. Past Failure (Select one option)**

0. I do not feel like a failure.

1. I have failed more than I should have.

2. As I look back, I see a lot of failures.

3. I feel I am a total failure as a person.

* **27. Loss of Pleasure (Select one option)**

0. I get as much pleasure as I ever did from the things I enjoy.

1. I don't enjoy things as much as I used to.

2. I get very little pleasure from the things I used to enjoy.

3. I can't get any pleasure from the things I used to enjoy.

* 28. Guilty Feelings (Select one option)

0. I don't feel particularly guilty.

1. I feel guilty over many things I have done or should have done.

2. I feel quite guilty most of the time.

3. I feel guilty all of the time.

* 29. Punishment Feelings (Select one option)

0. I don't feel I am being punished.

1. I feel I may be punished.

2. I expect to be punished.

3. I feel I am being punished.

* 30. Self-Dislike (Select one option)

0. I feel the same about myself as ever.

1. I have lost confidence in myself.

2. I am disappointed in myself.

3. I dislike myself.

* 31. Self-Criticalness (Select one option)

0. I don't criticize or blame myself more than usual.

1. I am more critical of myself than I used to be.

2. I criticize myself for all my faults.

3. I blame myself for everything bad that happens.

* 32. Suicidal Thoughts or Wishes (Select one option)

0. I don't have any thoughts of killing myself.

1. I have thoughts of killing myself, but I would never carry them out.

2. I would like to kill myself.

3. I would kill myself if I had the chance.

* 33. Crying (Select one option)

0. I don't cry any more than I used to.

1. I cry more than I used to.

2. I cry over every little thing.

3. I feel like crying, but I can't.

* 34. Agitation (Select one option)

0. I am no more restless or wound up than usual.

1. I feel more restless or wound up than usual.

2. I am so restless or agitated, it's hard to stay still.

3. I am so restless or agitated that I have to keep moving or doing something.

* 35. Loss of Interest (Select one option)

0. I have not lost interest in other people or activities.

1. I am less interested in other people or things than before.

2. I have lost most of my interest in other people or things.

3. It's hard to get interested in anything.

* 36. Indecisiveness (Select one option)

0. I make decisions about as well as ever.

1. I find it more difficult to make decisions than usual.

2. I have much greater difficulty in making decisions than I used to.

3. I have trouble making any decisions.

* 37. Worthlessness (Select one option)

0. I do not feel I am worthless.

1. I don't consider myself as worthwhile and useful as I used to.

2. I feel more worthless as compared to others.

3. I feel utterly worthless.

* 38. Loss of Energy (Select one option)

0. I have as much energy as ever.

1. I have less energy than I used to have.

2. I don't have enough energy to do very much.

3. I don't have enough energy to do anything.

* **39. Changes in Sleeping Pattern (Select one option)**

0. I have not experienced any change in my sleeping.

1a. I sleep somewhat more than usual.

1b. I seep somewhat less than usual.

2a. I sleep a lot more than usual.

2b. I sleep a lot less than usual.

3a. I sleep most of the day.

3b. I wake up 1-2 hours early and can't get back to sleep.

* **40. Irritability (Select one option)**

0. I am not more irritable than usual.

1. I am more irritable than usual.

2. I am much more irritable than usual.

3. I am irritable all the time.

* **41. Changes in Appetite (Select one option)**

0. I have not experienced any change in my appetite.

1a. My appetite is somewhat less than usual.

1b. My appetite is somewhat greater than usual.

2a. My appetite is much less than before.

2b. My appetite is much greater than usual.

3a. I have no appetite at all.

3b. I crave food all the time.

* **42. Concentration Difficulty (Select one option)**

0. I can concentrate as well as ever.

1. I can't concentrate as well as usual.

2. It's hard to keep my mind on anything for very long.

3. I find I can't concentrate on anything.

* **43. Tiredness or Fatigue (Select one option)**

0. I am no more tired of fatigued than usual.

1. I get more tired or fatigued more easily than usual.

2. I am too tired or fatigued to do a lot of the things I used to do.

3. I am too tired or fatigued to do most of the things I used to do.

* 44. Loss of Interest in Sex (Select one option)

0. I have not noticed any recent change in my interest in sex.

1. I am less interested in sex than I used to be.

2. I am much less interested in sex now.

3. I have lost interest in sex completely.

Emotional Assessment Part Two

45. This questionnaire is designed to measure how you've been feeling over the past week, including today. Please rate how much you have been bothered by each symptom, on a 4-point scale where 0 represents *Not at all,* to 3 representing, *Severely -I could barely stand it.*

	0 (Not at all)	1 (mildly but it didn't bother me much)	2 (Moderately, it wasn't pleasant at times)	3 (Severely, I could barely stand it)
*(a) Numbness or tingling				
*(b) Hands trembling				
*(c) Feeling hot				
*(d) Shaky				
*(e) Wobbliness in legs				
*(f) Fear of losing control				
*(g) Unable to relax				
*(h) Difficulty breathing				
*(i) Fear of the worst happening				
*(j) Fear of dying				
*(k) Dizzy or lightheaded				
*(l) Scared				
*(m) Heart pounding or racing				
*(n) Indigestion or discomfort in abdomen				
*(o) Unsteady				
*(p) Faint				
*(q) Terrified				
*(r) Flushed				

*(s) Nervous	☐	☐	☐	☐
*(t) Sweating (not due to heat)	☐	☐	☐	☐
*(u) Feelings of choking	☐	☐	☐	☐

Emotional Assessment Part Three

46. **Thinking about yourself and how you've felt over the past week, to what extent do you generally feel the following? Rate it on a scale from 1 to 5, where 1 represents never, and 5 always**

	1 (Never)	2	3	4	5 (Always)
*(a) Upset	☐	☐	☐	☐	☐
*(b) Hostile	☐	☐	☐	☐	☐
*(c) Alert	☐	☐	☐	☐	☐
*(d) Ashamed	☐	☐	☐	☐	☐
*(e) Inspired	☐	☐	☐	☐	☐
*(f) Nervous	☐	☐	☐	☐	☐
*(g) Determined	☐	☐	☐	☐	☐
*(h) Attentive	☐	☐	☐	☐	☐
*(i) Afraid	☐	☐	☐	☐	☐
*(j) Active	☐	☐	☐	☐	☐

Emotional Assessment Part Four

47. **The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate your response by selecting the circle that represents HOW OFTEN you felt or thought a certain way.**

	0 (Never)	1 (Almost Never)	2 (Sometimes)	3 (Fairly Often)	4 (Very Often)
*(a) In the last month, how often have you been upset because of something that happened unexpectedly?	☐	☐	☐	☐	☐
*(b) In the last month, how often have you felt that you were unable to control the important things in your life?	☐	☐	☐	☐	☐
*(c) In the last month, how often have you felt nervous and "stressed"?	☐	☐	☐	☐	☐

*(d) In the last month, how often have you felt confident about your ability to handle your personal problems?

*(e) In the last month, how often have you felt that things were going your way?

*(f) In the last month, how often have you found that you could not cope with all the things that you had to do?

*(g) In the last month, how often have you been able to control irritations in your life?

*(h) In the last month, how often have you felt that you were on top of things?

*(i) In the last month, how often have you been angered because of things that were outside your control?

*(j) In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

48. **Would you like to continue? The next questions will ask about your Long Covid experience. Keep in mind that you can leave the tab open and return to the survey as there is no time limit.**
    You are under no obligation to continue if you do not want to. We appreciate your participation. (Select one option)

    Yes

If you are needing a referral to a psychologist, psychiatrist or support group, we encourage you to call The South African Depression and Anxiety Group (SADAG) on 011 234 4837 or 0800 20 50 26 and speak to a trained counsellor who can assist you further. Or alternatively email Zane on zane@sadag.org

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Long Covid is the term used to describe effects of COVID-19 that persist for much longer after the initial illness's period. Usually, people become sick and recover from COVID-19 within 4 weeks, but long COVID-19 symptoms have even been found in patients up to 6 months after the initial infection period. Common symptoms include fatigue, tiredness, and concentration problems. Other symptoms have also been found, such as organ damage, insomnia, and erectile dysfunction.

49. When did you first get infected with COVID-19? Please give the month and year. (If unable to provide the month, please state the year)

---

50. Which of the following best describes the severity of your COVID-19 infection? (Select one option)

☐ I was able to recover at home

☐ I recovered at home, but should've gone to the hospital

☐ I was admitted to hospital care

☐ I received Oxygen therapy at hospital

☐ I was in critical care/ ICU at hospital

☐ Other (Please specify) _____

51. How long were you in hospital for? (Select one option)

☐ I was not hospitalised

☐ Less than 5 days

☐ a week

☐ 2-3 weeks

☐ more than a month

☐ Other (Please specify) _____

* 52. Do you think you are experiencing Long Covid? (Select one option)

☐ Yes

☐ No

* 53. Do you think you may have experienced Long Covid, and then later recovered? (Select one option)

☐ Yes

☐ No

54. If you are currently experiencing Long Covid now, what symptoms do you have?

Please tick all that apply

☐ I am not experiencing any symptoms

☐ Fatigue

☐ Sleeping Problems

☐ Muscle aches and pain

☐ Concentration problems (struggle to concentrate on tasks you could do before COVID-19)

☐ Attention problems

☐ Forgetfulness

☐ Difficulty breathing

☐ You feel like you 'think slower than you used to'

☐ You find it more difficult to think than before your COVID-19 infection

☐ Erectile Dysfunction

☐ Lack of smell/ issues with smell

☐ Lack of taste/ issues with taste

☐ Other (Please specify) _____

55. If you think you recovered from Long Covid, what symptoms did you experience? (if you think you still have Long Covid, please refer to the previous question)

☐ I never experienced any symptoms

☐ Fatigue

☐ Sleeping Problems

☐ Muscle aches and pain

☐ Concentration problems (struggle to concentrate on tasks you could do before COVID-19)

☐ Attention problems

☐ Forgetfulness

☐ Difficulty breathing

☐ You feel like you 'think slower than you used to'

☐ You find it more difficult to think than before your COVID-19 infection

☐ Erectile Dysfunction

☐ Lack of smell/ issues with smell

☐ Lack of taste/ issues with taste

☐ Other (Please specify) _____

56. Do you have any comments to make on your experience with Long Covid?

---

57. Would you be willing for someone who is in close enough proximity to you, who can comment on your changes due to COVID-19, to accompany you to a session at our research lab so that we can improve our understanding of your experience with Long Covid? (Select one option)

☐ Yes

☐ No

Appendix J

Control Group Questionnaire

* **Required Information**

Online Questionnaire: Consent Form

We are a team of researchers studying the long-term effects of the COVID-19 Virus. The overall purpose of this research is to characterise the mental aspects of fatigue that those with Long Covid present with. This questionnaire seeks to collect important data about your fatigue, emotional state, and cognitive levels as a means of comparison with Long Covid participants. If you, or anyone you know believes they have long Covid, please email the researchers so we may recruit you for the long Covid participant group. All mandatory questions only require you to select an option or one-word answer.

It should take a maximum of 35 minutes to complete and it is likely you will finish far sooner. We have inserted break pages between sections for your convenience. You may use these break pages as an opportunity to take a break; as long the browser tab is kept open, and you return to the survey within an hour your data will be retained.

There are risks involved with the questionnaire, as there are questions on mental health that will ask about suicidality, emotional strain, and stress. There are also questions on your overall physical and mental state. We have left our email contact at the bottom of this consent form; please email us if you experience distress while answering this questionnaire. We have also inserted links and contacts for mental health advocacy groups that can provide counselling at the end of this form and throughout the questionnaire.

This questionnaire will record some important data for this study, including your demographic information. Additionally, we will need your contact details to send you a de-briefing email. None of this information will be disclosed to any person outside of this study. At study completion, records shall also be stored in a two-factor authenticated drive, only accessible to researchers.

In the next few days after you complete the survey, you will receive a de-briefing email thanking you for your participation, with a list of support contacts and a reiteration of the rationale of the study. If you do submit a response on this survey, you will also receive an aggregation of the research findings early next year once the findings have been analysed. After this point, your contact information shall be removed from our database.

To start the survey, please give your consent below, and confirm that you meet the eligibility criteria. This is not binding - you may choose to stop the questionnaire at any time. The next section will then record biographic and demographic information before beginning the questionnaire. If any of this is unclear, please contact us at the email addresses listed below.

Thank you for your time.

Best

Altay Yuce Turan
Donné Minné
Madeleine Ashton
Arjun Maharaj

Email Contacts:

donneminne.za@gmail.com - Dr Donné Minné

trnalt001@myuct.ac.za - Altay Yuce Turan

Mental Health Referrals:

If you are needing a referral to a psychologist, psychiatrist or support group, we encourage you to call The South African Depression and Anxiety Group (SADAG) on 011 234 4837 or 0800 20 50 26 and speak to a trained counsellor who can assist you further. Or alternatively email Zane on zane@sadag.org

You are also encouraged to email one of the Principal Investigators in this study, Dr Donné Minné, who is a registered neuropsychologist with the HPCSA and who will be able to provide you with a consultation should you be requiring one.

Donneminne.za@gmail.com

(PS 0150380)We would also like to draw your attention to a number of other mental health support resources available to you:

Dr Reddy's Help Line
0800 21 22 23

Cipla 24hr Mental Health Helpline
0800 456 789

Pharmadynamics Police &Trauma Line
0800 20 50 26

Adcock Ingram Depression and Anxiety Helpline
0800 70 80 90

ADHD Helpline
0800 55 44 33

Department of Social Development Substance Abuse Line 24hr helpline
0800 12 13 14
SMS 32312

Suicide Crisis Line
0800 567 567

SADAG Mental Health Line
011 234 4837

Akeso Psychiatric Response Unit 24 Hour
0861 435 787

Cipla Whatsapp Chat Line
(9am-4pm, 7 days a week)
076 882 2775

24 hour Healthcare Workers Care Network Helpline
0800 21 21 21
SMS 43001

NPOWERSA Helpline
0800 515 515
SMS 43010

For affordable counselling, please contact the Counselling Hub

021 462-3902 (landline) or 067 235-0019 (mobile)

For non-appointment enquiries please email info@counsellinghub.org.za

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* 1. I confirm that I... (Select all that apply)

☐ Am between the age of 18 and 60 years old

☐ Am not currently diagnosed with neuropathy, neurological disorders, central nervous system disorders, developmental disorders or cognitive disorders

☐ Did not have a confirmed diagnosis of COVID-19

☐ Do not suspect that I contracted COVID-19 (IE: had all symptoms but did not confirm diagnosis with lab test)

* 2. I am not currently diagnosed with neuropathy, neurological disorders, central nervous system disorders, developmental disorders or cognitive disorders. Examples of such diagnoses include but are not limited to a diagnosis of: Alzheimer's disease, dementia, brain damage (caused either by a stroke or a traumatic head injury), intellectual disabilities, autism, a recent diagnosis of Major Depressive Disorder, fetal alcohol syndrome, or epilepsy. (Select one option)

☐ Yes

* 3. I have read the above, and I agree to my data and contact information being recorded for the purposes of this study (Select one option)

☐ Yes
☐ No

Biographic Information

* 4. What is your full (legal) name?
(First name(s) Surname)

_____

5. What is your student number, if applicable? (Necessary for UCT SRPP)

_____

* 6. What is your phone number?

_____

* 7. What is your e-mail address?

_____

* 8. Are you currently taking any of the following medications? (Check all that apply)

☐ I am not taking any medication

☐ Antidepressants (e.g. Zoloft, Prozac, Sarafem, Celexa, Paxil, Brisdelle, Pexeva, Lexapro, Luvox, Viibryd)

☐ Anti-anxiety medication (e.g. Alzam, Azor, Xanax, Zopax, Lexotan)

☐ Allergy medication (e.g. antihistamines)

☐ Blood pressure medication

☐ Other (Please specify) _____

Demographic Information

This section of the questionnaire records some important demographic information - please answer to the best of your ability. All data is strictly confidential.

* 9. How old are you?

* 10. Which of the following best describes your gender? (Select one option)

☐ Female

☐ Male

☐ Non-Binary

☐ If unmentioned, Please specify _____

* 11. What level of education have you received? (Choose the highest level you have received) (Select one option)

☐ Preparatory School (Grades 1-7)

☐ High School (Grades 8-12)

☐ Completed or enrolled for an undergraduate degree

☐ Completed or enrolled for a postgraduate degree

☐ Technical course or diploma equivalent

* 12. Are you currently employed? (Select one option)

☐ Yes

☐ No

* 13. Where do you live? (Select one option)

☐ Cape Town

☐ If elsewhere, please specify: _____

* 14. What is your estimated monthly household income? (Select one option)

☐ R0 - R1600

☐ R1600 - R7500

☐ R7500 - R17000

☐ R17000 - R30000

☐ R30000 - R60000

☐ R60000+

* 15. What is your home language (Select one option)

☐ Afrikaans

☐ English

☐ isiXhosa

☐ isiZulu

☐ Ndebele

☐ Pedi

☐ Sotho

☐ Swati

☐ Tsonga

☐ Tswana

☐ Venda

☐ Other (Please specify) _____

16. Which languages are you fluent in?

☐ Afrikaans

☐ English

☐ isiXhosa

☐ isiZulu

☐ Ndebele

☐ Pedi

☐ Sotho

☐ Swati

☐ Tsonga

☐ Tswana

☐ Venda

☐ If unmentioned, Please specify _____

* 17. **Would you like to continue? The next questions will ask about your fatigue and cognition. Keep in mind that you can leave the tab open and return to the surve within an hour and your data will be saved.**

   You are under no obligation to continue if you do not want to. We appreciate your participation.

   (Select one option)

yes

If you are experiencing any distress while answering the questionnaire, please contact the researchers at the email addresses listed below:

Donné Minné Donneminne.za@gmail.com

Altay Turan trnalt001@myuct.ac.za

If you are needing a referral to a psychologist, psychiatrist or support group, we encourage you to call The South African Depression and Anxiety Group (SADAG) on 011 234 4837 or 0800 20 50 26 and speak to a trained counsellor who can assist you further. Or alternatively email Zane on zane@sadag.org

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(PS 0150380)

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For affordable counselling, please contact the Counselling Hub

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For non-appointment enquiries please email info@counsellinghub.org.za

Fatigue Screening Part One

**Please read the statement, and select the most appropriate response.
The first test consists of nine statements that refer to the experience you may have with fatigue.**

Please read each statement, consider if it applies to you, and then circle a number from 1 to 7 according to how accurately you believe it describes your fatigue over the past seven days, and the extent that you agree or disagree with the statement's description of your fatigue. A low value (for example, 1) reflects strong disagreement, whereas a high value (e.g., 7) reflects strong agreement. You must circle a number for every statement.

1 represents strongly disagree, and 7 represents strongly agree

---

18. Select only one answer per question.

	1 (Strongly Disagree)	2	3	4	5	6	7 (Strongly Agree)
*(a) My motivation is lower when I am fatigued.							
*(b) Exercise brings on my fatigue.							
*(c) I am easily fatigued.							
*(d) Fatigue interferes with my physical functioning.							
*(e) Fatigue causes frequent problems for me.							
*(f) My fatigue prevents sustained physical functioning.							
*(g) Fatigue interferes with carrying out certain duties and responsibilities.							
*(h) Fatigue is among my most disabling symptoms.							
*(i) Fatigue interferes with my work, family or social life.							

Fatigue Screening Part Two

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19. The MFIS (Modified Fatigue Impact Scale) is a questionnaire designed to evaluate how fatigue has affected your experience. Please read the statements, and then circle the number which best reflects how regularly fatigue has impacted you in this way, over the past four weeks. Please select ONE response per row

	Never	Rarely	Sometimes	Often	Almost Always
*(a) I have been less alert.	☐	☐	☐	☐	☐
*(b) I have had difficulty paying attention for long periods of time.	☐	☐	☐	☐	☐
*(c) I have been unable to think clearly.	☐	☐	☐	☐	☐
*(d) I have been clumsy and uncoordinated.	☐	☐	☐	☐	☐
*(e) I have been forgetful.	☐	☐	☐	☐	☐
*(f) I have had to pace myself in my physical activities.	☐	☐	☐	☐	☐
*(g) I have been less motivated to do anything that requires physical effort.	☐	☐	☐	☐	☐
*(h) I have been less motivated to participate in social activities.	☐	☐	☐	☐	☐
*(i) I have been limited in my ability to do things away from home.	☐	☐	☐	☐	☐
*(j) I have trouble maintaining physical effort for long periods.	☐	☐	☐	☐	☐
*(k) I have had difficulty making decisions.	☐	☐	☐	☐	☐
*(l) I have been less motivated to do anything that requires thinking.	☐	☐	☐	☐	☐
*(m) My muscles have felt weak.	☐	☐	☐	☐	☐
*(n) I have been physically uncomfortable.	☐	☐	☐	☐	☐
*(o) I have had trouble finishing tasks that require thinking.	☐	☐	☐	☐	☐
*(p) I have had difficulty organizing my thoughts when doing things at home or at work.	☐	☐	☐	☐	☐
*(q) I have been less able to complete tasks that require physical effort.	☐	☐	☐	☐	☐
*(r) My thinking has been slowed down.	☐	☐	☐	☐	☐
*(s) I have had trouble concentrating.	☐	☐	☐	☐	☐
*(t) I have limited my physical activities.	☐	☐	☐	☐	☐
*(u) I have needed to rest more often or for longer periods.	☐	☐	☐	☐	☐

Cognitive Assessment Part One

The following questions are about minor mistakes which everyone makes from time to time, but some of which happen more often than others.

We would like you to estimate how often these things happened to you *before and after the pandemic*.

Please use the following scale:

Never – 0
Very Rarely – 1
Occasionally – 2
Quite Often – 3
Very Often – 4

20. Rating Before Pandemic

	0 (Never)	1 (Very Rarely)	2 (Occasionally)	3 (Quite Often)	4 (Very Often)
*(a) Do you read something and find you haven't been thinking about it and must read it again?	☐	☐	☐	☐	☐
*(b) Do you find you forget why you went from one part of the house to the other?	☐	☐	☐	☐	☐
*(c) Do you fail to notice signposts on the road?	☐	☐	☐	☐	☐
*(d) Do you find you confuse right and left when giving directions?	☐	☐	☐	☐	☐
*(e) Do you bump into people?	☐	☐	☐	☐	☐
*(f) Do you find you forget whether you've turned off a light or a fire or locked the door?	☐	☐	☐	☐	☐
*(g) Do you fail to listen to people's names when you are meeting them?	☐	☐	☐	☐	☐
*(h) Do you say something and realize afterwards that it might be taken as insulting?	☐	☐	☐	☐	☐
*(i) Do you fail to hear people speaking to you when you are doing something else?	☐	☐	☐	☐	☐
*(j) Do you lose your temper and regret it?	☐	☐	☐	☐	☐
*(k) Do you leave important letters unanswered for days?	☐	☐	☐	☐	☐
*(l) Do you find you forget which way to turn on a road you know well but rarely use?	☐	☐	☐	☐	☐
*(m) Do you fail to see what you want in a supermarket (although it's there)?	☐	☐	☐	☐	☐

	0 (Never)	1 (Very Rarely)	2 (Occasionally)	3 (Quite Often)	4 (Very Often)
*(n) Do you find yourself suddenly wondering whether you've used a word correctly?	☐	☐	☐	☐	☐
*(o) Do you have trouble making up your mind?	☐	☐	☐	☐	☐
*(p) Do you find you forget appointments?	☐	☐	☐	☐	☐
*(q) Do you forget where you put something like a newspaper or a book?	☐	☐	☐	☐	☐
*(r) Do you find you accidentally throw away the thing you want and keep what you meant to throw away -- as in the example of throwing away the matchbox and putting the used match in your pocket?	☐	☐	☐	☐	☐
*(s) Do you daydream when you ought to be listening to something?	☐	☐	☐	☐	☐
*(t) Do you find you forget people's names?	☐	☐	☐	☐	☐
*(u) Do you start doing one thing at home and get distracted into doing something else (unintentionally)?	☐	☐	☐	☐	☐
*(v) Do you find you can't quite remember something although it's "on the tip of your tongue"?	☐	☐	☐	☐	☐
*(w) Do you find you forget what you came to the shops to buy?	☐	☐	☐	☐	☐
*(x) Do you drop things?	☐	☐	☐	☐	☐
*(y) Do you find you can't think of anything to say?	☐	☐	☐	☐	☐

21. Rating After/During Pandemic

	0 (Never)	1 (Very Rarely)	2 (Occasionally)	3 (Quite Often)	4 (Very Often)
*(a) Do you read something and find you haven't been thinking about it and must read it again?	☐	☐	☐	☐	☐
*(b) Do you find you forget why you went from one part of the house to the other?	☐	☐	☐	☐	☐
*(c) Do you fail to notice signposts on the road?	☐	☐	☐	☐	☐
*(d) Do you find you confuse right and left when giving directions?	☐	☐	☐	☐	☐
*(e) Do you bump into people?	☐	☐	☐	☐	☐
*(f) Do you find you forget whether you've turned off a light or a fire or locked the door?	☐	☐	☐	☐	☐

*(g) Do you fail to listen to people's names when you are meeting them?

*(h) Do you say something and realize afterwards that it might be taken as insulting?

*(i) Do you fail to hear people speaking to you when you are doing something else?

*(j) Do you lose your temper and regret it?

*(k) Do you leave important letters unanswered for days?

*(l) Do you find you forget which way to turn on a road you know well but rarely use?

*(m) Do you fail to see what you want in a supermarket (although it's there)?

*(n) Do you find yourself suddenly wondering whether you've used a word correctly?

*(o) Do you have trouble making up your mind?

*(p) Do you find you forget appointments?

*(q) Do you forget where you put something like a newspaper or a book?

*(r) Do you find you accidentally throw away the thing you want and keep what you meant to throw away -- as in the example of throwing away the matchbox and putting the used match in your pocket?

*(s) Do you daydream when you ought to be listening to something?

*(t) Do you find you forget people's names?

*(u) Do you start doing one thing at home and get distracted into doing something else (unintentionally)?

*(v) Do you find you can't quite remember something although it's "on the tip of your tongue"?

*(w) Do you find you forget what you came to the shops to buy?

*(x) Do you drop things?

*(y) Do you find you can't think of anything to say?

* 22. Would you like to continue?

   The next questions will ask about your emotion and mood. We remind you that you can leave the tab open and return to the survey as there is no time limit.

   You are under no obligation to continue if you do not want to. We appreciate your participation.

   (Select one option)

Yes

If you are experiencing any distress while answering, please contact the researchers at the email addresses listed below:

Donné Minné Donneminne.za@gmail.com

Altay Turan trnalt001@myuct.ac.za

If you are needing a referral to a psychologist, psychiatrist or support group, we encourage you to call The South African Depression and Anxiety Group (SADAG) on 011 234 4837 or 0800 20 50 26 and speak to a trained counsellor who can assist you further. Or alternatively email Zane on zane@sadag.org

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For non-appointment enquiries please email info@counsellinghub.org.za

Emotional Assessment Part One

This questionnaire has 21 groups of statements. Please read each statement carefully, before selecting out the one statement in each group which most appropriately describes the way you've felt over the past two weeks, including today. If multiple statements apply to your experience, pick the one that has the highest number in the relevant group. Do not choose multiple answers for any group, including item 16 (sleep pattern changes), or item 18 (Changes in Appetite).

* 23. Sadness (Select one option)

0. I do not feel sad.

1. I feel sad much of the time.

2. I am sad all the time.

3. I am so sad or unhappy that I can't stand it.

* 24. Pessimism (Select one option)

0. I am not discouraged about my future.

1. I feel more discouraged about my future than I used to.

2. I do not expect things to work out for me.

3. I feel my future is hopeless and will only get worse.

* 25. Past Failure (Select one option)

0. I do not feel like a failure.

1. I have failed more than I should have.

2. As I look back, I see a lot of failures.

3. I feel I am a total failure as a person.

* 26. Loss of Pleasure (Select one option)

0. I get as much pleasure as I ever did from the things I enjoy.

1. I don't enjoy things as much as I used to.

2. I get very little pleasure from the things I used to enjoy.

3. I can't get any pleasure from the things I used to enjoy.

* 27. Guilty Feelings (Select one option)

0. I don't feel particularly guilty.

1. I feel guilty over many things I have done or should have done.

2. I feel quite guilty most of the time.

3. I feel guilty all of the time.

* 28. Punishment Feelings (Select one option)

0. I don't feel I am being punished.

1. I feel I may be punished.

2. I expect to be punished.

3. I feel I am being punished.

* 29. Self-Dislike (Select one option)

0. I feel the same about myself as ever.

1. I have lost confidence in myself.

2. I am disappointed in myself.

3. I dislike myself.

* 30. Self-Criticalness (Select one option)

0. I don't criticize or blame myself more than usual.

1. I am more critical of myself than I used to be.

2. I criticize myself for all my faults.

3. I blame myself for everything bad that happens.

* 31. Suicidal Thoughts or Wishes (Select one option)

0. I don't have any thoughts of killing myself.

1. I have thoughts of killing myself, but I would never carry them out.

2. I would like to kill myself.

3. I would kill myself if I had the chance.

* 32. Crying (Select one option)

0. I don't cry any more than I used to.

1. I cry more than I used to.

2. I cry over every little thing.

3. I feel like crying, but I can't.

* 33. Agitation (Select one option)

0. I am no more restless or wound up than usual.

1. I feel more restless or wound up than usual.

2. I am so restless or agitated, it's hard to stay still.

3. I am so restless or agitated that I have to keep moving or doing something.

* 34. Loss of Interest (Select one option)

0. I have not lost interest in other people or activities.

1. I am less interested in other people or things than before.

2. I have lost most of my interest in other people or things.

3. It's hard to get interested in anything.

* 35. Indecisiveness (Select one option)

0. I make decisions about as well as ever.

1. I find it more difficult to make decisions than usual.

2. I have much greater difficulty in making decisions than I used to.

3. I have trouble making any decisions.

* 36. Worthlessness (Select one option)

0. I do not feel I am worthless.

1. I don't consider myself as worthwhile and useful as I used to.

2. I feel more worthless as compared to others.

3. I feel utterly worthless.

* 37. Loss of Energy (Select one option)

0. I have as much energy as ever.

1. I have less energy than I used to have.

2. I don't have enough energy to do very much.

3. I don't have enough energy to do anything.

* 38. Changes in Sleeping Pattern (Select one option)

0. I have not experienced any change in my sleeping.

1a. I sleep somewhat more than usual.

1b. I seep somewhat less than usual.

2a. I sleep a lot more than usual.

2b. I sleep a lot less than usual.

3a. I sleep most of the day.

3b. I wake up 1-2 hours early and can't get back to sleep.

* 39. Irritability (Select one option)

0. I am not more irritable than usual.

1. I am more irritable than usual.

2. I am much more irritable than usual.

3. I am irritable all the time.

* 40. Changes in Appetite (Select one option)

0. I have not experienced any change in my appetite.

1a. My appetite is somewhat less than usual.

1b. My appetite is somewhat greater than usual.

2a. My appetite is much less than before.

2b. My appetite is much greater than usual.

3a. I have no appetite at all.

3b. I crave food all the time.

* 41. Concentration Difficulty (Select one option)

0. I can concentrate as well as ever.

1. I can't concentrate as well as usual.

2. It's hard to keep my mind on anything for very long.

3. I find I can't concentrate on anything.

* 42. Tiredness or Fatigue (Select one option)

0. I am no more tired of fatigued than usual.

1. I get more tired or fatigued more easily than usual.

2. I am too tired or fatigued to do a lot of the things I used to do.

3. I am too tired or fatigued to do most of the things I used to do.

* 43. Loss of Interest in Sex (Select one option)

0. I have not noticed any recent change in my interest in sex.

1. I am less interested in sex than I used to be.

2. I am much less interested in sex now.

3. I have lost interest in sex completely.

Emotional Assessment Part Two

44. This questionnaire is designed to measure how you've been feeling over the past week, including today. Please rate how much you have been bothered by each symptom, on a 4-point scale where 0 represents *Not at all,* to 3 representing, *Severely -I could barely stand it.*

	0 (Not at all)	1 (mildly but it didn't bother me much)	2 (Moderately, it wasn't pleasant at times)	3 (Severely, I could barely stand it)
*(a) Numbness or tingling				
*(b) Hands trembling				
*(c) Feeling hot				
*(d) Shaky				
*(e) Wobbliness in legs				
*(f) Fear of losing control				
*(g) Unable to relax				
*(h) Difficulty breathing				
*(i) Fear of the worst happening				
*(j) Fear of dying				
*(k) Dizzy or lightheaded				
*(l) Scared				
*(m) Heart pounding or racing				
*(n) Indigestion or discomfort in abdomen				
*(o) Unsteady				
*(p) Faint				
*(q) Terrified				
*(r) Flushed				
*(s) Nervous				
*(t) Sweating (not due to heat)				
*(u) Feelings of choking				

Emotional Assessment Part Three

45. Thinking about yourself and how you've felt over the past week, to what extent do you generally feel the following? Rate it on a scale from 1 to 5, where 1 represents never, and 5 always

	1 (Never)	2	3	4	5 (Always)
*(a) Upset	☐	☐	☐	☐	☐
*(b) Hostile	☐	☐	☐	☐	☐
*(c) Alert	☐	☐	☐	☐	☐
*(d) Ashamed	☐	☐	☐	☐	☐
*(e) Inspired	☐	☐	☐	☐	☐
*(f) Nervous	☐	☐	☐	☐	☐
*(g) Determined	☐	☐	☐	☐	☐
*(h) Attentive	☐	☐	☐	☐	☐
*(i) Afraid	☐	☐	☐	☐	☐
*(j) Active	☐	☐	☐	☐	☐

Emotional Assessment Part Four

46. The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate your response by selecting the circle that represents HOW OFTEN you felt or thought a certain way.

	0 (Never)	1 (Almost Never)	2 (Sometimes)	3 (Fairly Often)	4 (Very Often)
*(a) In the last month, how often have you been upset because of something that happened unexpectedly?	☐	☐	☐	☐	☐
*(b) In the last month, how often have you felt that you were unable to control the important things in your life?	☐	☐	☐	☐	☐
*(c) In the last month, how often have you felt nervous and "stressed"?	☐	☐	☐	☐	☐
*(d) In the last month, how often have you felt confident about your ability to handle your personal problems?	☐	☐	☐	☐	☐
*(e) In the last month, how often have you felt that things were going your way?	☐	☐	☐	☐	☐
*(f) In the last month, how often have you found that you could not cope with all the things that you had to do?	☐	☐	☐	☐	☐

*(g) In the last month, how often have you been able to control irritations in your life?

*(h) In the last month, how often have you felt that you were on top of things?

*(i) In the last month, how often have you been angered because of things that were outside your control?

*(j) In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

If you are needing a referral to a psychologist, psychiatrist or support group, we encourage you to call The South African Depression and Anxiety Group (SADAG) on 011 234 4837 or 0800 20 50 26 and speak to a trained counsellor who can assist you further. Or alternatively email Zane on zane@sadag.org

You are also encouraged to email one of the Principal Investigators in this study, Dr Donné Minné, who is a registered neuropsychologist with the HPCSA and who will be able to provide you with a consultation should you be requiring one.

Donneminne.za@gmail.com

(PS 0150380)

If you are experiencing any distress while answering, please contact the researchers at the email addresses listed below:

Donné Minné Donneminne.za@gmail.com

Altay Turan trnalt001@myuct.ac.za

We would also like to draw your attention to a number of other mental health support resources available to you:

Dr Reddy's Help Line
0800 21 22 23

Cipla 24hr Mental Health Helpline
0800 456 789

Pharmadynamics Police &Trauma Line
0800 20 50 26

Adcock Ingram Depression and Anxiety Helpline
0800 70 80 90

ADHD Helpline
0800 55 44 33

Department of Social Development Substance Abuse Line 24hr helpline
0800 12 13 14
SMS 32312

Suicide Crisis Line
0800 567 567

SADAG Mental Health Line
011 234 4837

Akeso Psychiatric Response Unit 24 Hour
0861 435 787

Cipla Whatsapp Chat Line
(9am-4pm, 7 days a week)
076 882 2775

24 hour Healthcare Workers Care Network Helpline
0800 21 21 21
SMS 43001

NPOWERSA Helpline
0800 515 515
SMS 43010

For affordable counselling, please contact the Counselling Hub

021 462-3902 (landline) or 067 235-0019 (mobile)

For non-appointment enquiries please email info@counsellinghub.org.za