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# Effects of COVID-19 Confinement on Physical Activity and Health-Related Quality of Life in Rehabilitation Patients

*Veränderungen des Bewegungsverhaltens und der gesundheitsbezogenen Lebensqualität bei Rehasportlern während der Covid-19 Pandemie*

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## Summary

- ▶ **Aim:** This article investigates the influence of the confinement from March 14th, 2020 until mid-May 2020 induced by the Covid-19 outbreak on the exercise behavior of rehabilitation patients and their health-related quality of life (HRQoL).
- ▶ **Methods:** A total of 118 rehabilitation patients completed a fully standardized online survey. The Short Form 12 Health Survey (SF-12) and the International Physical Activity Questionnaire in its short form (IPAQ) was used to assess HRQoL and weekly physical activity (PA) energy expenditure before and during the confinement.
- ▶ **Results:** Vigorous PA decreased by 64.7% ( $p=.001$ ,  $r=.31$ ) during confinement. There was also a decrease in moderate PA of 29.6% ( $p=.017$ ,  $r=.20$ ) and a decrease in total PA of 21.9% ( $p=.001$ ,  $r=.31$ ). Both physical and psychological HRQoL domains changed significantly during the confinement: the value of the physical component scale (PCS) decreased by 14.4% ( $p<.001$ ,  $r=.73$ ), the value of the mental component scale (MCS) by 0.05% ( $p=.018$ ,  $r=.22$ ). Correlation analysis showed significant associations between vigorous PA and PCS value ( $p<.001$ ), and between total PA and PCS value ( $p<.05$ ) during the confinement. There were neither significant relationships between moderate PA and PCS nor between walking and PCS. Furthermore, no correlations between any PA intensities and MCS values were observed.
- ▶ **Conclusion:** The confinement induced a significant decrease of weekly physical activity (PA) energy expenditure, especially vigorous PA, in rehabilitation patients. Both total PA ( $p<.05$ ) and vigorous PA ( $p<.001$ ) show significant positive correlations with the PCS values of the SF-12 questionnaire.

## KEY WORDS:

Vigorous Physical Activity, SF-12, IPAQ, Internal Medicine, Orthopedics, Exercise Therapy, Oncology

## Zusammenfassung

- ▶ **Zielstellung:** Das Ziel der Studie bestand darin, die Veränderungen der körperlichen Aktivität (kA) bei Rehasportlern während der Restriktionen der Covid-19 Pandemie und die Auswirkungen der Situation auf die gesundheitsbezogene Lebensqualität zu erfassen.
- ▶ **Methode:** Insgesamt 118 Rehasportler vervollständigten den standardisierten Fragebogen. Zur Erfassung der Lebensqualität und der kA vor und während der Restriktionen wurde der Short Form (12) Gesundheitsfragebogen (SF-12) und der International Physical Activity Questionnaire (IPAQ) in seiner Kurzversion eingesetzt.
- ▶ **Ergebnisse:** Anstrengende kA verringerte sich während der Restriktionen um 64,7% ( $p=.001$ ,  $r=.31$ ), moderate kA um 29,6% ( $p=.017$ ,  $r=.2$ ) und gesamte kA um 21,9% ( $p=.001$ ,  $r=.31$ ). Sowohl physische als auch psychische Faktoren der gesundheitsbezogenen Lebensqualität veränderten sich während der Restriktionen signifikant: der Mittelwert der körperlichen Summenskala (PCS) verringerte sich um 14,4% ( $p<.001$ ,  $r=.73$ ), der Wert der psychischen Summenskala (MCS) um 0,05% ( $p=.018$ ,  $r=.22$ ). Die Korrelationsanalyse zeigte signifikante Zusammenhänge zwischen der anstrengenden kA und dem PCS-Wert ( $p<.001$ ) und der gesamten kA und dem PCS-Wert ( $p<.5$ ). Es gab keine signifikanten Zusammenhänge zwischen moderater kA und PCS oder zwischen Gehaktivitäten und PCS. Darüber hinaus wurden keine Korrelationen zwischen kA und MCS-Werten beobachtet.
- ▶ **Fazit:** Die Restriktionen beeinflussten das Bewegungsverhalten von Rehasportlern signifikant negativ, insbesondere die anstrengenden kA verringerten sich signifikant. Sowohl die gesamte kA ( $p<.05$ ) als auch anstrengende kA ( $p<.001$ ) korrelieren signifikant positiv mit den Werten der körperlichen Summenskala des SF-12.

## SCHLÜSSELWÖRTER:

Kräftige körperliche Aktivität, SF-12, IPAQ, Innere Medizin, Orthopädie, Bewegungstherapie, Onkologie



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## Introduction

In December 2019, the novel coronavirus caused an outbreak of pneumonia in Wuhan that rapidly spread through China. On January 30, the WHO declared the outbreak to a public health emergency with international concern (33, 35). The novel coronavirus has a strong transmission capacity which causes a rapid spread and makes the control of Covid-19 extremely important (14). Measures to prevent the virus spread such as closing down gyms and other sports facilities altered our normal daily activities and exercise behavior (8). The situation may reduce daily activity levels and increase sedentary behaviors. Physical inactivity and sedentary behaviors are among the most im-

portant risk factors for major morbidity, especially for older people and chronically ill patient populations, who are most at risk of COVID-19-induced mortality (8, 21, 26, 31). The WHO suggested that people stay physically active at home in order to optimize their health status, decrease the negative psychosocial consequences of confinement, and maintain their immune system function (35). Physical activity is defined as any body movement caused by skeletal muscles. It includes any movement in daily life. Physical exercise, on the other hand, is planned, structured and performed repetitively with the aim of improving or maintain physical fitness (7).

Exercise has been shown to have several clear benefits for healthy individuals and for patients with chronic diseases (18, 34). Many studies have shown positive effects of physical activity (PA) on psychological status, such as health-related Quality of Life (HRQoL) (13, 17). The recommendations for cancer patients include the participation in movement therapy at any time to increase psychological parameters like HRQoL, physical parameters and to decrease therapy side effects like fatigue and lymphedema (6, 23, 25). Clinical studies have proven that prehabilitative exercise therapy interventions reduce the post-operative complication rate, accelerate the regeneration phase, and shorten the length of hospital stay (20, 30). During chemotherapeutic treatment PA improves strength (3, 32), reduces symptoms such as fatigue, boosts self-esteem and leads to an improvement in the chemotherapy completion rate (22, 27). There are a few studies which found a positive effect of PA on HRQoL in hypertensive subjects (2, 28) and in adults with type II diabetes (29). For patients with orthopedic disorders the main aim of physical exercise is to counteract dysfunctions and increase pain relief, thereby improving their HRQoL (15).

During the confinement induced by the Covid-19 outbreak rehabilitation sports ordered for individuals during and after their disease were suspended. These circumstances pose significant challenges for remaining physically active. Especially for patients with chronic diseases, who are unsettled under the circumstances of the pandemic, it might pose a huge challenge. This article investigates whether – and if so – to what extent the exercise behavior of rehabilitation patients has changed, and how the situation has affected their HRQoL.

**Material and Methods**

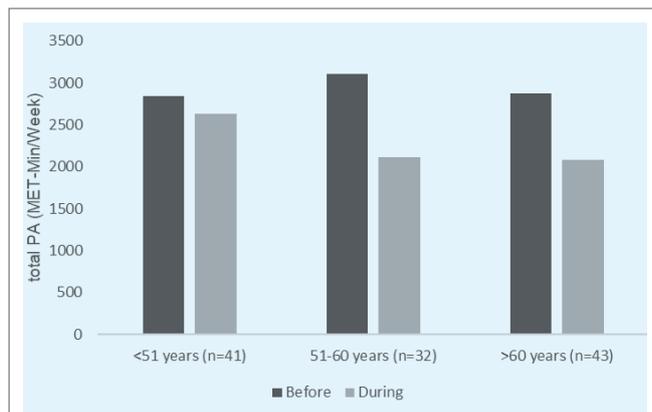
The situation before and during the confinement was recorded retrospectively using a fully standardized and anonymous online questionnaire. The survey period on the platform “soscisurvey” started on 8 May 2020 and ended on 31 May 2020. To collect socio-demographic data, three self-developed questions were required. The International Physical Activity Questionnaire (IPAQ) was used in its short version to record PA. HRQoL was assessed by the Short Form 12 Health Survey (SF-12) (5, 9). Based on the anonymous online survey an ethical approval was not necessary.

**Survey Promotion and Data Privacy**

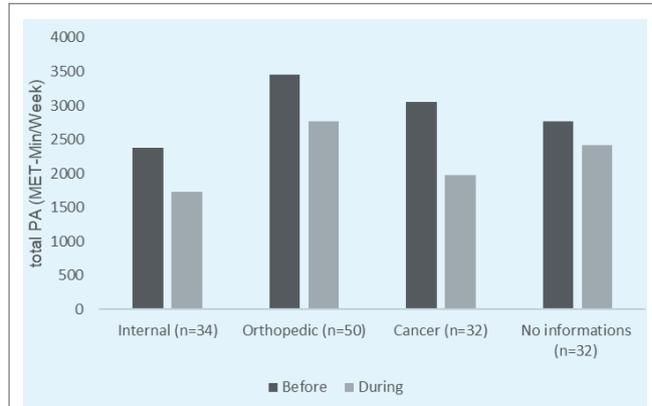
In cooperation with the Association for Health and Rehabilitation Sports at University Hospital Schleswig-Holstein (S-H) e. V., the Rehab and Disabled Sports Association and the State Sports Association of S-H as well as the German Cancer Society, rehabilitation patients were informed about the study via e-mail and asked to complete the questionnaire online. Test persons of all ages with different clinical pictures were recruited. The survey included an introductory page describing the background and aims of the survey. Survey participants were assured all data would be used only for research purposes. Participants’ answers were treated anonymously and confidentially. They were not permitted to provide their names or contact information.

**International Physical Activity Questionnaire Short Form (IPAQ-12)**

The IPAQ questionnaire is an internationally validated measurement tool for recording PA (9). It measures the frequency (days per week), duration (minutes per unit) and intensity level (vigorous, moderate, or walking). Participants are asked to document all PAs at work, at home and during leisure activities, as well PAs on their ways to get from one place to another. Total weekly



**Figure 1**  
Median values in MET-Min/week of total PA related to the disease before and during the confinement



**Figure 2**  
Median values in MET-Min/week of total PA related to the disease before and during the confinement

PA (MET-min/week) was estimated by multiplying the reported time of each intensity level with its specific MET value (walking = 3.3 METs, moderate PA = 4.0 METs and vigorous PA = 8.0 METs, based on IPAQ guideline).

**Short Form 12 Health Survey (SF-12)**

The SF-12 contains 12 questions about physical and mental health, which can be summarized in a physical and psychological sum scale. The physical component scale (PCS) summarizes the subscales physical functioning, physical role function, pain, and general health perception. The mental component scale (MCS) summarizes the questions on the subscales of vitality, social functioning, emotional role function and psychological well-being. A higher SF-12 score indicates a better health condition.

**Data Analysis**

All statistical analyses were performed using Microsoft Excel and SPSS Statistics version 27. Before the evaluation, the total number of data sets (n=227) was checked for completeness and correct completion. Invalid cases were filtered out according to IPAQ and SF-12 guidelines. The data was checked for normal distribution using the Shapiro-Wilk test. Medians and interquartile distances were calculated and documented for the values of the IPAQ questionnaire. Values of the SF-12 questionnaire were calculated as mean ± SD (standard deviation). To show significant differences between the situation before and during the confinement, paired samples Wilcoxon test was used. The effect size r was calculated using the standardized z-values and the sample sizes. The >

Table 1

Demographic characteristics of the participants.

VARIABLES		N	%
Age (years)	<51	41	34.7%
	51-60	32	27.1%
	>60	43	36.4%
	No information	2	1.7%
Disease	Internal disease	34	28.9%
	Orthopedic disease	50	42.3%
	Oncological disease	32	27.1%
	No information	32	27.1%

values were interpreted according to the following criteria: < 0.3 (small), 0.3-0.5 (moderate) and >0.5 (large). Statistical significance was accepted for  $p < 0.05$ .

## Results

### Participants

118 participants were included in the statistical analysis. The demographic data is shown in Table 1. The question about pre-existing conditions allowed several answers.

### Results of the IPAQ-Questionnaire

The positional measures of the metabolic equivalent for the periods before and during the confinement are given in Table 2. While the median activity of walking remained unchanged, the values of vigorous PA, moderate PA and consequently total PA during the pandemic decreased significantly. With regard to the age categories, the results in all 3 categories show a significant decrease in the total PA (<51 years:  $\Delta(\Delta\%) = 220.5$  MET-min/week(7.74%),  $p = .029$ ,  $r = -.23$ , 51-60 years:  $\Delta(\Delta\%) = 986.5$  MET-min/week(31.77%),  $p = .024$ ,  $r = .35$  and >61 years:  $\Delta(\Delta\%) = 801$  MET-min/week (27.81%),  $p = .039$ ,  $r = .27$ ) (cf. Figure 1). The results of the subgroups in relation to the respective disease indicate significant changes during the confinement for internal ( $\Delta(\Delta\%) = 644$  MET-min/week(27.14%),  $p = .024$ ,  $r = .34$ ), orthopedic ( $\Delta(\Delta\%) = 683.5$  MET-min/week(19.8%),  $p = .027$ ,  $r = .27$ ) and oncological diseases ( $\Delta(\Delta\%) = 1073.5$  MET-min/week(35.19%),  $p = .006$ ,  $r = .44$ ) (Figure 2).

### Results of the Short Form 12 Health Survey (SF-12)

The standardized scale values of the physical component scale (PCS) and mental component scale (MCS) at the time before and during the confinement are shown in Table 3. The value of the PCS in the whole sample decreased by 14.4% ( $p < .001$ ,  $r = .73$ ), the value of the MCS by 0.05% ( $p = .018$ ,  $r = .22$ ). The PCS value decreased significantly during the confinement in all subgroups, while the MCS value decreased significantly only in the age category <51 and in the subgroup orthopedic diseases. Correlation analysis showed significant associations between vigorous PA and PCS value ( $p < .001$ ), and between total PA and PCS value ( $p < .05$ ) during the confinement. There were neither significant relationships between moderate PA and PCS nor between walking and PCS. Furthermore, no correlations between any PA intensities and MCS values were observed (Table 4).

## Discussion

As expected, the confinement caused a significant decrease in physical activity. The greatest effects occurred in the vigorous physical activities. This may be explained by two reasons:

(1) the forced sudden inaccessibility to gyms and other sport facilities and

(2) the suspension of professionally supervised training in form of rehabilitation sports groups, and medical training therapy. The participants in this study, 63.5% older than 51 years and 36.4% even older than 60 years, may not be the target group of daily online workout routines promoted by health institutions, fitness centers, the internet or television. Thus, they have not found ways to compensate their regular activities with vigorous intensity. The same applies to activities with moderate intensity, which also decreased significantly during confinement. Regarding the walking activities, our data did not show any significant changes. This could be attributed to the fact that the measures to control the virus in Germany did not prohibit the movement outside and people may have used their time for long distanced walks outside. In all subgroups similar results were obtained in terms of age and disease pattern.

These findings raise the question to what extent the intensity and energy expenditure of the activity influence physical and psychological measures. In a meta-analysis by Samitz et al. (2011) of 80 cohort studies and a total of 1.3 million subjects the reduction in mortality risk was greatest for increments of vigorous PA and smaller for moderate PA of daily living as well as for walking activities (24). Each additional hour of intensive physical activity reduced the risk of mortality by 9% while each hour of moderate activity only by 4%. Especially older people seem to benefit more from additional activity than younger people.

Another study shows that walking speed compared to walking volume is a stronger independent predictor of all-cause mortality (48% versus 26% risk reduction) (11). Further, the intensity of PA seems to play a major role in the reduction of all-cause mortality. But does it also play a major role regarding the effectiveness of PA on the HRQoL? There are several studies investigating the impact of PA on HRQoL in diverse populations. However, there are hardly any that refer to domain-specific PA. Some of them examined the differences between leisure-time PA and transportation and domestic PA. They found positive correlations between leisure-time PA and HRQoL whereas transportation/ domestic PA was inversely related to HRQoL (16).

In our study we observed a strong positive correlation between vigorous PA and PCS value ( $p < .001$ ) during confinement, while there were no correlations found between moderate PA and PCS as well as between walking activities and PCS. In particular, the decrease in vigorous PA seems to have a negative impact on physical components such as pain perception and physical functioning. This results confirm with recent studies showing a significant reduction in physical activity (1, 36) and revealing an increase psychological burden triggered by social distancing and the home confinements (19).

Compared to the German norm sample with current or chronic diseases, taken from the SF-12 Manual, (5), our total population and all subgroups show significantly higher initial PCS values. Moreover, our study reached highly active people – some were far more active than recommended by the WHO. The selected sample is made up of a collective, which is probably extremely interested in sports and physical activity. However, there are a lot of people who move far less than our sample. The 2018 DKV (German Health Insurance) report shows that less than half of the Germans have moved sufficiently (10). Compared to previous years, this tendency continues. Although the WHO minimum activity guidelines are only 150 minutes of moderate or 75 minutes of intensive physical activity per week, more than half of the Germans (57%) do not manage to achieve this in their professional and private daily lives. It can be assumed that the population of chronically ill people moves far less than our sample. It is likely that the confinement caused by the pandemic has had a substantially greater effect

Table 2

MET-Min/week results expressed in median values (interquartile range) for vigorous, moderate PA as well as for walking and total PA recorded before and during confinement. \*the difference is significant at the alpha error level of 5% (1-sided).

	BEFORE CONFINEMENT	DURING CONFINEMENT	Δ(Δ%)	P	EFFECT SIZE
Walking [MET-min/week]	693 (1188)	693 (1188)	0 (0%)	.491	
Moderate PA [MET-min/week]	480 (750)	290 (800)	190 (-39.6%)	.017*	.20
Vigorous PA [MET-min/week]	1360 (1680)	480 (1710)	880 (-64.7%)	.001*	.31
total PA [MET-min/week]	2864 (2476)	2238 (2884)	626 (-21.9%)	.001*	.31

Table 3

Means±standard deviation of the standardized scale values of the physical (PCS) and mental component scale (MCS) before and during confinement.

	SF-12 COMPONENT SCALE	N	BEFORE CONFINEMENT	DURING CONFINEMENT	Δ(Δ%)	P	EFFECT SIZE
Overall group	PCS	118	48.72±9.39	41.68±6.5	7.02 (14.4%)	<.001*	.73
	MCS	118	51.22±7.75	48.47±10.39	2.75 (5.4%)	.018*	.22
<51	PCS	41	51.3±8.02	42.78±5.29	8.52 (16.61%)	<.001*	.77
	MCS	41	49.69±7.7	45.9±10.76	3.79 (7.63%)	.035*	.28
51-60	PCS	32	49.66±8.28	42.84±5.36	6.82 (13.73%)	<.001*	.71
	MCS	32	50.59±8.33	49.2±9.72	1.39 (2.75%)	.31	
>61	PCS	43	45.47±10.75	39.93±7.97	5.52 (12.18%)	<.001*	.67
	MCS	43	53.13±7.27	50.8±10.21	2.33 (4.39%)	.124	
Internal disease	PCS	34	44.62±11.77	38.68±8.12	5.94 (13.31%)	<.001*	.68
	MCS	34	52.25±8.22	50.71±10.16	1.52 (2.95%)	.09	
Orthopedic disease	PCS	50	45.3±9.64	40.86±7.3	4.44 (9.8%)	<.001*	.61
	MCS	50	51.02±8.28	46.97±11.36	4.05 (7.94%)	.005*	.36
Cancer	PCS	32	46.91±9.49	40.69±6.0	6.22 (13.26%)	<.001*	.63
	MCS	32	50.62±8.74	49.33±10.27	1.29 (2.55%)	.45	

Table 4

Correlation coefficient Spearman's Rho showing the strength of the association between PA and SF-12 values during confinement. \*p<0.05 \*\*p<0.001 (2-sided).

	VIGOROUS PA (MET-MIN/WEEK)	MODERATE PA (MET-MIN/WEEK)	WALKING (MET-MIN/WEEK)	TOTAL PA (MET-MIN/WEEK)
PCS	.252**	.136	.027	.211*
MCS	.007	.054	-.095	-.066

on the patients' movement behaviors. The already initial lack of movement has probably been exacerbated by the pandemic. However, physical activity has positive effects on physical and mental health, even in times of this pandemic. It is recommended to stay physically active during the pandemic, for example to stabilize the immune system to be better prepared to deal with the infection (4). In addition, it can be assumed that overall, the participants have claimed higher values because of social desirability. As a matter of fact, participants might have moved less. A further limitation is given by reaching participants online. It excludes those with limited access or internet aversion which might be especially common among older people. Moreover, additional research with a larger sample size is necessary to confirm our conclusion among different populations using representative samples.

### Conclusion

In conclusion, the current study has shown that the confinements of the Covid-19 pandemic induce a significant decrease of weekly PA energy expenditure, especially vigorous PA, in all age groups and patients with different diseases. We can conclude that there is a correlation between PA and perceived HRQoL during the

confinement period. These findings support the latest guidelines issued by the WHO advising people to stay active to counteract the negative effects of confinement. Furthermore, it is important to develop strategies to keep older and ill people active even in such a crisis. The results underline the urgent need of not only scientific recommendations but also exercise interventions that reach the target group of the elderly and people with pre-existing conditions (12). However, based on the limitations of the study further research in this field is of great importance to investigate the impact of the Covid-19 pandemic on physical activity, but also on physical and mental health in detail. In particular, the long-term effects of the pandemic should be central for further research. It can be assumed that the increased inactivity during the pandemic will have significant consequences on public health, such as an increased risk of several chronic diseases. Moreover, the strong decline in vigorous PA and the significantly positive correlation to the PCS demonstrate the need of future studies. Not only total PA but also domain-specific PA levels should be investigated in order to get more comprehensive insight the relationship between PA and HRQoL. ■

### Conflict of Interest

The authors have no conflict of interest.

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