Available Online at www.e-iph.co.uk
Indexed in Clarivate Analytics WoS, and ScienceOPEN

E-B Environment - Behaviour Proceedings Journal

AicQoL2024KotaKinabalu

https://www.amerabra.org

e-IPH e-International Publishing House Ltd., United Kingdom

12th AMER International Conference on Quality of Life
The Magellan Sutera Resort, Kota Kinabalu, Malaysia, 26-28 Jan 2024

Recovery in Physical Function, Fatigue and Quality of Life in Post-Mild COVID-19 Infection

Mohd Nazeri Kamarudin[1,2], Muhammad Amin Ibrahim[3], Li Whye Cindy Ng[4,5], Fatim Tahirah Mirza[1*]
**Corresponding Author*

[1] Centre for Physiotherapy Studies, Faculty of Health Sciences, Universiti Teknologi MARA (UiTM) Selangor, Malaysia,
[2] Physiotherapy Unit, Hospital Al-Sultan Abdullah (HASA), UiTM Selangor, Malaysia,
[3] Hospital KPJ Selangor, Malaysia,
[4] Department of Physiotherapy, Singapore General Hospital,
[5] Health and Social Cluster, Singapore Institute of Technology, Singapore.

mnazeri@uitm.edu.my, dr.muhd.amin@gmail.com, cindy.ng.l.w@sgh.com.sg, fatim_mirza@uitm.edu.my
Tel: +601 6323 5172

Abstract
Mild COVID-19 patients are either asymptomatic or present with mild respiratory symptoms, but as high as 5-10% may experience prolonged symptoms. Insufficient knowledge on mild-COVID-19 recovery poses uncertainties among healthcare professionals and patients, potentially causing treatment delays and may lead to a cluster of people not recovering from post-COVID-19 infection. This study aims to determine changes in respiratory symptoms, physical function, dyspnoea and fatigue, and Quality of Life in mild COVID-19 patients up to 3 months after the onset of symptoms. The results showed significant improvements in all outcomes at 3 months, but the scores were below normal.

Keywords: Physical function; Post-mild COVID-19; Quality of life; Recovery

DOI: https://doi.org/10.21834/e-bpj.v9i27.5719

1.0 Introduction

The coronavirus disease outbreak in December 2019 (COVID-19) began in China and rapidly spread worldwide. On March 11, 2020, the World Health Organization declared the COVID-19 outbreak a global pandemic. After three years, the COVID-19 crisis has transitioned towards its endemic phase, where the trend of moderate to severe cases has been lowered, suggesting the effectiveness of vaccination programs worldwide in achieving vaccine-induced herd immunity. In 2023, the number of new COVID-19 cases in Malaysia was, on average, 700/day in June and 3000/day in December. Although the number of new cases doubled in December, it is essential to note that patients requiring hospital admission were 216 (31%) in June and 246 (8%) in December (Ministry of Health Malaysia, 2023). This data suggested that more than 90% of those infected with COVID-19 today are in the mild category (i.e., not requiring hospital admission).

In mild COVID-19, infected people are either asymptomatic or develop mild respiratory symptoms such as fever, cough, fatigue, malaise, and breathlessness. To date, the management for those infected with mild COVID-19 only includes house surveillance orders (HSO) and self-monitoring (Ministry of Health Malaysia, 2022). No monitoring from healthcare professional was provided during their

DOI: https://doi.org/10.21834/e-bpj.v9i27.5734

acute infection, and no follow-ups were offered post-infection. This is despite some, especially those with chronic comorbid conditions or older age, experiencing persistent symptoms. It has been estimated that approximately 5–10% of the people infected with mild COVID-19 experience prolonged symptoms (Crook et al., 2021; Greenhalgh et al., 2020).

Post-mild COVID-19 patients are usually expected to return to work as soon as their HSO ends, with no assessment taken on whether these patients have recovered from their acute infection and are fit to work. Hence, the aims of this study were i) to determine the physical function, dyspnoea and fatigue symptoms, and Quality of Life (QoL), and ii) to identify changes in physical function, dyspnoea and fatigue symptoms, and Quality of Life (QoL) of mild COVID-19 patients up to 3 months after the onset of their COVID-19 symptoms.

2.0 Literature review

The COVID-19 outbreak has been transitioned to endemic and can be classified into five categories based on the presentation of the symptoms in each individual (Jebril, 2020). A recent meta-analysis of 6375 patients showed that almost 60% of the study participants were under mild infection (Ng et al., 2022). Initial symptoms include fever, cough, fatigue, and breathing difficulties, which are common across the severity of the infection, and in certain individuals, they remain asymptomatic. However, during the recovery, impairments in physical functionality (endurance and strength), body system function (fatigue and dyspnoea), and mental function (anxiety) were commonly present and, in continuity, may influence the quality of life among the COVID-19 survivor (Badinlou et al., 2023), or in some instances, the symptoms tend to worsen over the time if they are not adequately monitored.

The recovery process from COVID-19 involves distinct phases influenced by the impairment presented. Following this consideration, a classification for post-COVID-19 symptoms was proposed. The proposal includes the Transition Phase, symptoms linked to acute COVID-19 that last for four to five weeks; the acute post-COVID-19 phase, symptoms may be persistent from five to 12 weeks, long-post-COVID-19; symptoms extending from week 12 to week 24 and persistent-post-COVID-19; symptoms lasted beyond 24 weeks (Fernández-De-las-peñas et al., 2021). According to this information, the calculated timeline is essential to ensure a comprehensive and staggered monitoring process, allowing for evaluating the progress of recovery and minimising the risk of complications. To better understand each symptom, guidelines for post-COVID-19 assessment were recommended using specific outcome measures (BTS, 2020; Ministry of Health Malaysia, 2021). For a comprehensive evaluation of symptoms (dyspnoea and fatigue), modified Medical Research Council (mMRC) for dyspnoea and Fatigue Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) was proposed in evaluating the level of dyspnoea and fatigue. The physical function is evaluated using a simple six-minute walk test (6MWT) to evaluate the exercise capacity and a one-minute sit-to-stand test (1MSTST) to evaluate the lower limb endurance strength in providing status of musculoskeletal current status and improvement. As for the quality of life, EuroQoL 5 Dimension 5 Level (EQ-5D-5L) is recommended for assessing the impact of COVID-19 infection on quality of life and providing a holistic perspective for individuals recovering from COVID-19 infections. However, there are no clear clinical guidelines for managing mild COVID-19 individuals except for house isolation and self-monitoring (Ministry of Health Malaysia, 2021), even though evidence shows mild COVID-19 individuals may experience prolonged symptoms.

With limited information on the recovery of mild COVID-19 patients, there is uncertainty among healthcare professionals about whether to call these patients for post-acute infection assessment, as well as among patients on whether they need to seek medical help or wait for the symptoms (if present) to disappear. If treatment is needed, but no proper follow-up is done, this knowledge gap may cause a delay in delivering the required treatment to these patients and consequently lead to a cluster of people who did not recover post-COVID-19 infection.

3.0 Methodology

3.1 Study design and ethical consideration

This is a prospective consecutive cohort study of the healthcare workforce at Hospital Al-Sultan Abdullah (HASA) infected with mild COVID-19 between June and December 2022. Patients were assessed at 1-week post onset of symptom (range 8 to 10 days) at t_1, four weeks (range 4 to 5 weeks) at t_2, and 12 weeks (range 12 to 13 weeks) at t_3. Assessments include a respiratory symptoms checklist (Ministry of Health Malaysia, 2021), the six-minute walk test (6MWT) and 1 min Sit-to-Stand Test (1MSTST) for exercise capacity, the modified Medical Research Council Scale (mMRC) for dyspnoea, FACIT-F for fatigue and EQ-5D-5L for health-related Quality of Life (HRQOL). This study was approved by the Human Research Ethics Committee of Universiti Teknologi MARA (REC/06/202[ST/FB/6]) and HASA (200 – HUiTM [TPK 3/1]), and all participants gave written informed consent.

3.2 Participants

Potential participants were invited to participate in the study during their house surveillance orders (HSO). A text explaining the purpose and design of the study was sent to the registered mobile number in the HASA Occupational, Safety, and Health (OSH) list of healthcare workers under HSO due to COVID-19 infection by the UiTM OSH officer. Those interested in participating in this study were then given an appointment with the Principal Investigator (MNK) between 2-3 days upon returning to work (i.e., between 8-10 days after onset of symptoms).

3.3 Measurements

Demographic data were collected from the participants at the first session (t_1). Respiratory symptoms, physical function (6MWT and 1MSTST), dyspnoea and fatigue symptoms and HRQOL were measured three times at t_1, t_2 and t_3, and the sequence of assessments was arranged for participants to have proper rest between two physical tests.

For physical function assessment, the 6-minute walk test (6MWT) was conducted according to international guidelines (Holland et al., 2014) with a modified track length of 20m (Klein et al., 2021) due to space constraints. Participants were instructed to walk briskly, covering as much distance as possible within 6 minutes and allowed to rest if necessary. The distance covered was reported during each session. The 1-minute sit-to-stand test (1MSTST) involved participants transitioning between sitting and standing for 60 seconds using a standard (45 cm high) chair without armrests. The arms were folded across the chest, and the number of transitions performed within the allotted time was recorded, with participants allowed to rest if necessary and no verbal encouragement provided (Mirza et al., 2020).

The modified Medical Research Council (mMRC) dyspnoea scale assessed functional limitations resulting from dyspnoea. This scale comprises five statements, each assigned a grade ranging from zero to four. The participant selects the statement that best describes their limitation level in daily activities due to breathlessness (Celli et al., 2004).

Fatigue symptoms were assessed using the FACIT-F (Hartung et al., 2022). The questionnaire consists of 13 items related to fatigue, and participants were required to self-evaluate all the items by choosing between "not at all" to "very much," which later converted to a score of zero to four. With a maximum score of 52, the lower score indicates greater fatigue.

HRQOL was examined using the EuroQoL 5 Dimension 5 Level (EQ-5D-5L). The questionnaire consists of five questions that include five dimensions of HRQOL: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each score in every dimension is then transformed into a numerical scale ranging from -0.59 (worst possible health state) to 1 (best possible health state) (Garratt et al., 2023) and general health was also evaluated by scoring the visual analogue scale (VAS) from zero to one hundred; higher score represents greater health (Sullivan et al., 2020).

3.4 Data Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences software (SPSS version 29, SPSS Inc., Chicago, IL, USA). A repeated measures Analysis of Variance (ANOVA) was used to analyse the changes in physical function, dyspnoea, fatigue symptoms, and HRQOL variables. Post hoc tests (Bonferroni) were used to pinpoint group differences. Additionally, paired sample t-tests were conducted for pairwise comparisons and provided information on significant differences in data collected each time.

4.0 Findings

4.1 Study population

Of the 127-healthcare workforce reported being infected with COVID-19 from June to December 2022, 84 (66%) responded to the invitation to the study, 61 (48%) consented and attended all assessments at t_1, 58 (46%) completed all assessments at t_1, t_2, and t_3 (Fig 1).

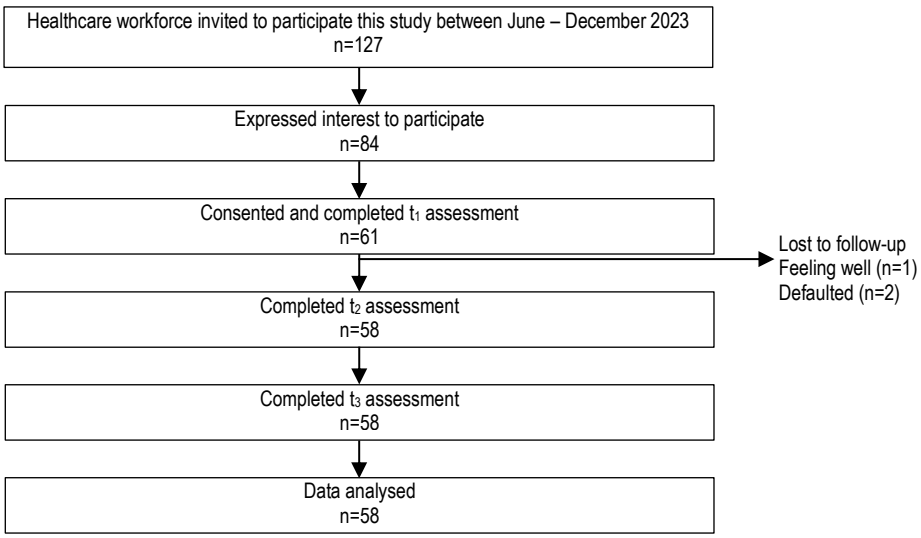


Fig. 1 Participants' enrolment and study flow

4.2 Participant characteristics

A summary of the participants' demographic is presented in Table 1. Of the 61 study participants, 13 (21%) reported having comorbidities; nine (15%) had asthma, two (3%) had hypertension, and two (3%) had diabetes mellitus. At the time of the assessment, all participants had at least two doses of COVID-19 vaccination (complete dose), and 55 (90%) had received their booster dose.

4.3 Physical function, dyspnoea, and fatigue symptoms, and HRQOL at t_1, t_2, and t_3

All participant was assessed at mean±SD (range) of 11±2 (7 to 15) days after the onset of infection for t_1, followed by 44±6 (35 to 62) days for t_2 and 103±6 (90 to 120) days for t_3. Participants' responses for respiratory and fatigue symptoms and HRQOL were tabulated in Table 2.

Table 1. General characteristics of participants.

	All participants (n=61)
Gender, n (%)	
Male	15 (25%)
Female	46 (75%)
Age, yr., M (SD)	34.0±7.0
Weight, kg, M (SD)	68.7±18.4
Height, m, M (SD)	1.6±0.1
BMI, kg/m^2, M (SD)	26.7±7.1

Data were presented as mean (standard deviation) and n (percentage) unless stated otherwise.
Abbreviation: kg; kilogram, kg/m^2; kilogram per square meter, m; meters, yr.; years old

4.4 Recovery in respiratory symptoms, physical function, dyspnoea, and fatigue symptoms, and HRQOL

The 6MWD significantly improved over time: mean increased by 42m (95% CI, 26m to 57m) from t_1-t_2 and by 16m (95% CI, 8m to 23m) from t_2-t_3, representing a 12% (95% CI, 45% to 100%) and 4% (95% CI, 22% to 64%) difference from baseline, respectively (Fig.2a). The 1MSTST also showed significant improvement: mean increased by 6 repetitions (95% CI, 5 repetitions to 7 repetitions) from t_1-t_2 and by 5 repetitions (95% CI, 4 repetitions to 7 repetitions) from t_2-t_3 (Fig. 2b). Percentage differences from baseline were 27% (95% CI, 100% to 140%) for t_1-t_2 and 19% (95% CI, 80% to 140%) for t_2-t_3. F-ratios for ANOVA were 54.488 and 181.866 for 6MWD and 1MSTST, respectively, showing significance ($p < 0.05$).

The FACIT-F score significantly improved over time, with a mean increase of 16 (95% CI, 11 to 21) from t_1-t_2 and 6 (95% CI, 3 to 10) from t_2-t_3 (Fig. 2d). Percentage differences from baseline were 42% (95% CI, 100% to 210%) for t_1-t_2 and 13% (95% CI, 43% to 143%) for t_2-t_3. The F-ratio for ANOVA was 74.285, indicating significance ($p < 0.05$). Dyspnoea symptoms reduced from 45% at t_1 to 5% at t_2 and zero at t_3 (Fig. 2c).

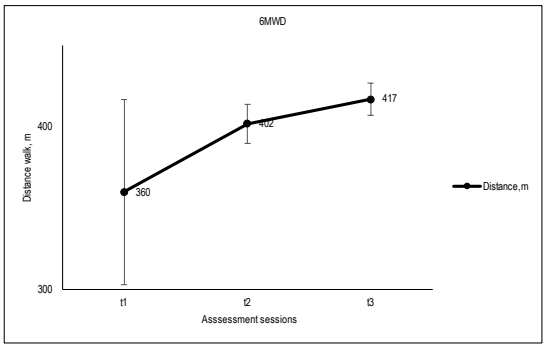
EQ-5D-5L responses at baseline (t_1): 16 participants reported having mobility issues, 26 participants having issues with usual activities, 40 participants having issues with pain/discomfort, and 17 participants having issues with anxiety/depression. Following session (t_2), issues responses were reduced by 17% in mobility, 62% in usual activities, 53% in pain/discomfort, and 18% in anxiety/depression, and at the third session (t_3), reductions of each dimension were 88% for mobility, 92% for usual activities, 78% for pain/discomfort, and 59% for anxiety/depression, respectively, compared to baseline (Fig. 3a). The EQ-5D-5L VAS mean±SD improved significantly, with a 5% increase (95% CI, 2% to 9%) at t_2 and 6% increase (95% CI, 3% to 8%) at t_2-t_3. The F-ratio for ANOVA was 41.430, indicating significance ($p < 0.05$). The EQ-5D-5L VAS score significantly improved over time, with a mean increase of 5 (95% CI, 2 to 9) from t_1-t_2 and 6 (95% CI, 3 to 8) from t_2-t_3. The F-ratio for ANOVA was 41.430, indicating significance ($p < 0.05$). Participant responses regarding issues in each dimension over the three assessments are displayed in Fig. 3b.

Table 2. Physical function, fatigue level, and health-related quality of life at three assessment points and changes between the sessions.

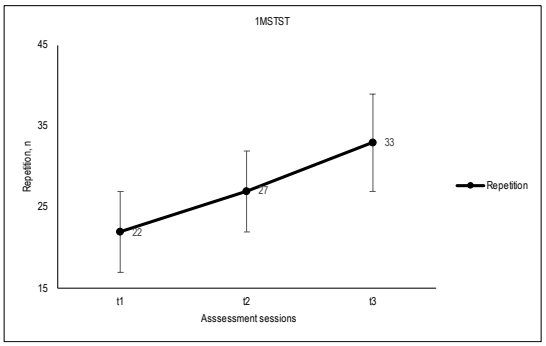
Physical function test	**t_1**	**t_2**	**t_3**	**Mean difference t_1 - t_2 (95%CI), p-value**	**Mean difference t_2 - t_3. (95%CI), p-value**
6MWT					
6MWD, m	360±57	402±36	417±27	42 (26 to 57) *	16 (8 to 23) *
%Pred distance, %	66±14	73±12	75±10	8 (5 to 10) *	3 (1 to 4) *
Nadir SpO_2, %	95±3	97±2	98±2	2 (1 to 2) *	1 (.3 to 2) *
Peak HR, bpm	106±13	101±10)	101±10	-.2 (-4 to 4) *	-4 (-6 to -1) *
1MSTST					
Repetition, n	22±5	27±5	33±6	6 (5 to 7) *	5 (4 to 7) *
%Pred repetitions, %	48±11	62±11	74±12	13 (10 to 16) *	12 (9 to 14) [a]
Nadir SpO_2, %	95±3	97±2	98±2	1 (.4 to 2) *	.5 (-.1 to 1) *

Peak HR, bpm	106±13	101±10	101±10	-4 (-7 to -1) *	-4 (-6 to -1) *
Dyspnoea					
mMRC, n(%)					
Grade 0	32 (55)	53 (91)	58 (100)		
Grade 1	22 (38)	5 (9)			
Grade 2	2 (2)				
Grade 3	2 (2)				
Grade 4	0				
Fatigue					
FACIT-F Score, %	38±10 (73±20)	46±7 (89±14)	50±3 (95±6)	16 (11 to 21) *	6 (3 to 10) *
No fatigue, n(%)	0	7 (12)	14 (24)		
Mild fatigue, n(%)	28 (48)	46 (79)	43 (74)		
Moderate fatigue, n(%)	26 (45)	4 (7)	1 (2)		
Severe fatigue, n(%)	4 (7)	1 (2)	0		
EQ-5D-5L					
Health-related VAS, %	84±12%	90±11%	95±6%	5 (2 to 9) *	6 (3 to 8),
Mobility	9 (15)	1 (2)	2 (3)		
Self-care	0	0	0		
Usual Activities	15 (26)	6 (10)	1 (2)		
Pain/discomfort	23 (40)	11 (19)	5 (9)		
Anxiety/depression	10 (17)	8 (9)	4 (7)		

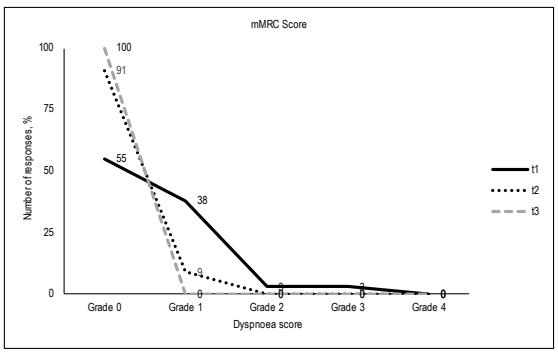
Data were presented as mean (standard deviation) and n (percentage) unless stated otherwise.
Abbreviations: bpm; beat per minute, EQ-5D-5L; EuroQOL 5 Dimension 5 Level, FACIT-F; Functional Assessment of Critical Illness Therapy-Fatigue, HR; heart rate; m; meter, 1MSTST; one minute sit to stand test, %Pred; percent predicted, 6MWD; six-minute walk distance, SpO_2; spontaneous oxygen saturation
*, p-value<.05



a) 6MWD over three time of assessment



b) 1MSTST repetitions over three time of assessment



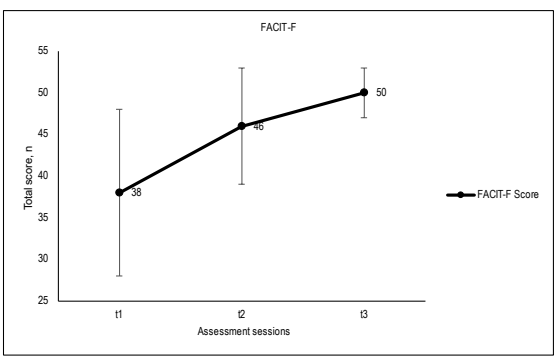
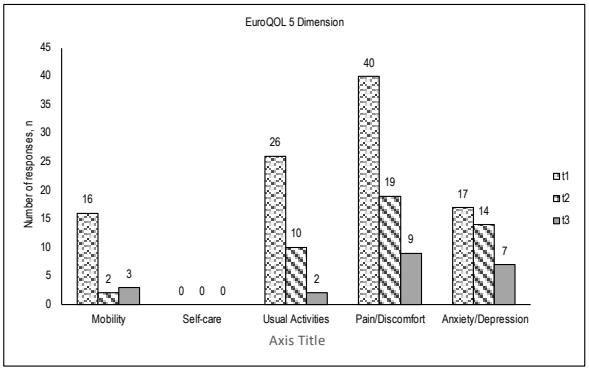
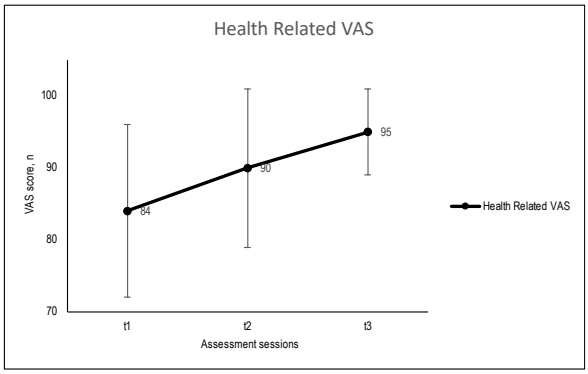


Fig. 2 Changes over the three sessions of assessment (t_1, t_2, and t_3) for a) 6MWD over three time of assessment, b) 1MSTST, c) mMRC responses over three time of assessments and d) FACIT-F total score over three time of assessments
Abbreviations: 1MSTST; one minute sit to stand test, 6MWD; six-minute walk distance, FACIT-F; Functional Assessment for Chronic Illness Therapy-Fatigue, mMRC; Modified Medical Research Council, t_1; first assessment, t_2; second assessment, t_3; third assessment



a) EQ-5D-5L responses over three time of assessment



b) Health related VAS score over three time of assessment

Fig. 3 Changes over the three assessment sessions (t_1, t_2, and t_3) for a) Number of participants reported issues in each dimension of EQ-5D-5L and b) Health-related VAS score.
Abbreviations: EQ-5D-5L, EuroQoL 5 Dimension 5 Level, t_1; first assessment, t_2; second assessment, t_3; third assessment, VAS; Visual Analogue Scale

5.0 Discussion

The present study found that i) physical function, dyspnoea and fatigue symptoms, and HRQOL of individuals infected with mild COVID-19 improved significantly three months after the onset infection, ii) however, the scores for physical function, specifically the 6MWD and 1MSTST were still below the scores in age- and sex-matched healthy counterparts (i.e., normative data) even 3-month after the onset of mild COVID-19 infection (Strassmann et al., 2013; Troosters et al., 1999) and iii) the magnitude of change in physical function, dyspnoea and fatigue symptoms at t_1 (i.e., 1-month after the onset of infection) were significantly higher than the magnitude of change at t_3 (3-month after the onset of infection).

5.1 Study participants

Of the 127 healthcare workforces invited to participate in the study, only 66% expressed an interest in joining, and as low as 46% attended their t_1 scheduled appointment. The mild COVID-19 category includes both categories, 1 (infected without symptoms) and 2 (infected with mild symptoms), and the trend in the proportion of patients in these categories today is about 50/50 (Yusof, 2021). Thus, the low rate could be from those with category 1 COVID-19 infection who presented with no symptoms. In fact, over 70% of the participants reported respiratory symptoms like coughing, sputum production, wheezing, and runny nose at t_1 (1-2 weeks after the onset of infection).

5.2 Physical function, dyspnoea and fatigue symptoms, and HRQOL.

Data was collected at three time points: mean of 11±2 (7-15) days, 32±2 (28-36) days, and 87±2 (84-92) days after the onset of mild COVID-19 infection for t_1, t_2 and t_3, respectively. The assessment days originally proposed were days 7th-10th (t_1) from the onset of the infection, followed by days 28th-35th (t_2), and days 84th-91st (t_3). Still, unfortunately, we were unable to fulfil the proposed time frame for assessment due to several challenges in our study setting. These challenges included: i) the necessity to conduct the assessment within the operational of the clinic working hours, ii) difficulties in synchronising mutually convenient time slots and dates with the participants (healthcare workforces), iii) the intensive work commitment among the healthcare workforce and iv) the calculation on the infection onset included weekends and public holiday.

For physical function assessment at t_3, all participants could only cover a mean distance of 360±57m and performed by a mean of 22±5 repetition of 1MSTST. However, these scores only projected about 66%±14% and 48%±11% from the normative data even after 12 weeks of infection onset. These findings could be related by i) none from this sample undergoing any exercise training to increase their loss of muscle mass, and ii) some could have reduced their physical activity level to cope with their remaining symptoms (e.g., 76% still reported fatigue at t_3). However, recovery levels remained below predicted values compared to age-sex-matched healthy counterparts, as indicated by previous studies(Berentschot et al., 2022). Despite positive changes, exercise capacity and lower limb strength persisted below normal predicted values or the possibility of pre-infection performance levels being below predicted values. However, this assumption remains subjective due to the absence of data pre-infection.

Assessments of dyspnoea from the mMRC (Table 2) showed that most participants do not have issues with dyspnoea as early as 4 weeks from the onset of infection. Following that, the percentage of fatigue score also improved, where a significant improvement was noticed between t1 and t2. However, 74% of the participants reported at least mild fatigue at t_3, which might be because their physical recovery did not meet their normal prediction. As for quality of life, most of the participants reported having issues concerning their usual activities (26%), pain/discomfort (40%), and anxiety/depression (17%). After 12 weeks, the percentage of participants who reported having issues within these three dimensions reduced to 2%, 9 %, and 7% as they had already returned to work and needed to adjust their current physical performance to match their working environment.

5.3 6MWD and 1MSTST recovery

The recovery in the physical function test for both 6MWD and 1MSTST shows a statistically significant improvement over time. For 6MWD, the analysis revealed an improvement of 42m±48m between the t_1-t_2 session and 15m±23m of improvement between t_2-t_3. This data showed that improvement in walk distance significantly occurred between t1 and t2. As for the 1MSTST repetition, the improvement between t_1-t_2 and t_2-t_3 displayed almost identical improvement by a mean of 6±4 and 5±4. The data projected from these analyses shows that the 6MWD distance improved more during the earlier session (t_1-t_2) compared toward the end session (t_2-t_3); as discussed earlier, they do not have any specific exercise program for their recovery. As for the 1MSTST, we can only assume that the muscle endurance is below normal.

5.4 Magnitude of change in physical function, dyspnoea, and fatigue symptoms

To calculate the change of variable, we employed repeated measures ANOVA to analyse the variation of improvement in physical function, dyspnoea, and fatigue symptoms over three times of assessments (7 days, 4 weeks, and 12 weeks from the infection onset). After identifying a significant overall effect, Bonferroni correction was applied to control Type I errors in multiple comparisons to ensure the reliability of our findings.

For 6MWD, the analysis revealed a statistically significant increase of 42m (95% CI, 29m to 54m) from t_1 to t_2 and 16m (95% CI, 9m to 22m) from t_2-t_3 (both $p < 0.001$). The greater improvement observed from t_1-t_2 suggests enhanced exercise capacity during recovery from the acute phase. Analysis for the 1MSTST demonstrated a statistically significant improvement, with an average increase of 4 repetitions (95% CI, 5 to 7) from t_1-t_2 and 4 repetitions (95% CI, 4 to 6) from t_2-t_3 (both $p < 0.001$). The slight improvement may indicate lower limb functional muscle strength during recovery from the acute phase than the later phase. The improvement in physical performance within one week post-mild COVID-19 infection suggests a notable recovery in individuals' physiological capacities. Typically, individuals recovering from mild cases of COVID-19 experience a range of symptoms that may affect physical well-being, such as fatigue, respiratory issues, and muscle weakness. The positive change observed within this short timeframe could be attributed to the body's natural healing processes, including resolving inflammation, repairing damaged tissues, and restoring normal physiological function. Essential consideration required that individual responses to COVID-19 can vary, and factors such as age, overall health, and underlying conditions may influence the rate and extent of recovery. Monitoring physical performance over time is crucial to understanding the recovery trajectory and identifying any persistent challenges that may require further attention or intervention.

The analyses using the repeated measure ANOVA for mMRC scores presented an improvement from t_1-t_2 was 0.55 (95% CI, 0.93 to 0.02), and t_2-t_3 was 3 (95% CI, 2 to 5), indicating recovery from the acute phase and a return to routine ($p < 0.001$). The greater improvement observed from t_2-t_3 suggests a positive impact on lower limb strength and exercise capacity during recovery. For FACIT-F and mMRC scores between different time points, revealing significant improvements. As for FACIT-F, the scores increased by 8 (95% CI, 6 to 10) from t_1-t_2 and 3 (95% CI, 2 to 5) from t_2-t_3, signifying the improvement of the fatigue symptoms that occurred more within the earlier sessions.

Compared to the normative data, the patient's scores were used in the present study to indicate recovery. We anticipated these patients' scores could have been reduced even before COVID-19 infected them. However, screening a large sample and waiting for some to be infected by COVID-19 would require higher costs and more extended study duration.

6.0 Conclusion & Recommendations

In summary, this study focused on the recovery of post-mild COVID-19 among the healthcare workforce over 12 weeks. Despite positive improvements in physical function, symptoms and HRQOL, the gains remained below the normative value, most likely due to a lack of monitoring and specific interventions. To enhance the outcome, we propose a properly targeted follow-up session, tailored intervention for individuals with post-mild COVID-19 infection.

Acknowledgement

The authors would like to acknowledge Hospital Al-Sultan Abdullah to everyone who contributed to this research.

Paper Contribution to Related Field of Study

This study comprehensively examines the recovery outcomes in the healthcare workforce post-mild COVID-19 infections over 12 weeks, and the recovery trajectory was highlighted throughout the study. Significantly, it highlights aspects of recovery that did not attain normal, potentially indicating specific areas for targeted interventions in post-mild COVID-19, hence creating awareness among medical professionals regarding the need for proper guidelines in managing individuals with mild COVID-19 and the awareness among the public on what to do and when to seek for help during recovering from mild COVID-19 infection.

References

Badinlou, F., Forsström, D., Jansson-Fröjmark, M., Abzhandadze, T., & Lundgren, T. (2023). Impairments following COVID-19 infection: manifestations and investigations of related factors. Scientific Reports, 13(1). https://doi.org/10.1038/s41598-023-33810-y

Berentschot, J. C., Heijenbrok-Kal, M. H., Bek, L. M., Huijts, S. M., van Bommel, J., & van Genderen, M. E. (2022). Physical recovery across care pathways up to 12 months after hospitalisation for COVID-19: A multicenter prospective cohort study (CO-FLOW). The Lancet Regional Health - Europe, 22. https://doi.org/https://doi.org/10.1016/j.lanepe.2022.100485

BTS. (2020). Delivering rehabilitation to patients surviving COVID-19 using an adapted pulmonary rehabilitation approach-BTS guidance. https://www.brit-thoracic.org.uk/covid-19/covid-19-resumption-and-continuation-of-respiratory-services/

Celli, B. R., Cote, C. G., Marin, J. M., Casanova, C., Montes De Oca, M., Mendez, R. A., Pinto Plata, V., & Cabral, H. J. (2004). The Body-Mass Index, Airflow Obstruction, Dyspnea, and Exercise Capacity Index in Chronic Obstructive Pulmonary Disease. In n engl j med (Vol. 10). www.nejm.org

Crook, H., Raza, S., Nowell, J., Young, M., & Edison, P. (2021). Long covid - Mechanisms, risk factors, and management. In The BMJ (Vol. 374). BMJ Publishing Group. https://doi.org/10.1136/bmj.n1648

Fernández-De-las-peñas, C., Palacios-Ceña, D., Gómez-Mayordomo, V., Cuadrado, M. L., & Florencio, L. L. (2021). Defining post-covid symptoms (Post-acute covid, long covid, persistent post-covid): An integrative classification. International Journal of Environmental Research and Public Health, 18(5), 1–9. https://doi.org/10.3390/ijerph18052621

Garratt, A. M., Engen, K., Kjeldberg, I. R., Nordvik, J. E., Ringheim, I., Westskogen, L., & Becker, F. (2023). Use of EQ-5D-5L for Assessing Patient-Reported Outcomes in a National Register for Specialized Rehabilitation. Archives of Physical Medicine and Rehabilitation. https://doi.org/10.1016/j.apmr.2023.04.026

Greenhalgh, T., Knight, M., A'Court, C., Buxton, M., & Husain, L. (2020). Management of post-acute covid-19 in primary care. The BMJ, 370. https://doi.org/10.1136/bmj.m3026

Hartung, T. J., Neumann, C., Bahmer, T., Chaplinskaya-Sobol, I., Endres, M., Geritz, J., Haeusler, K. G., Heuschmann, P. U., Hildesheim, H., Hinz, A., Hopff, S., Horn, A., Krawczak, M., Krist, L., Kudelka, J., Lieb, W., Maetzler, C., Mehnert-Theuerkauf, A., Montellano, F. A., … Finke, C. (2022). Fatigue and cognitive impairment after COVID-19: A prospective multicentre study. EClinicalMedicine, 53, 101651. https://doi.org/10.1016/j

Holland, A. E., Spruit, M. A., Troosters, T., Puhan, M. A., Pepin, V., Saey, D., McCormack, M. C., Carlin, B. W., Sciurba, F. C., Pitta, F., Wanger, J., MacIntyre, N., Kaminsky, D. A., Culver, B. H., Revill, S. M., Hernandes, N. A., Andrianopoulos, V., Camillo, C. A., Mitchell, K. E., … Singh, S. J. (2014). An official European respiratory society/American thoracic society technical standard: Field walking tests in chronic respiratory disease. European Respiratory Journal, 44(6), 1428–1446. https://doi.org/10.1183/09031936.00150314

Jebril, N. (2020). World Health Organization declared a pandemic public health menace: a systematic review of the coronavirus disease 2019 "COVID-19." International Journal of Psychosocial Rehabilitation, 24(9).

Klein, S. R., Gulart, A. A., Venâncio, R. S., Munari, A. B., Gavenda, S. G., Martins, A. C. B., & Mayer, A. F. (2021). Performance difference on the six-minute walk test on tracks of 20 and 30 meters for patients with chronic obstructive pulmonary disease: validity and reliability. Brazilian Journal of Physical Therapy, 25(1), 40–47. https://doi.org/10.1016/j.bjpt.2020.01.001

Ministry of Health Malaysia. (2021). Annex 50 - Post COVID-19 Management Protocol [1st Edition]. https://covid-19.moh.gov.my/garis-panduan/garis-panduan-kkm

Ministry of Health Malaysia. (2022). Annex 21 - Management of Healthcare Workers (HCW) During The COVID-19 Pandemic. https://covid-19.moh.gov.my/garis-panduan/garis-panduan-kkm

Ministry of Health Malaysia. (2023). COVID-19 KKMNOW. data.moh.gov.my/dashboard/covid-19

Mirza, F. T., Jenkins, S., Harrold, M., Othman, S. K., Ismail, R., Tengku Ismail, T. S., & Hill, K. (2020). Initiating exercise training early during the hospitalisation for an exacerbation of chronic obstructive pulmonary disease improves exercise capacity and quadriceps strength: A randomised controlled trial: Early exercise during COPD exacerbation. Respiratory Medicine: X, 2. https://doi.org/10.1016/j.yrmex.2020.100024

Ng, J. W., Chong, E. T. J., Tan, Y. A., Lee, H. G., Chan, L. L., Lee, Q. Z., Saw, Y. T., Wong, Y., Zakaria, A. A. Bin, Amin, Z. B., & Lee, P. C. (2022). Prevalence of Coronavirus Disease 2019 (COVID-19) in Different Clinical Stages before the National COVID-19 Vaccination Programme in Malaysia: A Systematic Review and Meta-Analysis. In International Journal of Environmental Research and Public Health (Vol. 19, Issue 4). MDPI. https://doi.org/10.3390/ijerph19042216

Strassmann, A., Steurer-Stey, C., Lana, K. D., Zoller, M., Turk, A. J., Suter, P., & Puhan, M. A. (2013). Population-based reference values for the 1-min sit-to-stand test. International Journal of Public Health, 58(6), 949–953. https://doi.org/10.1007/s00038-013-0504-z

Sullivan, T., Hansen, P., Ombler, F., Derrett, S., & Devlin, N. (2020). A new tool for creating personal and social EQ-5D-5L value sets, including valuing 'dead.' Social Science and Medicine, 246. https://doi.org/10.1016/j.socscimed.2019.112707

Troosters, T., Gosselink, R., & Decramer, M. (1999). Six minute walking distance in healthy elderly subjects.

Yusof, T. A. (2021, July 16). Half of today's Covid-19 cases are category 1. New Straits Time. Half of today's Covid-19 cases are category 1