

Effect of Nursing Rehabilitative Program Interventions on Health Outcomes of Post COVID-19 Patients

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Abstract

Background: Previous research findings suggested that there would be an increasing number of post-acute COVID-19 cases necessitating a reasonable rehabilitation strategy. This imposes the crucial need for implementing a nursing rehabilitation program by a multidisciplinary expert team; utilizing a range of tailored interventions. **Aim of the study:** to investigate the effect of the developed nursing rehabilitative program interventions on the health outcomes of post COVID-19 patients. **Materials and Method:** A quasi experimental research design; comprised one hundred of post COVID-19 patients who were attending at the Post COVID-19 Outpatient Clinic. Two tools were utilized for data collection; Tool I: "Post COVID-19 Patients Assessment Structured Interview Questionnaire", and Tool II: "Post COVID-19 Patient's Knowledge Structured Interview Schedule". Additionally, respiratory rehabilitation interventions were performed via diaphragmatic training; stretching exercises and home exercises. **Results:** The majority of subjects (90%) had poor overall knowledge score prior to program implementation; that improved in (52%) to good after one month of program intervention, to turn after three months to fair in (82%), ($p_1 < 0.001$, $p_2 < 0.001$, $p_3 = 0.007$; respectively). Furthermore, the subjects' overall health status indicators mean percent score was (7.35 ± 2.0) prior nursing program implementation, then improved one and three months thereafter ($P < 0.001$). A considerable improvement was observed in the overall (EQ-VAS), as well as in the overall six minutes' walk distance mean percent scores after implementing the three months nursing rehabilitation program. **Conclusion:** Post COVID-19 participants who received the nursing rehabilitative program interventions exhibited improved health outcomes at the end of the program. **Recommendations:** Extend the global scientific knowledge concerning post COVID-19 nursing rehabilitation. Further research should be conducted to examine this rehabilitation program effect on quality of life on larger post COVID-19 sample.

Keywords: Coronavirus COVID-19, Post COVID-19, Rehabilitation, Nursing program, Knowledge, Health outcomes, Program interventions.

Introduction

COVID-19 is a highly contagious respiratory disorder that leads to

breathing, physical, and emotional dysfunction. In most cases (81%), COVID-19 contagion deliberates mild illness with fever (88.7%), cough (57.6%),

and dyspnea (45.6%). However; for patients with comorbid disorders, the contagion can have very serious sequel; as among the hospitalized patients, 20% require ICU management for acute respiratory distress syndrome (ARDS) (Simpson & Robinson, 2020).

Similar to prior corona-virus illnesses (SARS, MERS), previous studies summarized that; all patients convalescing from COVID-19 may complain from persistent residual symptoms, including impaired pulmonary and physical function (Ong et al, 2004; Hui et al, 2005; Lam et al, 2009; and Moldofsky et al, 2011 Ong et al, 2004; Hui et al, 2005; Lam et al, 2009; and Moldofsky et al, 2011). Long-term consequences of COVID-19 contagion strongly decrease quality of life (QoL), and cause emotional distress (Carfi et al, 2020; and Huang et al, 2021).

Post-acute COVID-19 syndrome, is defined as “Persistent symptoms and/or delayed long-term complication of COVID-19 beyond 1 month from the symptoms onset (Nalbandian et al, 2014). Post-acute COVID-19 complaints were reported in more than one-third of individuals in England (Chopra et al, 2020). Additional results from several countries; Arnold et al, 2020; Carvalho-Schneider et al, 2021; Huang et al, 2021; Moreno-Pérez et al, 2021 correspondingly reported; persistent complaints for example: chest pain, lethargy, dyspnea and arthralgia.

Accordingly, the desires for emergent rehabilitation of individuals recovering from COVID-19 are obligatory. The evidence-based role of physiotherapy interventions arose as highly appropriate in addressing COVID-

19 rehabilitation. However; acute and post-acute rehabilitation in hospital sceneries and long-standing rehabilitation in out-patient practices were described to be of prominent advantage for the patients (Dean et al, 2020; Thomas et al, 2020; Puchner et al, 2021).

Rising data about the acute and post-acute rehabilitation desires of COVID-19 cases will additionally affect health-care organizations and alter the instructive curricular agendas. It is anticipated that cases with long-standing problems of this disease will potentially dominate medical accomplishes for the subsequent years, thus rehabilitation authorities should be prepared to deliver such care (Barker-Davies et al, 2020).

The COVID-19 outpatient clinics' staff who are dedicated to follow-up negative side effects and complications after disease recovery, have a great responsibility to develop and implement these individualized rehabilitation programs (The National Academy of Medicine, 2021).

Rehabilitation nurses, as a frontline participating in COVID-19 patients' care, have to master rehabilitation interventions in all disease phases: acute, post-acute and long-term. Prior rehabilitation each patient has to be carefully assessed for setting an individualized and convenient discharge rehabilitation plan based on the patient's needs, physical and emotional functional disability, and family support (Neal-Boylan, 2020).

Rehabilitation nurses are responsible for providing a holistic patient and family care, health education, counseling, and exercises training with

provision of basic knowledge using simple educational instructions about the disease, its expected relapse manifestations, healthy diet and measures that improve the immunity as well as anxiety management (Al Thobaity & Alshammari, 2020; Neal-Boylan, 2020; Wade, 2020; Zhao, 2020; Cortinovis, 2021).

Significance of study:

The recently emerged novel corona-virus poses a challenge for the researchers to establish a growing research evidence; focusing on prevention, new management plans, as well setting new rehabilitation strategies. Thus, the idea of the present study was emerged as several studies addressed post COVID-19 patient's rehabilitation; with very limited and incomplete evidences available investigating the effects of nursing rehabilitation programs after COVID-19 recovery. However, this research will expand the area of COVID-19 nursing rehabilitation.

Aim of the study:

The study aims to investigate the effect of the nursing rehabilitation program interventions on the health outcomes of post covid-19 patients.

Hypothesis

Post COVID-19 patients who receive the nursing rehabilitation program interventions exhibit better health outcomes at the end of the program, than before.

Operational definitions:

Health Outcomes:

Are observable measurements, which reflect the impact of the delivered comprehensive health care interventions on post COVID- 19 participants' health status". Health outcomes include assessing patients' health complaint, current Health Vertical Visual Analogue Self-Complete Scale evaluation, in addition to assessing their Six Minutes' Walk Test and their knowledge post nursing program intervention implementation.

Post COVID-19 Patients:

Are those patients who had at least one month since COVID-19 recovery.

Materials and method

Study Design

A time series quasi-experimental research design was utilized to fulfill the current study aim.

Setting

This study was conducted at Post COVID-19 Outpatient Clinic, which is separate quite room in the second floor of clinics building (Fever clinic) at Assuit main university hospital; facing a 10 meters corridor. It embraces a desk and four armchairs, computer for filing patients' data, an examination bed and an abdominal X-ray machine. Also a blood pressure apparatus, a weighing scale and a Shannon for keeping clinic's required supplies.

Participants

A purposive sample of 100 adult post COVID-19 patients; who met the inclusion criteria and came for follow-up, at the above-mentioned clinic, were recruited. **Sample size calculation:** The study *sample size* was calculated based on epi-info7 program according to the following parameters: Population size is 140/3 months, Confidence coefficient: 95%, Margin error 5%, Prevalence rate: 50% thus minimum sample minimum size= 100 Participants.

Inclusion criteria

- (1) Had a confirmed COVID-19 diagnosis (PCR and/or HRCT chest and laboratory investigations)
- (2) Able to communicate verbally.
- (3) Did not receive previous COVID-19 rehabilitative interventions program.

Exclusion criteria:

- (1) The presence of COPD or any other chronic respiratory disease, moderate or severe heart disease Grade III or IV according to (New York Heart Association).
- (2) Severe ischemic, hemorrhagic stroke or neurodegenerative diseases.

Tools:

Two tools were utilized for attaining the purpose of the study:

Tool I: “Post COVID-19 Patients Assessment Structured Interview Questionnaire”.

This tool was developed by the researchers based on the recent review of a variety of rehabilitative interventions relevant literature, for the purpose of rehabilitation nursing program evaluation and monitoring. It consists of the following five parts:

Part I: Patient’s socio-demographic Characteristics:

This part included data related to patients’ age, gender, level of education, BMI, occupation, marital status, diagnosis, and the area of residence.

Part II: Patient's Clinical Data:

It comprised information related to clinical data for previous hospitalization of the acute COVID-19 attack, and any associated comorbid disorders.

Part III: Health Status Indicators Assessment Sheet:

It was developed by the researchers to assess post COVID-19 patients’ health outcomes in relation to: the current post COVID-19 complaints, development of new complaints, as well as monitoring of the respiratory indicators. It was derived from the related literatures (CDC, 2019; Hui et al, 2020; Mayer et al, 2020).

❖ Scoring system:

The sheet consisted of fifteen items which were scored as: (0) = Not present, while (1) = present. The total items score was transformed to percent score ranging from 0 - 100%.

Part IV: Patient's Overall Current Health Vertical Visual Analogue Self-Complete Scale (EQ-VAS):

This scale was adopted from **The Euroqol Group (EQ-5D-Y™); 2004**. It aimed to evaluate the health outcome progress in a quantitative measure, from the patient's overall health perception. **Scoring system:** It comprises two endpoints categorized as: "The best health you can imagine = 100" and "The worst health you can imagine = 0". Each respondent places "X" mark on the scale explaining his/her health in that post COVID-19 clinic visit day. The scale score ranged between 0 and 100, where "100" is "the best health" and "0" "the worst health".

Part V: Six Minutes' Walk Test (6MWT):

This test was adopted from **Holland et al; 2014**. It aimed to evaluate the participants' ability to walk unsupported in 6 minutes for a distance which is compared later to the standard reference mean 264 m (865 feet). **Scoring system:** If participants were able to walk for longer distances with saturation >94%; this indicates "Health outcome improvement".

Tool II: "Post COVID-19 Patient's Knowledge Structured Interview Schedule":

This tool was developed by the researchers based on recent relevant literatures [**Lung Foundation Australia & the Thoracic Society of**

Australia and New Zealand, 2021; Sindet-Pedersen et al, 2021; Lung Foundation Australia, 2020; McCarthy et al, 2015]. It investigates patients' health literacy, preventive self-care practices, and evaluates effect of gained nursing intervention program knowledge on their post COVID-19 health outcome.

This tool focuses on **five post COVID-19 knowledge domains, namely;** disease process/pathophysiology and symptom (5 items), treatment & prevention activities (7 items), healthy diet (9 items), and respiratory & general exercise management (9 items) with a total of 30 statements. **Scoring system:** The tool's statements were in multiple choice (MCQ) and closed ended questions form, to be checked by researchers by "Yes", "No" or "Don't know" answers. Each "Yes" answer was scored as (1). While either "No", or "Do not know" answers were scored as (0). The total scores were summed up and converted to percentages from 0 to 100. The percent score levels were categorized as: "Good knowledge" ranged from 75% and more, "Fair knowledge" ranged from 50% < 75% and "Poor knowledge" less than 50%.

Methods

1. The study was approved by the Research Ethics Committee, Faculty of Nursing, Alexandria University.
2. An educational booklet was developed by the researchers in a simple Arabic language after a review of pertinent recent literature [**Hong-Mei, Yu-Xiao, Chen, 2020; Kariann et al, 2020; Camicia, Cournan and Rye, 2020; and Yang, Chou, and**

- Kao, 2020].** This booklet includes simple instructions and colored pictures related to COVID-19, its prevention and management.
3. Both the developed tools and the educational booklet were submitted to a jury of 5 experts specialized in Medical Surgical, Nursing of Education and Chest Disease Medicine, to measure content and construct validity; to ensure their relevance and comprehensiveness; necessary modifications were done accordingly.
 4. A preliminary study was focused on 10% of the total studied subjects to exam clarity, probability of the tool; necessary changes were done; however, those patients were excluded from the study sample.
 5. To fulfill the study aim, participants' **interview** was carried out at the Post COVID-19 Outpatient Clinic. Where the researchers conducted individualized sessions utilizing the study tools distributed as follows: one prior program implementation for assessment and explaining the study aim, as well as obtaining their consent. Two additional sessions, in a two following weeks, were conducted for educating and re-enforcing the study participants commitment to the nursing program plan, then two final sessions were held in the evaluation phase.
 6. The educational nursing rehabilitation interventions program was carried out in four phases: assessment, planning, implementation and evaluation.

Phase I: Assessment phase:

- ✓ This phase started with an individualized initial assessment.

Where, researchers-patient communication was carried out, to obtain baseline data, and attain subject's phone numbers; to ensure continuous contact.

- ✓ However, Tool I (Part I and II) were utilized once in the first phase, while parts III, IV, and V; in addition to tool II were used three times: prior to the nursing rehabilitation program interventions, one and three months thereafter; to evaluate participants' health outcome progress.

Phase II: Planning phase:

- ✓ In this phase the nursing intervention program, as well as the colored instructional booklet were developed to be distributed at the first implementation session.

Phase III: Implementation phase:

- ✓ In this phase the rehabilitation nursing interventions were performed through: diaphragmatic training, stretching exercises and home exercises; which were delivered in two sessions:

1. The First session

- In which the individualized rehabilitative nursing interventions were implemented via two educational strategies: the Interactive discussion using the colored booklet, and exercises demonstration /re-demonstration.
- As regard *the diaphragmatic breathing exercise:*
Each participant was instructed to lie down bending his/her knees. Place

one hand on upper chest and the other just below the rib cage. Then, breathe in slowly through the nose pulling air down the stomach; then slowly exhale through the nose.

- In **stretching exercises**:

Shoulder, calf, standing hamstring and neck stretch; as well Rib, chest wall and respiratory muscles stretching were performed under the guidance of the clinic's rehabilitation therapists. Subjects were instructed to implement the diaphragmatic breathing 30 sets/day, and stretching exercises 30 - 60 seconds; as tolerated multiple times daily.

- **Home exercises**:

Included pursed-lip breathing and coughing exercise, where the subjects were asked to perform thirty sets daily

2. **The second session** was carried out within one week after the first session, to encourage continuity of home exercises, and to ensure the use of the instructional booklet.

– Each implementation individualized session's **duration ranged** between 60-90 minutes.

Phase IV: Evaluation phase:

✓ Participant's evaluation was performed post implementing the nursing program intervention twice, to monitor participants' compliance to exercises, and compare health outcome progress where:

- **First evaluation** was done after one month from the first clinic's visit using tool I (part III, IV, and V) and tool II.

- **Second evaluation**: was performed three months from first visit; using the

same tools, via face to face follow up at the Post COVID-19 Clinic.

✓ Each individualized evaluation session's **duration ranged** between 40-60 minutes.

Health Outcome Assessment Measures:

- ❖ **Health outcome progress**: was measured via Patient's Overall Health Status Indicators Assessment, and the Overall Current Health Vertical Visual Analogue Self-Complete Scale (EQ-VAS).

- ❖ Also health outcome progress included assessing participant's **Exercise endurance**: which was measured using the (6MWT), which measured the distance each participant was able to walk over a total of six minutes duration on a ten meter (32.8084 feet) hard, flat corridor. Participants were encouraged to walk as far as possible, where oxygen saturation (SpO₂), and vital signs were assessed twice, before and after each test.

7- Data collection:

Data was collected in 6 months period from May 1st, to October 30th, 2020.

8- Statistical analysis:

It was done by SPSS, version 21 (IBM Inc., Armonk, New York, USA). However, non-parametric tests were utilized in the current study. $P \leq 0.05$ deliberated statistically significance.

9- Ethical Considerations:

Written informed consent was obtained from all participants after

explanation of the study aim. Also they were informed that their participation is voluntary, moreover confidentiality of data was assured, and patients' privacy was ascertained.

Results:

Table (1): The study included 100 participants. It was noted that; (66%) of them were females; the observed mean age was (41.33 ± 11.79) . More than half of study participants (57%) were from rural area, and the mean BMI was (30.66 ± 5.97) . Regarding the clinical data, (40%) of the study population was previously hospitalized; whereas (60%) were isolated at home for 14 days. All participants' reported symptoms including fever/chills, feeling un-well for unknown reason, loss of smell and taste senses.

Table (2): most of the study participants (90%) had poor overall knowledge score prior to program implementation (p1); that was improved after one month of program intervention (p2) to grow into good in (52%) of them, moreover 3 month after program intervention (p3) (82%) had fair overall knowledge score (p1<0.001, p2<0.001, p3=0.007; respectively).

Table (3): illustrated that the overall health status indicators mean percent score was (7.35 ± 2.0) prior nursing program implementation, then

improved substantially one and three months thereafter ($P < 0.001$). Also, a considerable subsequent improvement in the overall (EQ-VAS) mean percent score (64.50 ± 11.58 prior program, 76.15 ± 8.84 after one month, to reach 86.82 ± 6.66 three months thereafter). Strikingly, the overall six minutes' walked distance mean percent score was improved after implementing the nursing rehabilitation program with a statistical significance ($p < 0.001$). Furthermore, a substantial improvement was declared in the mean percent scores of vital signs along with SpO₂ ($P < 0.001$, < 0.001 , 0.010 and < 0.001 , respectively).

Table (4): disclosed a mild negative correlation between the participants' overall knowledge and their overall health status indicators mean percent scores (prior nursing program implementation) ($r = -0.247$ and $p = 0.013$). While, a positive correlation was noted between the overall knowledge score of the included subjects with both the overall current health vertical visual analogue self-complete scale and the overall recorded six minutes' walk test walked distance mean percent scores, (after 1 month of follow up) ($r = 0.382$, 0.261 and $p < 0.001$, 0.009, respectively). Furthermore, a positive correlation was declared between the overall knowledge score of the included subjects with both the overall health status indicators, and the overall current health vertical visual analogue self-complete scale mean percent scores; after three months of follow up ($r = 0.577$, 0.421, and $p < 0.001$, respectively).

Table (1): Socio-demographic characteristics and clinical data of the studied post-COVID 19 patients.

A- Patient's socio-demographic characteristics	Subjects (n = 100)	
	No.	%
Age (years)		
18<35	25	25.0
35<50	51	51.0
50≤ 65	24	24.0
Mean age		41.33 ± 11.79
Gender		
Male	34	34.0
Female	66	66.0
BMI		
Mean ± SD		30.66 ± 5.97
Level of education		
Illiterate	6	6.0
Read and write	10	10.0
High School/ University	84	84.0
Occupation		
Manual work	47	47.0
Clerical work	25	25.0
House wife	4	4.0
Not working	24	24.0
Marital status		
Single	19	19.0
Married	73	73.0
Widow	8	8.0
Residence		
Rural	57	57.0
Urban	43	43.0
B- Patients' Clinical Data		
Previous hospitalization		
Yes	40	40.0
Home isolation only	60	60.0
Symptoms at acute attack of COVID-19		
Fever / chills	100	100.0
Feeling unwell for an unknown reason	100	100.0
Loss of smell and taste senses	100	100.0
New cough or a cough that is getting worse	96	96.0
Difficulty breathing	96	96.0
Shortness of breath (in regular sitting or walking)	92	92.0
Unusual level of fatigue/ tendency to fall	92	92.0
Unusual headache	88	88.0
Nausea / vomiting, diarrhea, and or loss of appetite	66	66.0
A runny or congested nose (not due to allergies)	34	34.0
Sore throat (non-allergic)	32	32.0
Comorbid diseases		
Obesity	26	26.0
Diabetes mellitus	19	19.0
Hypertension	25	25.0
Hyperlipidemia	23	23.0
Anemia	10	10.0

Table (2): Overall knowledge mean scores of the studied post-COVID 19 patients at the three observed follow-up intervals of the nursing rehabilitation program.

Post COVID 19 patients' overall knowledge	Patients (n = 100)						P
	1 st observation (Prior-program)		2 nd observation (Post 1 month)		3 rd observation (Post 3 month)		
	No.	%	No.	%	No.	%	
Poor (<50%)	90	90.0	0	0.0	0	0.0	<0.001*
Fair (50 - <75%)	10	10.0	48	48.0	82	82.0	
Good (≥75%)	0	0.0	52	52.0	18	18.0	
Mean percent score							<0.001*
Mean ± SD	27.87 ± 13.88		73.38 ± 3.71		67.87 ± 6.71		
Significance between Periods	p1<0.001*, p2<0.001*, p3=0.007*						

p: p value for comparing between the studied periods

p1: p value for comparing between **Baseline data** and **1 month Follow up**

p2: p value for comparing between **Baseline data** and **3 month Follow up**

p3: p value for comparing between **1 month Follow up** and **3 month Follow up**

*: Statistically significant at p ≤ 0.05

Table (3): The studied post COVID 19 patients' health outcome indicators mean percent scores prior, one and three months of follow-up post implementing the nursing rehabilitation program.

Health outcome indicators mean percent scores	Patients (n = 100)			P	Sig. between periods		
	1st observation (Prior-program)	2nd observation (Post 1 month)	3rd observation (Post 3 month)		P1	P2	P3
Part I: Overall health Status Indicators							
Assessment score (mean ±SD)	7.35 ± 2.0	3.0 ± 1.02	1.23 ± 1.28	<0.001*	<0.001*	<0.001*	<0.001*
Part II: Overall current health self-complete vertical visual analogue scale (mean ±SD)							
	64.50 ± 11.58	76.15 ± 8.84	86.82 ± 6.66	<0.001*	<0.001*	<0.001*	<0.001*
Part III: Overall Six Minutes' Walking Test							
1- Walked distance (mean ±SD)	53.13 ± 55.77	477.84 ± 70.74	543.80 ± 94.57	<0.001*	<0.001*	<0.001*	<0.001*
2-Pulse (mean ±SD)	87.0 ± 18.0	88.54 ± 12.02	86.53 ± 7.71	0.223	–	–	–
3-Respiration (mean ±SD)	24.56 ± 3.80	23.11 ± 2.80	21.73 ± 3.74	<0.001*	<0.001*	<0.001*	<0.001*
4-Systolic Blood pressure (mean ±SD)	118.6 ± 13.47	118.2 ± 9.88	114.50 ± 10.53	<0.001*	1.000	<0.001*	0.001*
5-Diastolic Blood pressure (mean ±SD)	76.30 ± 7.57	77.20 ± 7.39	75.40 ± 5.97	0.010*	0.517	0.083	0.005*
6-SpO ₂ (mean ±SD)	95.93 ± 2.75	96.46 ± 1.45	97.37 ± 1.09	<0.001*	0.036*	<0.001*	<0.001*

*: Statistically significant at p ≤ 0.05

Table (4): Correlation between Post-COVID-19 patients' knowledge and their health outcomes mean percent scores in the three studied follow-up periods of implementing the nursing rehabilitation program.

Health outcomes indicators mean percent scores	The overall knowledge mean percent score					
	1st observation (Prior-program)		2nd observation (Post 1 month)		3rd observation (Post 3 month)	
	r	p	r	p	r	p
Part I: Overall health Status Indicators Assessment mean percent scores	-0.247*	0.013*	-0.071	0.480	0.577*	<0.001*
Part II: Overall current health vertical visual analogue self-complete scale mean percent scores	0.104	0.304	0.382*	<0.001*	0.421*	<0.001*
Part III: Overall recorded six minutes' walk test walked distance mean percent scores	0.099	0.325	0.261*	0.009*	0.124	0.219

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

Discussion

The main results of the current study were that the overall knowledge mean scores were improved significantly after one and three months of implementing the nursing intervention program. Also a substantial correlation was noticed between post-COVID-19 patients' knowledge and their overall health outcome indicators mean percent scores after three months of follow up post implementing the nursing intervention program.

Previous findings suggested that; there would be an increasing number of post-acute COVID-19 cases necessitating a reasonable rehabilitation strategy [(Carda et al, 2020; MEDICA, 2020)]. This imposes the crucial need for implementing a nursing rehabilitation program by a multidisciplinary expert

team; utilizing a range of tailored interventions. Therefore, the **focus of this research** was to address the effect of multiple nursing rehabilitation intervention aspects after one and three months of performing daily home stretching exercises, deep breathing exercises, aerobic exercises and further educating them about; self-care practices; symptoms self-management, and raising the immune system through healthy diet. Nevertheless; this research signified that the post COVID-19 participants who received the implemented nursing rehabilitative program interventions exhibited health outcomes improvement at the end of the program.

In harmony with our results, Sun et al, 2020 and Murray, 2020; stated that, "Rehabilitation improved patients' functional abilities, respiratory function, and reduce complications risk, length of hospital stays, mortality rates, and

readmission risks". Additionally, **Carfi et al, 2020** declared that; COVID-19 patients should receive hospital education program about the disease prior to discharge, and then are scheduled for follow-up 4- 6 weeks thereafter. Moreover, **Wade, (2020)** confirmed that; COVID-19 rehabilitative exercise increases muscle strength, and minimize fatigue, emotional disturbance, lack of confidence, and improve activities. Also, **Lien (2020)** illustrated that psychological rehabilitation can be achieved through deep breathing exercises to decrease anxiety, and improve sleep quality experienced with COVID-19 severe symptoms. Furthermore, **Liu et al, (2020)** concluded that a one & half month respiratory rehabilitation program has suggestively ameliorated the breathing function, life quality, and nervousness in older cases with COVID-19.

In the current study, most of the included subjects had poor overall knowledge score prior to program implementation; that was further improved after one month of program intervention to become good in more than half of them, lastly after 3 month of program evaluation in the majority of them; their overall knowledge score become fair. This agreed with **Polastri, (2021)** who reported similar results in his study assessing Knowledge on Post-Acute Rehabilitation in COVID-19 patients.

In this respect, from the researchers' point of view, the lack of patients' knowledge regarding COVID-19 rehabilitation prior program implementation may be primarily ought to the emphasis of media broadcasts and the published articles on population's

education regarding the general symptoms, protection and prevention related to COVID-19. This differs from the study's rehabilitation program general perspectives for patient education.

Moreover, this study affirmed that; the subjects' overall health status indicators mean percent score was improved substantially one and three months after nursing program implementation. Also, a considerable improvement in the overall (EQ-VAS) mean percent score after three months of program implementation. In accordance with these results, **Liu et al, (2020)** summarized that; rehabilitation program can improve pulmonary function, life quality and nervousness in cases with COVID-19. Similarly, **Demeco et al, (2020) and Zha et al, (2020)** declared that; rehabilitation for post COVID-19 cases is designed to ameliorate and improve their health outcome regarding complaints of breathing difficulties, relieve nervousness and hopelessness, diminish complications, avoid and improve dysfunction, decrease disability, reserve function to the extreme extent, and enhance QOL. Furthermore, **Felten-Barentsz et al, in 2021** stressed a substantial improvement in health-related outcomes after performing physiotherapy interventions for strengthening post COVID-19 patients' muscles and restoring balance in functional activity through; breathing exercise, lower limb light strength exercises, and AROM exercises based on patient's need and tolerance.

In the current study, the overall six minutes' walked distance mean percent score was significantly improved after implementing the nursing rehabilitation

program. In accordance, **Spielmanns et al, 2021** declared the effectiveness of their intensive pulmonary rehabilitation program for improving their post COVID-19 patients' 6-MWT distance with an average 180 (± 101) meters. Similarly, **Liu et al, 2020** illustrated a substantial improvement in exercise tolerance via 6MWT for their study group after a one and half month rehabilitative intervention. On the other hand, **Curci et al, 2020** demonstrated that; the post-acute COVID-19 cases complained from breathing difficulties with a subsequent marked disability, and only a few of them were able to complete 6-MWT with unfortunate outcomes and they recommended that an initial rehabilitation procedure was anticipated consistent with the baseline management of their cases.

The study results also showed a positive correlation between participants' overall knowledge and both their overall current health vertical visual analogue self-complete scale, and their overall recorded six minutes' walk test walked distance mean percent scores, after 1 month of follow up.

In spite minimal researches were conducted measuring the effect of COVID-19 knowledge on both health vertical visual analogue self-complete scale, and six minutes' walk test improvements. However, in accordance to the present research results; **Ping et al, 2020** stated that, the most reported post COVID-19 complain were pain/discomfort (19.0%) and anxiety/depression (17.6%). Though, COVID-19 has significantly raised the mean EQ- VAS score; emphasizing the urgent need for post covid-19 education and rehabilitation to manage these health

outcomes threatening symptoms. Nevertheless, **Spielmanns, 2021** clarified that; implementing a comprehensive education and pulmonary rehabilitation are effective, recommending performance of 6-MWT following post-COVID-19 contagion.

Finally, the current research signified that delivering the post COVID-19 nursing rehabilitation must manage the full range of COVID-19 infestation educational physical health requirement, and its mental health consequences as well. Thus, each patient needs an individualized program that comprises; aerobic exercise, strength training, balance training, respiratory physiotherapy, functional, dietary management and vocational activities (**Spruit et al, 2020**).

The study limitations:

Some difficulties were encountered by the researchers; longer duration for data collection as the clinic works once/ week. The Second; the study did not emphasis on assessing the role of the implemented rehabilitation nursing program on pulmonary function fluctuation in post COVID-19 patients. In addition; to lacking previously conducted studies in this research area of nursing programs.

Conclusion

It was apparent that the post COVID-19 cases who received the nursing rehabilitative program interventions exhibited health outcomes improvement at the end of the program. Furthermore, in clinical settings, post COVID-19 patients' discharge instruction

must be given high priority to avoid post-discharge care delays and to improve patients' overall health and function. Moreover, patients should be kept in touch after discharge in order to develop nursing rehabilitation, follow-up plan in addition to monitoring their progress.

Recommendations

Extend the global scientific knowledge and evidence pathway regarding this post COVID-19 nursing rehabilitation program. Encourage physiatrists and physiotherapists involvement in the care of these patients, to improve physical and psychological efficiency, besides restoring their QOL.

Rehabilitation service providers should adapt multiple clinical actions for post COVID-19 patients; this includes prioritizing patients' ongoing care interventions, providing early discharge plan, and evolving an organized follow-up strategies. In addition; strengthen the access to psychosocial and community support services.

As well, further researches should be conducted to examine this rehabilitation program's effect on quality of life on larger post COVID-19 sample.

References

Al Thobaity A, Alshammari F. (2020): Nurses on the Frontline against the COVID-19 Pandemic: An Integrative Review. *Dubai Med J.*; 3:87-92.

Arnold D.T., Hamilton F.W., Milne A., Morley A.J., Viner J., Attwood M., Noel A., Gunning S., Hatrick J.,

Hamilton S., et al. (2020): Patient outcomes after hospitalization with COVID-19 and implications for follow-up: Results from a prospective UK cohort. *Thorax*; 76:399–401.

Barker-Davies RM., O'Sullivan O., Senaratne KP., Baker P., Cranley M., Dharm-Datta S., Ellis H., et al. (2020): The Stanford Hall consensus statement for post-COVID-19 rehabilitation. *British journal of sports medicine*; 54(16):949-59.

Camicia ME, Cournan MC, Rye J. (2021). COVID-19 and Inpatient Rehabilitation Nursing Care: Lessons Learned and Implications for the Future. *Rehabilitation Nursing: the Official Journal of the Association of Rehabilitation Nurses*, 46(4), 187–96.

Carda S, Invernizzi M, Bavikatte G, Bensmail D, Bianchi F, Deltombe T, Draulans N, et al. (2020): The role of physical and rehabilitation medicine in the COVID-19 pandemic: the clinician's view. *Annals of physical and rehabilitation medicine*; 63(6):554.

Carfi A., Bernabei R., and Landi F. (2020): Persistent Symptoms in Patients after Acute COVID-19. *JAMA*; 324(6):603-5.

Carvalho-Schneider C., Laurent E., Lemaigen A., Beaufils E., Bourbao-Tournois C., Laribi S., Flament T., et al. (2021): Follow-up of adults with noncritical COVID-19 two months after symptom onset. *Clin. Microbiol. Infect. Publ. Eur. Soc. Clin. Microbiol. Infect. Dis.*; 27:258–63.

- Centers for Disease Control and Prevention (CDC).** (2019): Novel coronavirus, Wuhan, Chins. Symptoms, CDC. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/non-us-settings/overview/index.html> [Accessed 28 March 2021].
- Chopra V., Flanders S.A., O'Malley M., Malani A.N., Prescott H.C.** (2020): Sixty-Day Outcomes among Patients Hospitalized With COVID-19. *Ann. Intern. Med.*; 174:576–8.
- Cortinovis M., Perico N., Remuzzi G.** (2021): Long-term follow-up of recovered patients with COVID-19. 397: 10270, 173-5.
- Curci C., Pisano F., Bonacci E., Camozzi D., Ceravolo C., Bergonzi R., Franceschi S., et al.** (2020): Early rehabilitation in post-acute COVID-19 patients: data from an Italian COVID-19 Rehabilitation Unit and proposal of a treatment protocol. *Eur. J. Phys. Rehabil. Med.*; 56(5): 633-41.
- Dean E., Jones A., Yu H.P.-M., Gosselink R., Skinner M.** (2020): Translating COVID-19 Evidence to Maximize Physical Therapists' Impact and Public Health Response. *Phys. Ther.*; 100:1458–64.
- Demeco A., Marotta N., Barletta M., Marinaro C., Petraroli A., Moggio L., Ammendolia A.** (2020): Rehabilitation of patients post-COVID-19 infection: a literature review. *Review J Int Med Res*;48(8).
- EuroQol Research Foundation.** 2019: EQ-5D-5L User Guide. Available at: <https://euroqol.org/publications/user-guides/> [Accessed 28 March 2021].
- Felten-Barentsz K., Oorsouw R., and Klooster E., Koenders N., Driehuis F., Hulzebos E., Schaaf M., et al.** (2020): Recommendations for Hospital-Based Physical Therapists Managing Patients with COVID-19.” *Physl. Ther.* 100: 1444-57.
- Holland A., Spruit M., Troosters T., Puhan M., Pepin V., Saey D., McCormack M., et al.** (2014): An official European Respiratory Society/American Thoracic Society technical standard: field walking tests in chronic respiratory disease. *European Respiratory Journal*; 44(6), 1428-46.
- Hong-Meil Z., Yu-Xiao X. and Chen W.** (2020). Recommendations for respiratory rehabilitation in adults with coronavirus disease. 2019. *Chinese Medical Journal*; 133(13), 1595-602.
- Huang C., Wang Y., Li X., Ren L., Gu X., Kang L., Guo L., Liu M., Zhou X., et al.** (2021): 6-month consequences of COVID-19 in patients discharged from hospital: A cohort study. *Lancet*; 397:220–32.
- Hui DS, Azhar EI, Madani TA, Ntoumi F, Kock R, Dar O, Ippolito G, Mchugh TD, Memish ZA, Drosten C, Zumla A.** (2021): The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health—The latest 2019 novel coronavirus outbreak in Wuhan, China. *International journal of infectious diseases*; 1; 91:264-6.

- Kariann R., Daniel E., Bonnie J., and Ramzi N. (2020):** Telemedicine and e-Health: 26 (11): 1322-4.
- Lam M.H.-B., Wing Y.-K., Yu M.W.-M., Leung C.-M., Ma R.C.W., Kong A.P.S., So W.Y., Fong S.Y.-Y., Lam S.-P. (2009):** Mental morbidities and chronic fatigue in severe acute respiratory syndrome survivors: Long-term follow-up. *Arch. Intern. Med.*; 169:2142-7.
- Lien P. (2020):** Coronavirus recovery: Breathing exercises. Available at: www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/coronavirus-recovery-breathing-exercises [Accessed 20 April 2021].
- Liu K., Zhang W., Yang Y., Zhang J., Li Y., Chen Y. (2020):** Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study. *Complementary therapies in clinical practice*; 1(39):101166.
- Lung Foundation Australia & The Thoracic Society of Australia and New Zealand, (2017):** Australia and New Zealand Pulmonary Rehabilitation Clinical Practice Guidelines, 1: Wiley. Available at: <https://lungfoundation.com.au/wp-content/uploads/2018/09/Book-Australia-and-New-Zealand-Pulmonary-Rehabilitation-Guidelines-Feb2017.pdf> [Accessed 20 April 2021].
- Lung Foundation Australia. (2016):** COPE-COPD Online Patient Education. Available at: <http://www.cope.lungfoundation.com.au/> [Accessed 31 January 2021].
- Mayer K., Sturgill J., Kalema A., Soper M., Seif S., Cassity E., Kolpek J., et al. (2020):** Recovery from COVID-19 and acute respiratory distress syndrome: the potential role of an intensive care unit recovery clinic: a case report, *J Med Case Rep.*, 10;14(1):161.
- McCarthy B, Casey D, Devane D, Murphy K, Murphy E, Lacasse Y. (2015):** Pulmonary rehabilitation for chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews*, Issue 2.
- Medica EM. (2020):** COVID-19 pandemic. What should PRM specialists do? A clinician's perspective. *Eur J phys rehabil Med.*; 56(4):515-24.
- Moldofsky H., Patcai J. (2011):** Chronic widespread musculoskeletal pain, fatigue, depression and disordered sleep in chronic post-SARS syndrome; a case-controlled study. *BMC Neurol.*; 11:37.
- Moreno-Pérez O., Merino E., Leon-Ramirez J.-M., Andres M., Ramos J.M., Arenas-Jiménez J., Asensio S., Sanchez R., Ruiz-Torregrosa P., Galan I., et al. (2021):** Post-acute COVID-19 syndrome. Incidence and risk factors: A Mediterranean cohort study. *J. Infect.*; 82:378-83.
- Murray A, Gerada C, Morris J. (2020):** We need a Nightingale model for rehab after covid-19. *Health Serv. J.* Available at: <https://www.hsj.co.uk/commissioning/we-need-a-nightingale-model-for->

- [rehab-after-covid-19-/7027335.article](#)
[Accessed 31 January 2021].
- Nalbandian A., Sehgal K., Gupta A., Madhavan M.V., McGroder C., Stevens J.S., Cook J.R., Nordvig A.S., Shalev D., Sehrawat T.S., et al.** (2021): Post-acute COVID-19 syndrome. *Nat. Med.*;27:601–15.
- Neal-Boylan L.** (2020): Rehabilitation nursing in the age of COVID-19, *Rehabil. Nurs.*; 45(4):179.
- Ong K.-C., Ng W.-K., Lee S.-U., Kaw G., Kwek S.-K., Leow K.-S., Earnest A.** (2004): Pulmonary function and exercise capacity in survivors of severe acute respiratory syndrome. *Eur. Respir. J.*; 24:436–42.
- Ping W., Zheng J., Niu X., Guo C., Zhang J., Yang H., Shi Y.** (2020). Evaluation of health-related quality of life using EQ-5D in China during the COVID-19 pandemic. *PLoS One*; 15(6):e0234850.
- Polastri M.** (2021): Increasing Knowledge on Post-Acute Rehabilitation in COVID-19, *Respiration*; 100: 933–4.
- Puchner B., Sahanic S., Kirchmair R., Pizzini A., Sonnweber B., Wöll E., Mühlbacher A., Garimorth K., Dareb B., Ehling R., et al.** (2021): Beneficial effects of multi-disciplinary rehabilitation in post-acute COVID-19 - an observational cohort study. *Eur. J. Phys. Rehabil. Med.*; 57:189–98.
- Simpson R, Robinson L.** (2020): Rehabilitation after critical illness in people with COVID-19 infection. *American journal of physical medicine & rehabilitation*; 99(6):470.
- Sindet-Pedersen, C., Olesen, J. B., Blanche, P., Gerds, T. A., Strange, J. E., Butt, J. H., El-Chouli, et al.** (2021): Effect of government interventions to contain the COVID-19 pandemic on incidence of pulmonary embolism - A Danish nationwide register-based cohort study. *Thrombosis research*, 199, 97–100.
- Spielmanns M., Pekacka-Egli A.-M., Schoendorf S., Windisch W., Hermann M.** (2021): Effects of a Comprehensive Pulmonary Rehabilitation in Severe Post-COVID-19 Patients. *International Journal of Environmental Research and Public Health*, 18(5), 2695.
- Spruit, M.A., Holland, A. E., Singh, S. J., Tonia, T., Wilson, K. C., & Troosters, T.** (2020): COVID-19: Interim Guidance on Rehabilitation in the Hospital and Post-Hospital Phase from a European Respiratory Society and American Thoracic Society-coordinated International Task Force. *The European respiratory journal*, 56(6), 2002197.
- Sun T., Guo L., Tian F., Dai T., Xing X., Zhao J., Li Q.** (2020): Rehabilitation of patients with COVID-19. *Expert Rev Respir Med.*;14(12):1249-56.
- The National Academy of Medicine.** (2021): The Future of Nursing 2020-2030: Charting a Path to Achieve Health Equity. Webinar meetings

report. Available at:
<https://nam.edu/publications/the-future-of-nursing-2020-2030/>
[Accessed 28 February 2021].

Thomas P., Baldwin C., Bissett B., Boden I., Gosselink R., Granger C.L., Hodgson C., Jones A.Y., Kho M.E., Moses R., et al. (2020): Physiotherapy management for COVID-19 in the acute hospital setting: Clinical practice recommendations. *J. Physiother*; 66:73–82.

Wade D. (2020): Rehabilitation after COVID-19: an evidence-based approach. *Clin Med*; 20(4):359-65.

Yang Y., Chou C., Kao C. (2020): Exercise, nutrition, and medication considerations in the light of the COVID pandemic, with specific focus on geriatric population: A literature review, *Journal of the Chinese Medical Association*; 83(11): 977–80.

Zha L., Xu X., Wang D., Qiao G., Zhuang W., Huang S. (2020): Modified rehabilitation exercises for mild cases of COVID-19. *Ann Palliat Med*, 9(5):3100-06.