

Physical activity and coping moderated by depressive symptoms

Bachelor Thesis

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Date: 04.07.2022

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Abstract

Background. Post-COVID is a disease caused by an infection with SARS-CoV-2 if symptoms last for longer than 12 weeks. The current study investigated factors that can aid afflicted individuals of post-COVID with the recovery process, which included and was indicated in the study by the level of physical activity. Emotion-focused and problem-focused coping was considered to correlate with physical activity. The relationship was assumed to be moderated by depressive symptoms.

Method. To examine these assumptions a descriptive cross-sectional study design as well as the three questionnaires IPAQ-SF, Brief-Cope and PHQ-9 were employed. 63 participants ($M_{age} = 35.05$, $SD_{age} = 13.06$, 69.8% women, 28.6% men) were recruited through snowballing and convenience sampling.

Results. Spearman's rank correlation and moderation with PROCESS were used. Neither the correlation analyses ($p = .84$) and ($p = .58$) nor the moderations ($p = .28$) and ($p = .23$) were significant. Participants scored higher than expected on the PHQ-SF and lower than expected on the PHQ-9 achieving 'moderate' scores on both scales.

Discussion. The findings are not consistent with prior research and indicated that there is no correlation between emotion-focused-, problem-focused coping and level of physical activity in this sample. Further the results illustrate that depressive symptoms do not moderate the relationship. The current sample appeared to be healthier than expected and the measurement instruments showed several shortcomings as they were not tailored to the sample. However, the study confirmed previous research concerning the symptoms of post-COVID and demonstrated the participant's perceived ability to cope with stressors.

Keywords: post-COVID, physical activity, emotion-focused coping, problem-focused coping, depressive symptoms, correlation, moderation, descriptive cross-sectional study

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Introduction

On the 11th of March 2020 the World Health Organisation (WHO) announced that the outbreak caused by the virus SARS-CoV-2, causing the disease generally known as COVID-19, can be characterised as a pandemic (euro.who, 2022). For some individuals the illness leads to the newly discovered diseases called ‘post-COVID-19 syndrome’ which will be referred to as post-COVID in this research paper.

Individuals suffering from post-COVID tend to experience significant health issues such as fatigue, shortness of breath or depression (van Kessel et al., 2022; Robert Koch Institute (RKI), 2022). This can lead to difficulties performing physical activities such as vacuuming or going on a walk. Therefore, many sufferers from post-COVID consider even light physical activities as important to gain back their independence and recover (van Roekel et al., 2015). Not much is known about how people engage in their recovery process. However, there are several similarities between post-COVID and chronic illnesses such as CFS (chronic fatigue syndrome) (Wong & Weitzer, 2021). Past studies on chronic illnesses in general and CFS in specific indicate coping styles as an influencing factor on the recovery process of people suffering from chronic illnesses (Jason et al., 2021; Lim & Son, 2020). Additionally depressive symptoms, experienced by many individuals with post-COVID, have been shown to affect physical activity (Bélair et al., 2018; Malik et al., 2021; McIntyre et al., 2019; Schuch et al., 2017) and coping abilities (Dozois & Beck, 2008; Grahek et al., 2019). Thus, the current study will investigate the correlation between coping style and level of physical activity in post-COVID sufferers and the potential moderating effect of depression on this relationship.

Symptomology of post-COVID

Currently, there is no unified clinical profile for post-COVID; however, the British National Institute for Health and Care Excellence (NICE) characterized several symptoms related to post-COVID. Generally, someone suffers from post-COVID if symptoms are still

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present 12 weeks after the initial infection and cannot be explained by an alternative diagnosis (RKI, 2022). Many people are affected by the disease and suffer from its symptoms. As of the 1st of May 2022, in the UK, for example, around 1 440 000 people reported suffering from post-COVID symptoms (Office for National Statistics, 2022).

More specifically, according to current studies, fatigue is the most frequently experienced symptom (van Kessel et al., 2022). This is regularly accompanied by a plethora of other symptoms such as loss of energy, shortness of breath, brain fog, and psychological problems such as depression and anxiety (RKI, 2022). As these symptoms frequently appear in combination, patients are often significantly impaired in their ability to go back to work or lead a social life (Rajan et al., 2021). Furthermore, they report feeling substantially debilitated due to the symptoms of post-COVID, resulting in significantly reduced physical activity (Humphreys et al., 2021).

Physical activity in sufferers of post-COVID

Physical activity is defined by the WHO as “Any bodily movement produced by skeletal muscles that require energy expenditure” (WHO, 2020, p. 1452). Its intensity is determined in Metabolic equivalent of task (MET) and divided into three categories. Light-intensity physical activity (LPA) is any physical activity between 1.5 and 3 METs, such as slow walking or bathing (WHO, 2020). Physical activities classified as moderate-intensity (MPA) fall between 3 and 6 METs and entail walking briskly or raking the yard. Lastly, vigorous physical activity is any activity higher than 6 METs, for example, jogging or running (WHO, 2020; Piercy et al., 2018). Physical activity, in general, has been shown to affect a person’s overall well-being positively. (Woods et al., 2020).

It would thus be important for any person to be physically active. However, as physical activity is challenging for people suffering from post-COVID, it is essential to highlight that light physical activity is sufficient to decrease fatigue and general distress (van Roekel et al., 2015). Importantly, patients themselves have spoken positively about the effects

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that light physical activity can exhibit on their symptoms: “I do the physical things that look after my mental health. So going outside and getting some fresh air looks after my mental health, and it in doing so helps the other symptoms.” (Humphreys et al., 2021). Therefore, light physical activity could prove to be an important factor for post-COVID patients to improve their physical strength, mental health and regain their independence by doing simple house chores such as vacuuming.

Although improved physical activity appears to be a relevant factor in post-COVID sufferers’ recovery, the knowledge on how to increase their physical activity is still limited.

Parallels between post-COVID and CFS

Thus, it appears beneficial to compare conditions with similar symptomology to post-COVID, such as CFS, as a starting point for possible improvements in the help post-COVID sufferers receive (Wong & Weitzer, 2021). CFS and post-COVID sufferers regularly experience difficulties focusing (Jason et al., 2021), fatigue (Jason et al., 2021; Lim & Son, 2020), and reduced daily activities (Wong & Weitzer, 2021).

Due to their resemblance, it might be helpful to consider how sufferers from CFS experience improvements in their symptoms. Various cognitive variables such as self-efficacy beliefs and fear-avoidance have been found to affect symptoms of fatigue and pain. Reducing fear and modifying avoidance behaviour is thus essential to alleviate the debilitating symptoms of CFS (Thompson et al., 2018). Additionally, individuals experiencing CFS have highlighted the ability to re-framing their symptoms or practice mindfulness as important (Cheshire et al., 2021). These diverse techniques to improve their condition can be summarised under the emotion-focused and problem-focused coping styles by Lazarus and Folkman (Kristofferzon et al., 2018; Petrie & Reynolds, 2014).

The cognitive transactional model of stress by Lazarus

Therefore, the two coping strategies that will be taken into consideration as possibly aiding people suffering from post-COVID are problem-focused coping and emotion-focused

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copied. Both are part of the cognitive transactional model of stress developed by Richard Lazarus in 1984. The starting point of this model is a stress response. It results when the individual determines a stressful event as threatening (Ryan, 2013). In the case of illnesses such as CFS, post-COVID, or when experiencing depressive symptoms, the stress response is determined by the appraisal of the perceived threat posed by the symptomology and the internal and external resources available to cope with the illness (Petrie & Reynolds, 2014).

The stress response itself encompasses two types of appraisals. During the primary appraisal, a person decides whether they consider an event stressful or not. The secondary appraisal describes a person's evaluation of their ability to cope with the stressor (Ryan, 2013).

The cognitive transactional model of stress applied to post-COVID

As CFS and post-COVID exhibit several similarities, the cognitive transactional model of stress can also be applied to sufferers of post-COVID. Quotes illustrate that they frequently experience symptoms of post-COVID as stressful. One person, for example, states, "I'd get really anxious because I knew I couldn't string a sentence together or even send a proper email" (Humphreys et al., 2021). Concerning the secondary appraisal, the evaluation of their coping abilities, many sufferers seem to perceive their abilities as insufficient. They indicate, for example, avoiding even light physical activity such as a walk to prevent dealing with burdensome symptoms (Kingstone et al., 2020).

In order to handle these stressful events two different coping styles may be employed. Firstly, problem-focused coping includes actively planning or engaging in behaviour to overcome problems causing distress (Ryan, 2013). This style generally aims to resolve stressful situations or alter the source of stress. This can be achieved, for example, by searching for information on the illness or planning (Petrie & Reynolds, 2014), such as pacing. The second coping strategy outlined in the cognitive transactional model of stress is emotion-focused coping. This strategy encompasses an individual's attempts to regulate the

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emotions caused by the distressing event, which may include positive reframing, acceptance, or permitting oneself to rest (Ryan, 2012) and shifting one's priorities through mindfulness or patience (Humphreys et al., 2021). However, the stressful event of experiencing symptoms of post-COVID might have further implications than prompting individuals to increase their use of coping strategies.

Depressive symptoms as moderator

Symptoms such as depression can directly influence a person's ability to cope and perform physical activities. The reasoning for this connection can be found in the symptomology of depressive symptoms.

Firstly, depressive symptoms cause a decreased physical activity evoked by a lack of motivation and energy. (Deka et al., 2021; Roshanaei-Moghaddam et al., 2009). This has been reported to cause non-adherence to recommended guidelines for physical activity (Deka et al., 2021). For sufferers of post-COVID, this could be applied to the recommendation of pacing. Furthermore, studies have discovered several physiological links between depression and decreased physical activity. Both have been associated with sympathetic nervous system overactivity (Mueller, 2007) and inflammatory markers (Dantzer et al., 2008).

Secondly, depressive symptoms affect an individual's cognitive ability and capacity to use coping strategies. Individuals suffering from a depressive mood have been found to experience deficits in cognitive control due to changes in brain activity. This may cause sufferers to encounter problems with attention, interpretation, and memory (Grahek et al., 2019). Additionally, depressive symptoms have been linked to cognitive distortions such as 'Dichotomous thinking' or 'Catastrophizing' (Dozois & Beck, 2008). Such cognitive impairments can negatively affect a person's ability to effectively use the aforementioned coping strategies in connection with physical activity. They might therefore function as a moderator on the relationship between coping style and level of physical ability.

Present study

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In conclusion, post-COVID can be highly debilitating due to its symptoms such as fatigue, depression, or shortness of breath. For patients, it is important to increase their physical activity level to regain their independence and reduce their symptoms. Problem-focused coping and emotion-focused coping has been described as helpful for sufferers of CFS, a condition with similar symptomology to post-COVID. However, currently, there are no studies linking the two different coping styles to physical activity levels of post-COVID sufferers. Furthermore, past research indicates a moderating effect of depressive symptoms on the relationship as they have been shown to have a negative impact on physical activity and coping mechanisms.

The thesis will thus aim to answer the following research questions (see also Figure 1):

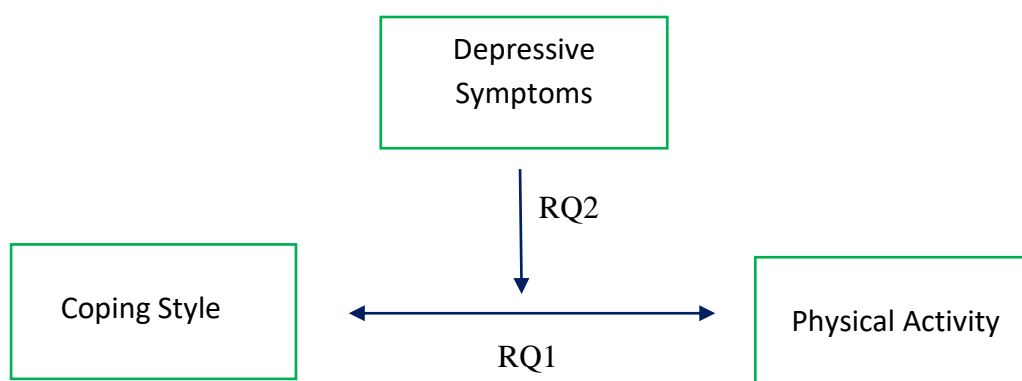
RQ1: To what extent does applying problem-focused or emotion-focused coping

mechanisms correlate with physical activity in people suffering from post-COVID?

RQ2: To what extent are the relationships between problem-focused coping, emotion-focused coping and physical activity moderated by depressive symptoms?

Figure 1

Research Design



Two expectations that will be taken into consideration when answering the first research question:

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Hypothesis 1: Higher scores of problem-focused coping positively correlates with the level of physical activity in individuals suffering from post-COVID.

Hypothesis 2: Higher scores of emotion-focused coping positively correlates with the level of physical activity in individuals suffering from post-COVID.

In regard to the second research question there are two differing hypotheses:

Hypothesis 3: Depressive symptoms moderate the positive relationship between problem-focused coping and physical activity.

Hypothesis 4: Depressive symptoms moderate the positive relationship between emotion-focused coping and physical activity.

Methods

Study design

The study entailed a descriptive cross-sectional design. Three separate questionnaires were used to study the characteristics physical activity, preferred type of coping style and depressive symptoms of the population at a certain point in time. As the study was part of a joint project with multiple researchers, several variables were measured in the survey.

However, they are not relevant for the current study and will thus not be mentioned in this paper. The study was approved by the BMS ethical committee of the University of Twente with the request number 220405.

Participants

Participants were recruited through convenience- and snowball sampling methods by disseminating the survey on various social media platforms. On Instagram the survey was shared in the researchers' story for 24h on three different days. On Reddit the survey was posted multiple times in the subgroups 'r/LongCovid' and 'r/CoronaDeutschland' which are both specifically tailored for post-covid sufferers. Additionally, the survey was disseminated

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via WhatsApp as well as asking friends to further share the survey with their circle of acquaintances.

The inclusion criteria encompassed a probable or confirmed SARS-Cov-2 infection, 12 weeks from the onset of the initial infection with one or more symptoms. Further, participants had to provide informed consent, complete the survey, be at least 18 years of age and report at least one of the symptoms mentioned in the survey. Additionally, as the survey is available in English and German, a good understanding of either of these two languages was required. No compensation was provided to the respondents. Data was collected from the 8th of April 2022 until the 21th of May 2022. In order for the study to reach a power of 95% to detect an effect of 15 % with a significance level of .05, 89 participants were required. This sample was calculated for the moderation analysis with one predictor.

In total 336 participants clicked on the link to the survey with 156 clicks on the German version and 180 clicks on the English version. Participants not fulfilling the inclusion criteria were excluded from the study. Thus, the final sample consisted of 63 participants and did not satisfy the required sample size.

Materials

The study encompassed three questionnaires provided in German and English respectively: The IPAQ (International Physical Activity Questionnaire) short form, the Brief-COPE and the Patient Health Questionnaire (PHQ-9).

The IPAQ – short form

The IPAQ-SF (*International Physical Activity Questionnaire*, 2000) measured the level of participants physical activity concerning the three categories ‘*high*’ achieving between 1500 and 3000 MET-minutes/week, ‘*moderate*’ achieving at least 600 MET-min/week or ‘*low*’ achieving less than 600 MET-minutes/week. The questionnaire included the four items ‘*vigorous*’, ‘*moderate*’, ‘*walking*’ and ‘*sitting*’ with a total of 7 questions. For each item respondents indicated the amount of time they typically undertake a certain physical activity’

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in the last 7 days (Appendix A). MET-scores differentiate between the different levels of physical activity by multiplying the minutes spend on each activity with the factor 8 for vigorous physical activity, 4 for moderate physical activity and 3.3 for low physical activity (Appendix B). The IPAQ-SF was translated and culturally adapted into various different languages, including German (Geisinger, 1994). Through a meta-analysis the test-retest reliability of the IPAQ-SF has been revealed to be moderately high ($r = .74$). The concurrent validity has likewise been demonstrated as moderately high ($r = .72$) (Sember et al., 2020).

The Brief-Cope

An adaptation of the Brief-Cope questionnaire (Carver, 1997) was used to investigate how individuals cope with hardships in their life. The original questionnaire consists of 28 items. Respondents indicated to what extent each item matches their coping style on a 4-point-likerd like scale (1 = *I haven't been doing this at all* and 4 = *I've been doing this a lot*). As individuals suffering from post-COVID frequently experience difficulties focusing for a prolonged period of time several items have been removed from the questionnaire. Two items each for the category self-distraction, denial, substance use, behavioural disengagement and self-blame were excluded, as these concern avoidant coping mechanisms, which out of the scope of this study. The remaining categories thus concern active coping and emotion-focused coping. In total the respondents were asked to fill out a total of 18 items (Appendix D). The questionnaire has been translated into several different languages including German (Knoll et al., 2005). The Brief-Cope is considered to be a well validated questionnaire with an acceptable internal consistency reliability ($\alpha = .61$) (Mohanraj et al., 2016).

The PHQ-9

The PHQ-9 (Kroenke et al., 2001) assessed the level of depressive symptoms of the participants. The scale contained 9 items, evaluated on a 4-point Likert like scale (0 = *not at all* and 3 = *nearly every day*) items include statements such as "*Little interest or pleasure in doing things*" or "*Poor appetite or overeating*". Participants indicated how often they have

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Demographics

The questionnaire concerning demographic data included 9 items. These items concerned the respondents' gender (female, male, other), age and nationality (German, Dutch, Other). Furthermore, the questionnaire included items on the type of diagnosis (positive PCR test, positive Antigen test, assumed infection) and currently experienced symptoms. Lastly it was investigated whether participants had been hospitalised (yes/no), experience physical impairment (yes/no) and the time of initial infection.

Procedure

Participants were directed to a Qualtrics online survey by clicking on the link disseminated through social media. On the first page, the respondents were informed about the aim and length of the survey. This was followed by the informed consent form (Appendix A) which included the researchers contact details, inclusion criteria, purpose of the study, study procedure and information on the confidentiality and anonymity of the participant's collected data. After indicating their understanding of the voluntary nature of the survey and their ability to withdraw at any time participants first filled out the IPAQ-SF, followed by the Brief-Cope, four further questionnaires not relevant for this paper, the PHQ-9 and finally the demographics. The questionnaires were arranged according to their estimated difficulty and a half-way mark was included, in order to facilitate the answering of the survey. The questionnaires were filled out by the participants on their own devices in an environment and at a time of their own choosing. Duration of the procedure was determined to be around 2

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hours on average. This is caused by two participants taking around 66 and 69 hours.

Excluding these outliers, participants needed on average 45 minutes to complete the survey.

Data analysis

Starting the analysis all data was imported from Qualtrics to the statistical program SPSS. The datasets from the German and the English survey were combined into one dataset. Then all cases not meeting the inclusion criteria of having been infected with SARS-CoV-2 more than 12 weeks ago were removed from the dataset. Participants not indicating having any symptoms were discarded. Furthermore, the dataset was examined for potential outliers. A data point was considered an outlier if the z-scores were higher than 2.68 or lower than -2.68. Two outliers were removed. The internal consistencies of the emotion-focused coping and problem-focused coping subscales and the PHQ-9 were examined.

To answer the two research questions the assumption of normality, equal variance of residuals, linearity, independence, homoscedasticity and multicollinearity were tested. Concerning the first research question a Spearman's rank correlation was conducted to determine to what extent emotion-focused coping and problem-focused coping correlate with the level of physical activity. To answer the second research question the moderation analysis via the PROCESS macro v4.1 from Hayes (2022) for SPSS was utilized. The first model was used to calculate the moderation effect of depressive symptoms on the relationship between emotion-focused and problem-focused coping as dependent variable and the level of physical activity as independent variable. Due to the small sample size a bootstrapping of 5000 samples was employed. Through resampling techniques this increases the sample size of 63 through simulated samples to a total dataset of 5000 samples. To assess the statistical significance confidence interval of 95% was used.

Results

Descriptive statistics

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The final sample as seen in Table 1 included 18 men, 44 women and one participant identifying as 'other'. Respondents were mostly from Germany ($n = 39.7\%$) or other countries ($n = 57.1\%$). Participants mostly found out about their SARS-CoV-2 infection via a positive PCR test ($n = 63.5\%$). Frequently reported symptoms of the sample were fatigue or tiredness ($n = 90.5\%$), difficulties concentrating, memory problems and/or confusion ($n = 81\%$) and changes in mood and/or anxiety ($n = 65.1\%$) (Table 2). On average participants experienced 5 out of 10 symptoms ($M = 5.4$, $SD = 1.93$) The maximum amount of symptoms experienced was 9.

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Table 1*Sample characteristics*

Participant characteristics	Frequencies		Descriptive Statistics	
	<i>n</i>	%	<i>M</i>	<i>SD</i>
Age			35.05	13.06
Gender				
Female	44	69.8		
Male	18	28.6		
Other	1	1.6		
Nationality				
German	25	39.7		
Dutch	2	3.2		
Other	36	57.1		
Diagnosis				
positive PCR test	40	63.5		
positive Antigen test	11	17.5		
assumed infection	12	19		
Physical impairments	8	12.7		
Hospitalization	4	6.3		

Note. $N = 63$. Other nationalities included for example American, Canadian or Serbian.

Table 2*Frequencies or descriptive data of symptoms*

Symptoms	Frequencies	
	<i>n</i>	%
Fatigue/tiredness	57	90.5
Cough	16	25.4
Fever and chills	10	15.9
Shortness of breath	42	66.7
Difficulties moving or talking	33	52.4
Loss of taste of smell	17	27
Difficulties concentrating, memory problems and/or confusion	51	81
Pain/Aches or soreness	41	65.1
Changes in mood and/or anxiety	41	65.1
Other symptoms	28	44.4

Note. $N = 63$. Other symptoms includes for example muscle twitching, throat swelling or tinnitus.

The descriptive statistics for the level of physical activity, the problem-focused coping scale, the emotion-focused coping scale and the depressive symptoms are presented in Table 3. Participants in the study performed on average a moderate amount of physical activity per week according to the calculated MET scores. Furthermore, the participants' scores for emotion-focused and problem-focused coping ranked between the 60th and 65th percentile. This indicates that they utilized both coping styles more than 60 - 65% of the normative population. According to the 'Guide for Interpreting PHQ-9 Scores' the participants' scores of depressive symptoms were of moderate severity.

Table 3*Descriptive statistics of the IPAQ-SF, Brief-COPE and PHQ-9*

	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Physical activity in MET-minutes	2439.15	3296.41	0	19404
Problem-focused coping	2.9	.55	1.63	4
Emotion-focused coping	2.44	.4	1.50	3.4
Depressive symptoms	12	6.43	1	27

*Note. N= 63***Internal consistency of Brief-Cope and PHQ-9**

Cronbach's α was utilized to test the internal consistency of the two subscales emotion-focused coping and problem-focused coping of the Brief-Cope questionnaire and of the PHQ-9. The emotion-focused coping subscale indicated an unacceptable internal constancy with a Cronbach's α of .44. This may be caused by several items within the subscale displaying a negative Cronbach's α such as 'getting comfort and understanding from others' correlated with 'finding comfort in religion or spiritual beliefs' with a Cronbach's α of -.32. The problem-focused subscale acceptable with a Cronbach's α of .74. The PHQ-9 had good internal consistency with a Cronbach's α of .84.

Spearman's rank correlation

There was a negative, non-significant correlation between problem-focused coping and the level of physical activity, $r(60) = -.03, p = .84$. There was a negative, non-significant correlation between emotion-focused coping and level of physical activity, $r(60) = -.07, p = .58$. Thus, both hypotheses are rejected.

Moderation testing

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The assumption of normality was violated for the moderation of problem-focused coping on level of physical activity and the moderation of emotion-focused coping on level of physical activity. The bootstrapping of 5000 samples was employed to mitigate the non-normality. Further details of the model can be seen in Table 4.

The moderation analysis measuring the effect of depressive symptoms on the relationship of emotion-focused coping and level of physical activity was not significant ($F(3,59) = 1.3, p = .28, R^2 = .06$). Furthermore, the predictor emotion-focused coping ($B = -2357.56, 95\% \text{ CI } [-6891.74, 6245.47]$), the moderator depressive symptoms ($B = -400.22, 95\% \text{ CI } [-1092.82, 907.19]$) and the interaction term [emCope*dep_sum] ($B = 126.94, 95\% \text{ CI } [-427.36, 425.81]$) did not have a significant effect on the level of physical activity. Therefore, the third hypothesis is rejected.

Additionally, the moderation effect of depressive symptoms on the relationship between problem-focused coping and depressive symptoms was not significant ($F(3,59) = 1.46, p = .23, R^2 = .07$). The predictor problem-focused coping ($B = -2331.97, 95\% \text{ CI } [-5757.17, 1731.54]$) as well as the moderator depressive symptoms ($B = -466.26, 95\% \text{ CI } [-999.58, 91.65]$) and the interaction term [prCope*dep_sum] ($B = 132.59, 95\% \text{ CI } [-84.67, 320.85]$) had a non-significant effect on the level of physical activity. Thus, the fourth hypothesis is rejected.

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Table 4

Moderation effect of depressive symptoms on the relationship between preferred coping style and physical activity

Parameter	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	95% Confidence Interval	
					Lower*	Upper*
					Bound	Bound
Moderation analysis depressive symptoms on problem-focused coping and physical activity						
Intercept	10224.24	4990.58	2.05	.04	-553.46	19934.37
Problem-focused coping	-2331.97	1747.2	-1.33	.19	-5757.17	1731.54
Depressive symptoms	-466.26	297.49	-1.57	.12	-999.58	91.65
Interaction item	132.59	107.06	1.24	.22	-84.67	320.85
Moderation analysis depressive symptoms on emotion-focused coping and physical activity						
Intercept	9288.93	5268.53	1.76	.08	-10668.69	19661.99
Emotion-focused coping	-2357.56	2209.12	-1.07	.29	-6891.74	6245.47
Depressive symptoms	-400.22	413.13	-.97	.34	-1092.82	907.19
Interaction item	126.94	176.12	.72	.47	-427.36	425.81

Notes. *N* = 63. * Statistics from bootstrapping.

Discussion

The study aimed to gain insight into the correlation between problem-focused and emotion-focused coping strategies and the level of physical activity of individuals suffering from post-COVID. The research further focused on the possible moderation effect of depressive symptoms on this correlation. It was hypothesized that problem-focused coping as well as emotion-focused coping positively correlate with the level of physical activity of people experiencing post-COVID and that depressive symptoms moderate both correlations. All hypotheses were found to be non-significant and thus refuted. Notably, participants scored better than expected concerning their level of physical activity and severity of depressive symptoms, which allows for several different hypotheses concerning the non-significant research results.

Unexpectedly health sample

One possible explanation can be found when investigating the IPAQ-SF. Participants in this study received moderate scores ($M = 2439$ MET-min/week). Nevertheless, research would suggest that individuals afflicted with post-COVID would achieve scores within the category 'low' due to symptoms such as fatigue or shortness of breath (Kassel et al., 2022; RKI, 2022). It is possible that participants being physically more active experience less severe symptoms. Therefore, there might be no correlation between the level of physical activity and coping strategies, as participants in this study might not have struggled with physical activity. However, although participants indicated many different complaints, they did not have to add their extent. Hence, this cannot be further investigated.

Another possible explanation for the non-significant results within this sample is portrayed by the moderate level of depressive symptoms with an average score of 12. Previous research found depression as a possible consequence of post-COVID (Malik et al., 2021). Hence, 'moderately severe' symptoms were anticipated within the sample. Although moderate scores demonstrate the existence of some depressive symptoms, it is lower than expected. Thus, the

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participants did not appear to have significant complaints concerning depressive symptoms.

This might explain the lack of moderation of ‘depressive symptoms.’

A potential interpretation for the lower scores in depressive can be found when examining the higher scores in coping strategies. Participants scored higher than average in between the 60th and 65th percentile for using both coping styles. This includes, for example, problem-focused coping mechanisms such as planning as well as emotion-focused coping mechanisms such as acceptance. Both styles have been found to mitigate depressive symptoms (Cong et al., 2021; Uchmanowicz et al., 2016). Using differing coping mechanisms within the sample might thus prevent a heightened level of depressive symptoms. Subsequently, depressive symptoms would not be a prevalent moderator in the relationship.

A second reason, as previously established, could be that participants indicated a higher than expected level of physical activity. Presumably, afflicted individuals in this sample were thus still able to perform moderate levels of physical activity and stay independent in mastering their daily life. The participants might thus not have suffered as much under the typical symptoms of post-COVID or, as inferred previously, might have experienced the symptoms to a lesser extent. Thus, there might not have been any depressive symptoms due to the possible milder symptoms in this sample.

Consequently, the sample in this study might have been healthier than expected, which reduced the importance of coping techniques and decreased the prevalence of depressive symptoms. This might explain the non-significant results found in the current study.

Complications with the measurement instruments

A second reason for the findings may be detected in the measurement instruments used in the study. Considering, for example, the IPAQ-SF, the wording of the questionnaire might have distorted the final scores. Although there are examples of possible physical activities on the first page of the IPAQ-SF, the description of moderate activities in the survey omits specific examples. Instead, it is mentioned that moderate activities cause people to

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breathe ‘somewhat harder’. This description is likely to distort outcomes in this sample, as 66.7% ($n = 42$) of the participants indicate experiencing shortness of breath as part of their symptomology of post-COVID. Additionally, shortness of breath is one of the main complaints of post-COVID sufferers (RKI, 2022). Thus, activities otherwise considered as light physical activity might cause difficulties breathing. For example, interviews conducted by Humphreys et al. (2021) indicate that sufferers of post-COVID feel exhausted after merely changing the bedding. According to the description of the IPAQ-SF, participants might consider these activities as moderate physical effort. This could inflate the final sum score as moderate physical activity is multiplied by a higher factor than light physical activity to compute the MET scores (IPAQ scoring protocol, 2005). It is thus possible that participants achieved a higher level of physical activity by unwittingly indicating light physical activities as moderate. Hence the findings might have been unexpectedly high due to the imprecise wording of the IPAQ-SF.

Another instrument potentially distorting the findings was the Brief-Cope questionnaire. It entailed an emotion-focused and problem-focused coping scale. These two concepts are rather broad, encompassing multiple specific coping techniques (Kristofferzon et al., 2018; Petrie & Reynolds, 2014). Concerning the current study, certain coping mechanisms were used rather frequently. For example, 52.4% ($n = 33$) of participants chose the category ‘I have been doing this a lot’ for the coping mechanisms ‘concentrating one’s efforts on something about the situation’ However, only 7.9 % ($n = 5$) of participants indicated mostly finding comfort in religion or spiritual beliefs. This indicates that the scope of coping mechanisms summarised under the two broader concepts was potentially too wide. Additionally, the coping mechanisms encompassed in this questionnaire are not specific to increasing physical activity. Thus, more specific coping mechanisms might have correlated with physical activity.

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Subsequently, both the vague wording of the IPAQ-SF as well as the two broad and unspecific coping mechanisms of the Brief-Cope might have distorted the findings and thus led to non-significant results.

Strengths and limitations

Although all hypotheses were refuted based on non-significant effects, the current study encompasses a few strengths. As the current study required participants to indicate the symptoms, they are experiencing at the time of filling out the survey. The collected data provided a comprehensive overview of the most frequently experienced symptoms. The thus received information corroborates previous findings indicating that fatigue (90.5%), difficulties concentrating, memory problems and/ or confusion (81%), and shortness of breath (66.7%) are among the most frequently experienced symptoms. Furthermore, the study highlighted that participants use a plethora of different coping styles. This indicates that they feel able to apply different coping mechanisms, although they simultaneously display a wide variety of symptoms ($M = 5$).

Asides from these strengths, the current study also entails several limitations. Concerning the sample, it is essential to note that the requirements to reach a satisfying statistical power ($n = 89$) were not fulfilled. Instead, the sample consisted only of 63 participants. Additionally, the survey was only disseminated via social media. Individuals that do not utilize the platforms used to distribute the survey were thus not reached. Furthermore, the emotion-focused subscale displayed low reliability with a Cronbach's α of .44, which is considered unacceptable. Lastly, the survey was rather long. Participants had to fill out various questionnaires, which might cause them to skip a question. It might also lead to participants losing concentration, especially as they suffer from post-COVID.

Recommendations for future research

Based on the findings and limitations mentioned above, several recommendations can be made for future research.

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The first recommendation concerns the constructs investigated in the study. As indicated previously, the constructs used for coping in the current study were rather broad. It would thus be interesting to investigate more specific coping techniques instead of emotion-focused and problem-focused coping. Coming up with a strategy was one of the most frequently utilised coping mechanisms, with a mean of 3.27 on a 4-point Likert-like scale. Furthermore, learning to live with it ($M = 2.83$) and accepting reality for the fact that it happened ($M = 3.05$), both indicators of the coping technique acceptance, were used frequently by participants. Therefore, investigating concepts such as strategizing or acceptance might add further insight. Additionally, pacing might be an interesting variable to investigate as its use is specifically recommended for individuals afflicted with post-COVID to increase their level of physical activity (Wright et al., 2022).

In this regard, it would be interesting to conduct an in-depth study on perceived coping strategies to understand better which coping mechanisms sufferers find the most helpful in increasing their physical activity. Furthermore, it can allow insight into other moderators than depression, which sufferers consider affecting their process of increasing physical activity levels. Via interviews or through focus groups, rich data on this topic can be collected, and researchers can obtain a clearer idea of possible variables affecting the level of physical activity of afflicted individuals.

The last recommendation refers to the usage of different questionnaires. Instead of the IPAQ-SF, future research could utilise the Baeck physical activity questionnaire. It does not mention the difficulty of breathing as an indicator of the level of physical activity. Lastly, instead of the broad Brief-Cope, future research could employ, for example, employ an acceptance questionnaire and adapt it for post-COVID sufferers.

Conclusion

The current study aimed to investigate the possible correlation between the two different coping styles, emotion-focused and problem-focused coping, and the level of

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physical activity of sufferers from post-COVID. Additionally, it was examined whether depressive symptoms moderate this relationship. No evidence was found neither for the correlations nor for the moderation. Possible explanations are the surprisingly good scores of the sample and the deficiencies in the measurement instruments used. It is recommendable to gain a more in-depth understanding of the specific coping mechanisms used by participants and use different questionnaires more tailored to the participants.

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Appendix A: IPAQ-SF**IPAQ-SF english****INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE****(August 2002)****SHORT LAST 7 DAYS SELF-ADMINISTERED FORMAT****FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)**

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health-related physical activity.

Background on IPAQ

The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.

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Using IPAQ

Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is recommended that no changes be made to the order or wording of the questions as this will affect the psychometric properties of the instruments.

Translation from English and Cultural Adaptation

Translation from English is supported to facilitate worldwide use of IPAQ. Information on the availability of IPAQ in different languages can be obtained at www.ipaq.ki.se. If a new translation is undertaken we highly recommend using the prescribed back translation methods available on the IPAQ website. If possible please consider making your translated version of IPAQ available to others by contributing it to the IPAQ website. Further details on translation and cultural adaptation can be downloaded from the website.

Further Developments of IPAQ

International collaboration on IPAQ is on-going and an ***International Physical Activity Prevalence Study*** is in progress. For further information see the IPAQ website.

More Information

More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at www.ipaq.ki.se and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective*. Research Quarterly for Exercise and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ are summarized on the website.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

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We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

No vigorous physical activities **→** *Skip to question 3*

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

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Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

No moderate physical activities **→** *Skip to question 5*

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

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Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

No walking → *Skip to question 7*

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

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7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

Don't know/Not sure

IPAQ-SF german


INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

SHORT LAST 7 DAYS SELF-ADMINISTERED FORMAT- German Version

Wir sind daran interessiert herauszufinden, welche Arten von körperlichen Aktivitäten Menschen in ihrem alltäglichen Leben vollziehen. Die Befragung bezieht sich auf die Zeit die Sie während der **letzten 7 Tage** in körperlicher Aktivität verbracht haben. Bitte beantworten Sie alle Fragen (auch wenn Sie sich selbst nicht als aktive Person ansehen). Bitte berücksichtigen Sie die Aktivitäten im Rahmen Ihrer Arbeit, in Haus und Garten, um von einem Ort zum anderen zu kommen und in Ihrer Freizeit für Erholung, Leibesübungen und Sport.

Denken Sie an all Ihre **anstrengenden** und **moderaten** Aktivitäten in den **vergangenen 7 Tagen**. **Anstrengende** Aktivitäten bezeichnen Aktivitäten, die starke körperliche Anstrengungen erfordern und bei denen Sie deutlich stärker atmen als normal. **Moderate** Aktivitäten bezeichnen Aktivitäten mit moderater körperlicher Anstrengung bei denen Sie ein wenig stärker atmen als normal.

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1. Denken sie nur an die körperlichen Aktivitäten die Sie für *mindestens 10 Minuten* ohne Unterbrechung verrichtet haben. An wie vielen der **vergangenen 7 Tage** haben Sie **anstrengende** körperliche Aktivitäten wie Aerobic, Laufen, schnelles Fahrradfahren oder schnelles Schwimmen verrichtet? 

_____ **Tage pro Woche**

Keine anstrengende Aktivität (Frage 3)

2. Wie viel Zeit haben Sie für gewöhnlich an *einem* dieser Tage mit **anstrengender** körperlicher Aktivität verbracht?

_____ **Stunden pro Tag**

_____ **Minuten pro Tag**

Ich weiß nicht/ bin nicht sicher

3. Denken Sie erneut nur an die körperlichen Aktivitäten die Sie für *mindestens 10 Minuten* ohne Unterbrechung verrichtet haben. An wie vielen der **vergangenen 7 Tage** haben sie **moderate** körperliche Aktivitäten, wie das Tragen leichter Lasten, Fahrradfahren bei gewöhnlicher Geschwindigkeit oder Schwimmen bei gewöhnlicher Geschwindigkeit verrichtet? Hierzu zählt nicht zu Fuß gehen.

_____ **Tage pro Woche**

Keine moderate Aktivität (↔ Frage 5)

4. Wie viel Zeit haben Sie für gewöhnlich an *einem* dieser Tage mit **moderater** körperlicher Aktivität verbracht?

_____ **Stunden pro Tag**

_____ **Minuten pro Tag**

Ich weiß nicht/ bin nicht sicher

5. An wie vielen der **vergangenen 7 Tage** sind Sie *mindestens 10 Minuten* ohne Unterbrechung **zu Fuß** gegangen? Dieses beinhaltet Gehstrecken daheim oder in der Arbeit, gehen um von einem Ort zu einem anderen zu gelangen, sowie alles andere Gehen zur Erholung, Bewegung oder Freizeit. ➔

_____ **Tage pro Woche** **Keine entsprechenden Wege zu Fuß (Frage 7)**

6. Wie viel Zeit haben Sie für gewöhnlich an *einem* dieser Tage mit **Gehen** verbracht?

_____ **Stunden pro Tag** _____ **Minuten pro Tag**

Ich weiß nicht/ bin nicht sicher

7. Wie viel Zeit haben Sie in den **vergangenen 7 Tagen** an **einem Wochentag** mit **Sitzen** verbracht? Dies kann Zeit beinhalten wie Sitzen am Schreibtisch, Besuchen von Freunden, vor dem Fernseher sitzen oder liegen und auch sitzen in einem öffentlichen Verkehrsmittel.

_____ **Stunden pro Tag** _____ **Minuten pro Tag**

Ich weiß nicht/ bin nicht sicher

Appendix B: Scoring of IPAQ-SF**At A Glance****IPAQ Scoring Protocol (Short Forms)****Continuous Score**

Expressed as MET-min per week: MET level x minutes of activity/day x days per week

*Sample Calculation***MET levels****MET-minutes/week for 30 min/day, 5 days**

Walking = 3.3 METs

$3.3 \times 30 \times 5 = 495$ MET-

minutes/week Moderate Intensity = 4.0 METs $4.0 \times 30 \times 5 = 600$ MET-

minutes/week Vigorous Intensity = 8.0 METs $8.0 \times 30 \times 5 = 1,200$ MET-

minutes/week

TOTAL = 2,295 MET-minutes/week

Total MET-minutes/week = Walk (METs*min*days) + Mod (METs*min*days)

+ Vig(METs*min*days)

Categorical Score- three levels of physical activity are proposed**1. Low**

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- No activity is reported **OR**
- Some activity is reported but not enough to meet Categories 2 or 3.

2. Moderate

Either of the following 3 criteria

- 3 or more days of vigorous activity of at least 20 minutes per day **OR**
- 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day **OR**
- 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET-minutes/week.

3. High

Any one of the following 2 criteria

- Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week **OR**
- 7 or more days of any combination of walking, moderate- or vigorous-intensity activities accumulating at least 3000 MET-minutes/week

Appendix C: Brief-Cope**Brief-Cope English**

When people experience hardship, such as a post-COVID syndrome, they use different strategies to deal with the situation. The following 18 questions ask how you have sought to cope with a hardship in your life. Read the statements and indicate how much you have been using each coping style.

	I haven't been doing this at all	A little bit	A medium amount	I've been doing this a lot
1. I've been concentrating my efforts on doing something about the situation I'm in.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. I've been getting emotional support from others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. I've been taking action to try to make the situation better.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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4. I've been saying things to let my unpleasant feelings escape.
5. I've been getting help and advice from other people.
6. I've been trying to see it in a different light, to make it seem more positive.
7. I've been trying to come up with a strategy about what to do.
8. I've been getting comfort and understanding from someone.
- | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

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9. I've been looking for something good in what is happening.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I've been making jokes about it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I've been accepting the reality of the fact that it has happened.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I've been expressing my negative feelings.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I've been trying to find comfort in my religion or spiritual beliefs.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I've been trying to get	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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advice or help				
from other				
people.				
15. I've been				
learning to live				
with it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I've been				
thinking hard				
about what steps				
to take.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. I've been				
praying or				
meditating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. I've been				
making fun of				
the situation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Brief-Cope German

Brief-COPE Personen die mit schwierigen Situationen wie Long-COVID konfrontiert werden, verwenden verschiedene Bewältigungsstrategien, um mit der Situation umzugehen. Beurteilen Sie bitte, inwiefern die folgenden 18 Aussagen auf Ihr Denken und Handeln in vergangenen unangenehmen oder schwierigen Situationen zutreffen. Bitte machen Sie für jede Aussage eine Angabe.

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	Überhaupt nicht	Ein bisschen	Ziemlich	Sehr
1. Ich habe mich darauf konzentriert, etwas an meiner Situation zu verändern.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Ich habe aufmunternde Unterstützung von anderen erhalten.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Ich habe aktiv gehandelt, um die Situation zu verbessern.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Ich habe meinen Gefühlen freien Lauf gelassen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Ich habe andere Menschen um Hilfe und Rat gebeten.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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6. Ich habe versucht, die Dinge von einer positiveren Seite zu betrachten.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Ich habe versucht, mir einen Plan zu überlegen, was ich tun kann.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Jemand hat mich getröstet und mir Verständnis entgegengebracht.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Ich habe versucht, etwas Gutes in dem zu finden, was mir passiert ist.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. Ich habe Witze darüber gemacht.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. Ich habe mich	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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damit				
abgefunden, dass				
es passiert ist.				
12. Ich habe offen				
gezeigt, wie				
schlecht ich mich	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
fühle.				
13. Ich habe				
versucht, Halt im				
Glauben zu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
finden.				
14. Ich habe				
versucht, von				
anderen				
Menschen Rat	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
oder Hilfe				
einzuholen.				
15. Ich habe				
gelernt, damit zu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
leben.				
16. Ich habe mir				
viele Gedanken				
darüber gemacht,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
was hier das				

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Richtige wäre.

17. Ich habe

gebetet oder

meditiert.

18. Ich habe alles

mit Humor

genommen.

Appendix D: PHQ-9**PHQ-9 English**

The following 9 questions will assess how you felt during the past 2 weeks. How often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Feeling down, depressed, or hopeless.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Trouble falling or staying asleep, or sleeping too much.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Feeling tired or having little energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Poor appetite or overeating.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Feeling bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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about yourself -
or that you are a
failure or have
let yourself or
your family
down.

7. Trouble
concentrating on
things, such as
reading the
newspaper or
watching
television.



8. Moving or
speaking so
slowly that other
people could
have noticed. Or
the opposite
being - so figety
or restless that
you have been
moving around a
lot more than
usual.



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9. Thoughts that you would be better off dead, or of hurting yourself.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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PHQ-9 German

Die folgenden 9 Fragen messen, wie du dich die letzten 2 Wochen gefühlt hast. Wie oft fühlten Sie sich im Verlauf der letzten 2 Wochen durch die folgenden Beschwerden beeinträchtigt?

	Überhaupt nicht	An einzelnen Tages	An mehr als der Hälfte der Tage	Beinahe jeden Tag
1. Wenig Interesse oder Freude an Ihren Tätigkeiten.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Niedergeschlagenheit, Schwermut oder Hoffnungslosigkeit.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Schwierigkeiten ein- oder durchzuschlafen oder vermehrter Schlaf.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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4. Müdigkeit oder Gefühl, keine Energie zu haben.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Verminderter Appetit oder übermäßiges Bedürfnis zu essen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Schlechte Meinung von sich selbst; Gefühl, ein Versager zu sein oder die Familie enttäuscht zu haben.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Schwierigkeiten, sich auf etwas zu konzentrieren, z.B. beim Zeitunglesen oder Fernsehen.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Waren Ihre Bewegungen oder Ihre Sprache so verlangsamt, dass es auch anderen auffallen würde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Oder waren Sie im
Gegenteil „zappelig“
oder ruhelos und
hatten dadurch einen
stärkeren
Bewegungsdrang als
sonst?

9. Gedanken, dass Sie
lieber tot wären oder
sich Leid zufügen
möchten.



Appendix E: Informed consent form**Informed consent form english****Informed Consent - Physical Activity in Post-COVID Patients****Researchers (Bachelor):**

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Researcher (Supervisor):

Gerko Schaap (g.schaap@utwente.nl)

Inclusion Criteria

Only participants with probable or confirmed SARS-Cov-2 infection, usually 12 weeks from the onset of COVID-19 with symptoms that last for at least 8 weeks and cannot be explained by an alternative diagnosis, are eligible for this study.

Purpose of the Study

This study is carried out as part of a bachelor's research project on the physical activity of post-COVID patients. Before you decide to participate in this study, it is essential to know why the research is done and what it will involve. Please read the following information carefully.

Managing physical activity can be difficult for individuals with post-COVID not only because

Physical activity and coping moderated by depressive symptoms of physical symptoms such as fatigue but also because of physiological symptoms that often accompany the syndrome. Therefore, investigating this relationship is important to enabling more informed decision-making in developing interventions or other efforts to facilitate the recovery process of individuals suffering from post-COVID.

If there are any questions, do not hesitate to approach one of the researchers for more information or, if you feel more comfortable talking to a more experienced professional, the supervisor.

Study Procedures

The study consists of seven short questionnaires that need to be filled in. Participation is entirely voluntary, and the procedure can be stopped at any time without giving any reason for it. The questionnaires will take around 20 minutes to complete, and if you feel the need to take a break, you can do so.

Confidentiality

Your response to this survey will be anonymous; the researchers will only know you by a number. Participants' data will be kept confidential except in cases where the researchers are legally obligated to report specific incidents. These incidents include, but may not be limited to, incidents of abuse and suicide risk. Data will be stored safely and no longer than two years before being deleted.

Voluntary Participation

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you choose to participate, you will be asked to accept the statements below. After doing so, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not negatively affect you.

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I understand that my participation is voluntary. I am free to withdraw at any time, without giving a reason and I voluntarily agree to participate in this study.

Informed consent form german

Informationen zur Studienteilnahme und Einverständniserklärung – Physische Aktivität von Corona Langzeit-leidenden

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Supervision:

Gerko Schaap (g.schaap@utwente.nl)

Teilnahmebedingungen

Nur Personen, mit einer vermuteten oder bestätigten SARS-CoV-2 Infektion, die drei Monate nach Beginn der COVID-19 Erkrankung für mindestens zwei Monate Symptome gezeigt haben, die nicht anders erklärt werden können sind zu dieser Studie zugelassen.

Hintergrund und Ziele der Studie

Diese Studie ist Teil eines Bachelor-Projekts in Bezug auf die physische Aktivität von

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Menschen die unter Langzeitfolgen von COVID-19 leiden. Bevor Sie an dieser Studie teilnehmen, ist es wichtig, dass Sie wissen und verstehen, warum diese Nachforschungen betrieben werden und was Sie zu erwarten haben. Bitte lesen Sie den folgenden Absatz besonders sorgsam.

Sich physisch zu betätigen kann grade für Menschen die unter Langzeitfolgen des Corona Virus‘ leiden schwierig sein. Physische Symptome wie Müdigkeit aber auch physiologische Symptome sind oft Teil der Langzeitfolgen. Dementsprechend wichtig ist es die Beziehung der Krankheit zu physischer Aktivitäten zu untersuchen und die Informationsgrundlage für potenzielle Interventionen oder andere Versuche der Heilung und Unterstützung für Langzeitleidende zu erleichtern.

Sollten Sie noch irgendwelche Fragen haben, zögern Sie nicht uns zu kontaktieren. Im Fall, dass Sie lieber mit jemandem sprechen wollen, der mehr Erfahrung hat, kontaktieren Sie gerne den Supervisor.

Ablauf der Studie

Die Studie besteht aus sieben kurzen Fragebögen. Die Teilnahme an dieser Studie ist freiwillig and kann jeder Zeit gestoppt werden, ohne dies begründen zu müssen. Das Ausfüllen der Fragebögen dauert ca. 20 Minuten. Sie können jeder Zeit eine Pause machen und zu einem späteren Zeitpunkt weitermachen.

Diskretion

Ihre Antwort zu den Fragebögen ist anonym und wird nur in Zusammenhang mit einer Nummer einsehbar sein. Die Daten eines jeden Teilnehmers werden vertraulich und diskret behandelt, außer in Fällen, in denen wir dazu legal dazu verpflichtet sind sie zu melden. Das beinhaltet beispielsweise Vorfälle von Missbrauch oder Suizidrisiko und ist nicht darauf

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beschränkt. Ihre Daten werden sicher aufbewahrt und nicht länger als zwei Jahre gespeichert und anschließend gelöscht.

Freiwillige Teilnahme

Die Teilnahme an dieser Studie ist freiwillig und Sie können entscheiden, ob Sie teilnehmen wollen, oder nicht. Falls Sie sich dazu entscheiden teilzunehmen, bitten wir Sie die unten folgenden Aussagen zu bestätigen. Wenn Sie dies getan haben, sind Sie dennoch frei jederzeit aus dieser Studie auszutreten ohne einen Grund dafür angeben zu müssen. Rücktritt von dieser Studie hat keine negativen Konsequenzen für Sie.

- Ich verstehe, dass meine Teilnahme freiwillig ist. Ich verstehe, dass ich frei darin bin diese Studie jederzeit verlassen ohne einen Grund angeben zu müssen und ich stimme freiwillig zu an dieser Studie teilzunehmen.