Effect of Implementing Telerehabilitation versus Traditional Pulmonary Rehabilitation Program on Clinical Outcomes of Patients Post Covid-19

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Abstract

Background: Post COVID-19 syndrome is a persistent signs and symptoms that emerge during or after COVID-19 infection. Telerehabilitation is a method to overcome the limitations of traditional based pulmonary rehabilitation through the use of communication technologies to provide rehabilitation services from a distance **Aim:** This study aimed to evaluate the effect of implementing telerehabilitation versus traditional pulmonary rehabilitation program on the clinical outcomes of patients post covid-19. **Subjects and Method:** a purposive sample of 60 patients post covid-19 infection, who admitted Contiguous disease control center at Tanta Main University Hospitals and Isolation department in Qutor Central Hospital affiliated to Ministry of Health and Population during the period of data collection. **Tools**: four tools were used. **First Tool:** A Structure Interview Questionnaire**,** which composed of three parts: Part (1): patients' socio-demographic data. Part (2): Clinical patients' data, as past medical history. Part (3): Lab investigations which Include: PCR and PT. **Second Tool:** Chronic Respiratory Disease Questionnaire (CRQ). **Third Tool**: Fatigue Assessment Scale (FAS).**fourth Tool**: Modified Borg Scale (MBS).**Results:** the main results revealed that there was a high significant improvement in the total health related quality of life, fatigue and dyspnea in telerehablitation group since p value was ≤ 0.05 one month post implementing the program. **Conclusion& Recommendations**: The implementation of pulmonary telerehablitation program had a good impact on post covid- 19 patients' HRQOL, fatigue and dyspnea. It was recommended that nurses should follow pulmonary rehabilitative program as a routine care for patients.

Key words

Telerehablitation, Pulmonary Rehabilitation, Post covid-19, HRQOL, Fatigue and Dyspnea.

Introduction

Coronavirus disease (COVID-19) is natural disasters, a recently emergent disease and epidemics that cause many challenges in providing health care, caused by SARS-CoV-2. COVID-19 spreads primarily with respiratory droplets that caused when a person's saliva discharged through coughing or sneezing and occurs in a space of 1 m (close contact). [1,2,3]

According to world meter statistics in 2021, the prevalence of Covid-19 is about 232,186,217confirmed cases and 4,755,384 deaths worldwide. Regarding Egypt the prevalenceare 286.352 confirmed cases and 16.671death.[4,5] A statistical record of Tanta University Contiguous disease control center indicated that the number of patients admitted with covid-19 at 2021 is 155 patients and the statistical record in Qotor Central Hospital Affiliated to ministry of health is 200 patients .[6,7]

Covid-19 clinical manifestations include mild features as fever, running nose and loss of smell. Moderate features as shortness of breath and oxygen saturation is greater or equal to 94%. Sever features as respiratory

spo_2 less than 89% on room air, lung infiltration less than 50% gray colored skin and pressure in the chest .[8,9]

Post covid-19 syndrome (PCS) is defined as an ongoing symptomatic illness in patients who have recovered from their initial COVID-19 infection. These persistent symptoms include fatigue, dyspnea. Also, the COVID-19 severity, as a risk factor for developing PCS and poor quality of life. [10-11]

pulmonary rehabilitation (PR) is defined as a comprehensive intervention based on patient assessment followed by patient-tailored therapies, which include, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease which may be followed with patients through many technology and telehealth.[12]

Telerehabilitation is a method to overcome the limitations of traditional based pulmonary rehabilitation through the use of communication technologies to provide rehabilitation services from a distance, on the other hand traditional pulmonary rehabilitation is delivered care directly (face to face) to a patient's at home or a nearby healthcare facility' where nurses worked to improve the healthcare performance and monitoring patients for 24/h to provide early rehabilitation [13-14]

Benefits of telerehabilitation include reducing health care costs, improving treatment adherence, improving physical and mental function and quality of life, and be delivered in a manner that is satisfactory to patients.[13,14,15] Most of the telerehabilitation studies address outcomes of synchronous, real-time time rehabilitation, although there is some evidence that asynchronous telemedicine can also be effective for specific patient populations, as those following joint replacement. The payment methods is major factor in implementation[15,16]

Significance of the study

COVID-19 pandemic has created a complex scenario for global health, with various levels of functional impairment in millions of individuals recovering from the disease worldwide. The severe form of the disease causes lung damage. Subsequently, the affected patients may develop pulmonary fibrosis due to the process of lung injury repair. Patients, who recover from COVID-19 after a prolonged ICU stay should undergo pulmonary rehabilitation, initial in gradual manner during hospitalization and continuing after hospital discharge. [17, 18]. So the aim of this study is to evaluate the effect of implementing telerehabilitation versus traditional based pulmonary rehabilitation program on the clinical outcomes of patients post covid19.

The aim of the Study

Aimed to evaluate the effect of implementing telerehabilitation versus traditional pulmonary rehabilitation program on the clinical outcomes of patients post covid-19.

Research Hypothesis

-The patients who will receive pulmonary rehabilitation through telerehablitation will exhibit less dyspnea, fatigue and improve health related quality of life than who will receive traditional pulmonary rehabilitation program.

Subjects and Method

Research design

A comparative research design was utilized in this study.

Setting

The study was conducted in isolation department in Qutor Central Hospital affiliated to Ministry of Health and Population and Contiguous disease control center at Tanta Main University Hospitals, Tanta.

Subjects

A purposive sample of 60 post covid -19 patients, who admitted the above-mentioned settings during the period of data collection. The sample size estimated by power analysis of independent t tests [One tail, Effect size = 0.55; The significance level (α) at 0.05; Power (1-β) = 0.85].

Inclusion criteria

The subjects were recruited based on the following criteria:

- Adult patients (21-60 years), both gender
- Post- Acute covide 19.
-Physiological parameters (respiratory rate less than 30 cycles per minute and oxygen saturation ≥93% at rest).
- Access to a phone with personal device and reliable internet connection.

Tools of the study

Four tools were used to collect the required data as follow:

First Tool: "A Structure Interview Questionnaire: This tool was developed by the researcher after reviewing of the related literatures [(19)], it included three parts:

Part (I) Socio-demographic data" which included, patient code, age, gender, educational level, occupation and residence.

Part (II): Health relevant assessment sheet which includes diagnosis, past medical and surgical history, smoking history , vaccination of covid19, body mass index (BMI),vital signs and spo2.

Part (III) Lab investigations which includes: PCR, CBC and CRP.

Tool (II) : **Chronic Respiratory Disease Questionnaire (CRQ):**

This tool was developed by **Guyatt (1987)[(20)]** and was modified by **Valero-Moreno (2019)**[(21).], it was modified by the researcher to measure the 4 important HRQoL domains associated with chronic respiratory disease:(dyspnea, fatigue, emotional functioning, and disease control). Higher score indicate high quality of life.

Total score ranged from (20 or less) indicting very poor HRQOL, (21-40) Poor HRQOL, (41-60) Moderate HRQOL, (61-80) Good HRQOL, (81-100) Very good HRQOL.

Tool (III) : **Fatigue Assessment Scale (FAS),** was developed by **by Michielson (2003)[(22)]** and was modified by **Horisberger (2019)**[(23)] and will be adopted by the researcher to assess severity of fatigue. The FAS is a 10-items general fatigue questionnaire, five questions reflect physical fatigue and 5 questions reflect mental fatigue, per statement take one out of five answer categories can be chosen from never to always (never=1), (sometimes=2), (regularly=3), (often =4) and (always =5) and an answer to each question has to be given, even if the person does not have any complaints at the moment.

Total score ranged from (10 – 21) No fatigue (normal), (22-34) Fatigue, (scores ≥ 35) Extreme fatigue.

Tool (IV) Modified Borg Scale (MBS), was developed by **Borg (1982)**[(24)] and was modified by **Mahler and Horowitz in 1994**[(25)] and was adopted by the researcher to assess severity of dyspnea. This modified 12 point scale consists (0, 0.5, 1-10) corresponds with increasing shortness of breath, patients were asked to mark the most appropriate description or number of their shortness of breath at rest and during exercise.

Total score ranged from (0 Nothing at all), (0.5Very very slight), (1 Very slight), (2 Slight), (3 Moderate), (4 somewhat sever), (5-6 Sever), (7-8 Very sever), (9 Very very sever), (10 Maximal)

Method:

Ethical and legal consideration

Official letters from the faculty of nursing were delivered to the appropriate authorities in the selected area of the study; Permission to conduct the study was obtained from the

directors of the Isolation department in Qutor Central Hospital affiliated to Ministry of Health and Population and Contiguous disease control center at Tanta Main University Hospitals. An Informed consent was taken from all participants in this research after explanation the aim of the study and the right to withdrawal at any time. Confidentiality and privacy were taken into consideration regarding data collection. A code number was used instead of names.

Methods of data collection

1. The tools of the study were translated to Arabic language and back to English by an expert in English and Arabic language. Content validity of the translated version was examined by 5 experts who are holding a PhD in Medical Surgical Nursing and chest disorder field physician. .The required modifications were conducted accordingly. The reliability of the tools reported as acceptable level of (.839).
2. The reliability for the study tools was calculated by Cronbach's alpha test; it was related to tool II: measuring health related quality of life (Chronic Respiratory Disease Questionnaire CRQ) is .937, tool III: Fatigue Assessment Scale (FAS) is .909, tool III: Modified Borg Scale (MBS) is (.839).
3. A pilot study was carried out on 10% of the total study sample to test the clarity and practicability of the tools. Participants in the pilot study were excluded from the study.
4. The current study data collected in the beginning of February until the end of September 2022, for about 7 months
5. The present study was conducted through four phases (Assessment, planning, implementation and evaluation) and it was continued with each patient individually through their follow ups.

Assessment phase; data collected from patient by different methods according to their groups (telerehabilitation group and traditional group) by using tools I, II, III and IV

Planning phase; the designed pulmonary rehabilitation program was planned based on the study subjects' needs. An illustrative structured colored booklet was prepared and written in simple and attractive language supported by illustrative pictures as a guide in addition to recorded video and power point for traditional and telehealth groups respectively . The rehabilitation program was carried out in (4) sessions individually for every patient. Researcher followed safety precautions before working with the patient according to world health organization recommendation such as wearing the face mask, gown, eye goggle, over shoes and gloves.

Implementation phase; the rehabilitation program was developed and carried out by the researcher for **(telerehabilitation group):** the group was received the pulmonary rehabilitation program post Covid-19 through three sessions and the duration of each session will be 30:40 minutes per day for three consecutive days by using different method (video call , whatsapp and videos recorded by the researcher). **For (Traditional group):** the group was received the same program with the same sequence as telerehabilitation group but the manner of teaching is face to face (traditional method).

I-On the first session included explaining how to perform **the** butyko breathing exercise. [26]

First step: "Control pause"; asking the patient to ;-

1. Sit up straight, close his or her mouth, and take a normal breath through the nose, then taking a control pause, after that , inhale for two seconds, followed by an exhalation (in 3 seconds) ,then hold his or her nose while exhaling , still having some air in the lungs.
2. Measure how long he can go without needing to breathe in again, then hold the

breath until he need to breathe in for the first time, after that ,open the nose and take a deep breath, be sure the first breath taken after the cp should be like normal breath.

Second step: Breathing shallowly; ask the patient to:-

1. Sit up straight and place a finger under his / her nose in a horizontal position to measure the amount of airflow, without obstruct the nose.
2. Take a small breath into nostril tips. For instance, only inhale enough air to completely fill her / his nostrils, with each breath, take in a flicker of air (about 1 cm), focus on calming the patient's breath to lessen the amount of warm air that is felt on the finger when the patient exhales; the warmer the air felt, the deeper the breathing.
3. Gradually reduce the amount of warm air applied to their finger until they start to feel the need or desire for air, then attempt to sustain the need for air for four minutes.

Third step: Consolidate the preceding steps (Shallow breathing and Control pause).

II- The second session included explaining the type, duration and how to perform the strength exercise that included upper limb strength and endurance exercise such as **light hand weights :-** asking the patient to take the start position (sitting or standing), then carry light weights in her / his hands ,after that moving the arms forward and sides, in addition to **wall press :-** asking the patient to stand up from the start position, after that lean into the wall then push up away from wall , then move feet away from the wall in addition to lower limb strength and endurance exercise such as **sit-to-stand :-** ask the patient to sit on the edge of chair , then stand upright without using the arms, in addition to **walking: -** ask the patient to walk daily . **Duration** for each exercise about 10 minutes at least twice a week [(27)]

III- On third session type and how to perform stretch exercise was explained which included: - **Side neck stretch:** asking the patient to slowly tilt head towards one shoulder and hold for 10 seconds, then repeat toward other shoulder for two to three times .**Shoulder rotation:** asking the patient to place hands on her/his shoulders, then slowly make forwards and backwards circles with the elbows and repeat five times each way. **Thoracic stretch** asking the patient to hold hands behind your back , then move your hands away from your back , after that hold for 20 seconds , and repeat two to three times**. Quadriceps stretch ;** asking the patient to pull her/ his foot towards the buttock until a stretch is felt in the front of the thigh, then hold for 20 seconds and repeat two to three times**.**[(27)] Diet recommendation for the patient, encouraged the consumption of fruits, vegetables and whole grain foods. Fruits (eg, orange, grapefruit) and vegetables such as broccoli, and carrots, avoiding the intake of salt, fat, and sugar and encouraged reductions in sugary drinks. [(28)]

Evaluation phase: the studied groups were evaluated by the following schedule; pre, immediately one week and one month post implementing the rehabilitation program by using tools (I, II ,III and IV) for evaluation by using different method (video call , whats app , phone call and videos for telerehabilitation group and by using face to face for traditional group)

Methods of data analysis

All data were collected, coded, tabulated and subjected to statistical analysis. Statistical analysis was performed by statistical Package SPSS in general (version 20), Data expressed as number and percentage. Qualitative data were described using number and percent. Chi-square test for categorical variables, to compare between different groups. P value was statistically significant at a level 0.05%.

Results

Table (1) illustrated the distribution of the patients according to their Socio demographic data. It showed that less than half (43.3%) of the studied groups were in the age group between (50≤60 years) and about quarters of them were in the age group between (31 ≤40 years) with their mean age 53.43±8.73 and 37.57± 11.46 among traditional and telehealth group respectively. **Also,** more than half (58.3%) of the studied groups were female and most of them (75%) were married. **In addition to**, more than two third (68.3%) of the studied groups were lives in rural areas and less than half (41.7%) and one third (33.3%) of the studied groups were employee and house wife respectively.

Figure (1): illustrated the distribution of the studied groups according to Patient's educational level .it showed that less than half (43.3%) of telehealth group were have university education, while about one third (30%) of the traditional group were diploma.

Table (*2*) illustrated the distribution of the studied patients according to their clinical data. Concerning to the hospitalized period, smoking, vaccination history and BMI. It showed that more than two third (71.7%) of the studied groups were stayed in hospital <10 days. **Also,** more than three quarter (76.7%) of the studied groups were non-smoker. **Moreover,** more than half (56.7%) of studied groups were vaccinated before and nearly one third (35.3%) and slightly less than one third (29.4) of studied groups were received astrazeneca and sinovac vaccine respectively. **Additionally,** about half (46.7%) and more than third (35%) of studied groups were have over and normal body weight respectively.

Figure (2): illustrated the distribution of the studied groups according to overall Chronic Respiratory Disease Questionnaire (CRQ) (HRQOL),it showed that less than half (40%) telehealth group have poor quality of life regarding chronic respiratory disease questionnaire pre implementing the program and more than two third (73.3%) of them have good quality of life one month after implementing the program . **Also,** about two third (66.7%) of the traditional group have poor quality of life regarding chronic respiratory disease questionnaire pre implementing the program and the most (63.3 %) of them have good quality of life one month after implementing the pulmonary rehabilitation program respectively.

Figure (3): illustrated the distribution of the studied groups according to total score of Fatigue Assessment Scale (FAS). It revealed that more than half (60%) and the majority (80%) of telehealth and traditional groups were suffering from extreme fatigue pre implementing the program respectively, **meanwhile** after one month of implementing the program, two third (66.7%) and more than half (63.3%) in the telehealth and traditional group were have no fatigue respectively.

Table (*3*) illustrated the distribution of the studied patients according to according to Modified Borg Scale (MBS), it showed that less than half (46.7%) and (43.3%) suffering from somewhat sever dyspnea during rest among telehealth and traditional group pre implementing the program respectively, **meanwhile** more than quarter (26.7%) and less than half (40%) have slight dyspnea in telehealth and traditional group after one month of implementing the program respectively. **Also,** it illustrated that more than half (53.3%) and about half (50%) have severe dyspnea during exercise among telehealth and traditional group pre implementing the program respectively, **meanwhile** less than half (36.7%) and (36.7%) have slight and moderate dyspnea in

telehealth and traditional group one month after implementing the program respectively.

Table (4): illustrated the Correlation between Modified Borg Scale (MBS) with chronic respiratory disease questionnaire (CRQ) and fatigue assessment scale. It showed that there was a statistical negative correlation between chronic respiratory disease questionnaire (CRQ) health related quality of life and Modified Borg Scale pre implementing, week and one month after implementation of the program wherep_1= (<0.05) in traditional and telehealth group respectively. ***Moreover*** there was significant positive correlation between Modified Borg Scale and fatigue assessment scale pre implementing ,week and one month after implementation of the program where P = (<0.05) in telehealth and traditional group respectivel.

Table (1): Distribution of the studied groups according to patient's socio-demographic data.

	Traditional (n = 30)		Telehealth (n = 30)		Total (n = 60)		Test of Sig.	p
	No.	%	No.	%	No.	%		
Age (years)								
21- 30 years	0	0.0	11	36.7	11	18.3		
31 -< 40 years	4	13.3	9	30.0	13	21.7	χ^2=	<0.001
41-<50 year	5	16.7	5	16.7	10	16.7	22.769	
50-<60 years	21	70.0	5	16.7	26	43.3		
Mean ± SD.	53.43 ± 8.73		37.57 ± 11.46		45.50 ±12.88		U=142.50	<0.001
Sex								
Male	14	46.7	11	36.7	25	41.7	χ^2=	0.432
Female	16	53.3	19	63.3	35	58.3	0.617	
Marital Status								
Married	20	66.7	25	83.3	45	75.0		
Divorced	0	0.0	1	3.3	1	1.7	χ^2=	^{MC}p=
Single	1	3.3	4	13.3	5	8.3	12.961	0.002
Widow	9	30.0	0	0.0	9	15.0		
Residential								
Rural	23	76.7	18	60.0	41	68.3	χ^2=	0.165
Urban	7	23.3	12	40.0	19	31.7	1.926	
Occupation								
Manual work	10	33.3	2	6.7	12	20.0		
Employee	5	16.7	20	66.7	25	41.7		
Technical work	0	0.0	1	3.3	1	1.7	χ^2=	^{MC}p
House wife	14	46.7	6	20.0	20	33.3	20.490	<0.001
Student	0	0.0	1	3.3	1	1.7		
Not working	1	3.3	0	0.0	1	1.7		

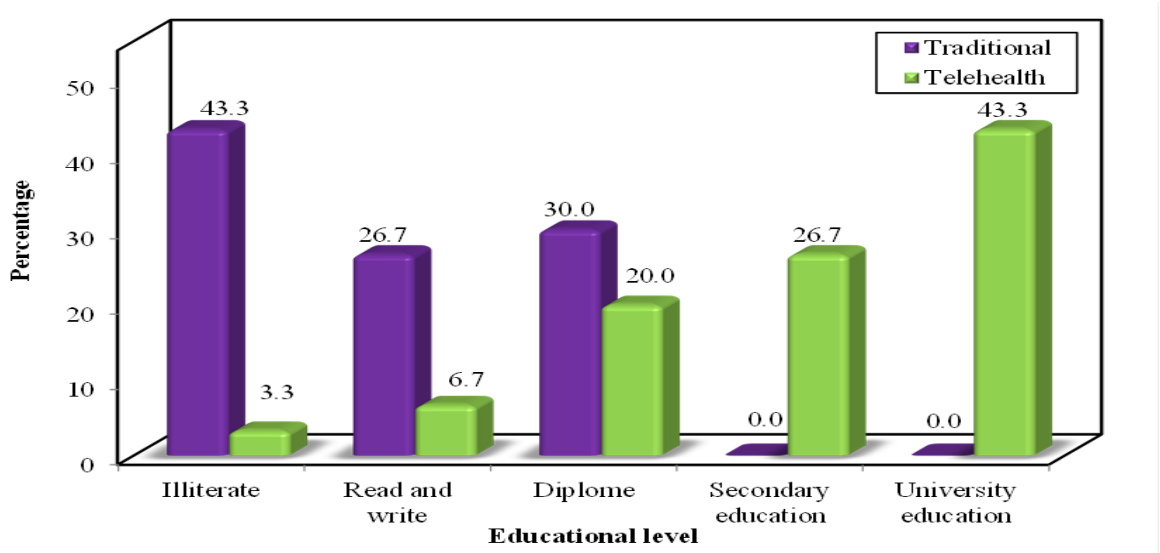

Figure (1): Distribution of the studied groups according to Patient's educational level..

Table (2): Distribution of the studied groups according to clinical data.

	Traditional (n = 30)		Telehealth (n = 30)		Total (n = 60)		χ^2	p
	No.	%	No.	%	No.	%		
Duration of hospital stay								
<10	20	66.7	23	76.7	**43**	**71.7**	χ^2= 2.852	^{MC}p= 0.334
10-<20	7	23.3	7	23.3	14	23.3		
≥20	3	10.0	0	0.0	3	5.0		
Mean ± SD.	9.53 ± 5.86		7.47 ± 2.05		8.50 ± 4.47		U=411.50	^{MC}p=0.544
Smoking history								
Smoke	5	16.7	5	16.7	10	16.7	4.101	^{MC}p= 0.178
Non smoking	**21**	**70.0**	**25**	**83.3**	**46**	**76.7**		
Ex smoking	4	13.3	0	0.0	4	6.7		
Previous Vaccine intake								
Yes	11	36.7	**23**	**76.7**	**34**	**56.7**	9.774	^{MC}p= 0.002
No	**19**	**63.3**	7	23.3	26	43.3		
If yes mention type of vaccine								
AstraZeneca	1	9.1	**11**	**47.8**	**12**	**35.3**	7.770	^{MC}p= 0.101
Sinopharma	**4**	**36.4**	4	17.4	8	23.5		
Sinovac	**4**	**36.4**	**6**	**26.1**	**10**	**29.4**		
Johnson	0	0.0	1	4.3	1	2.9		
Pfizer	1	9.1	1	4.3	2	5.9		
Other (moderna)	1	9.1	0	0.0	1	2.9		
BMI								
BMI less than 18.5 is under weight	0	0.0	2	6.7	2	3.3	χ^2= 4.068	^{MC}p= 0.382
BMI of 18.5 to 24.9 is normal	**12**	**40.0**	**9**	**30.0**	**21**	**35.0**		

BMI of 25 to 29.9 is overweigh	**12**	**40.0**	**16**	**53.3**	**28**	**46.7**		
BMI of 30 to 39.9 is obesity	5	16.7	3	10.0	8	13.3		
BMI greater than 40 is extreme obesity	1	3.3	0	0.0	1	1.7		
Mean ± SD.	26.84 ± 4.69		25.74 ± 4.51		26.29 ± 4.59		t=0.927	0.358

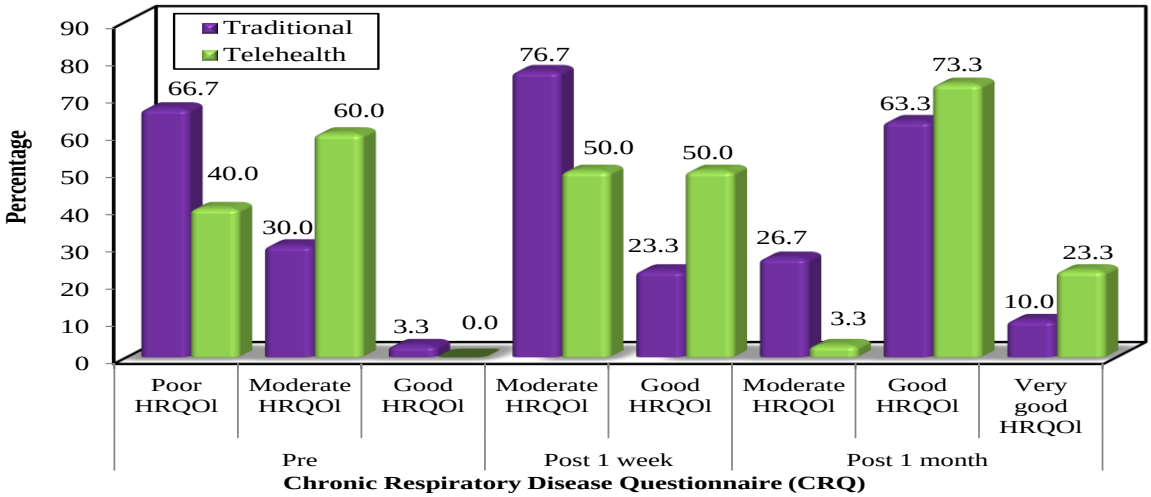

Figure (2): Distribution of the studied groups according to overall Chronic Respiratory Disease Questionnaire (CRQ)(HRQOL) .

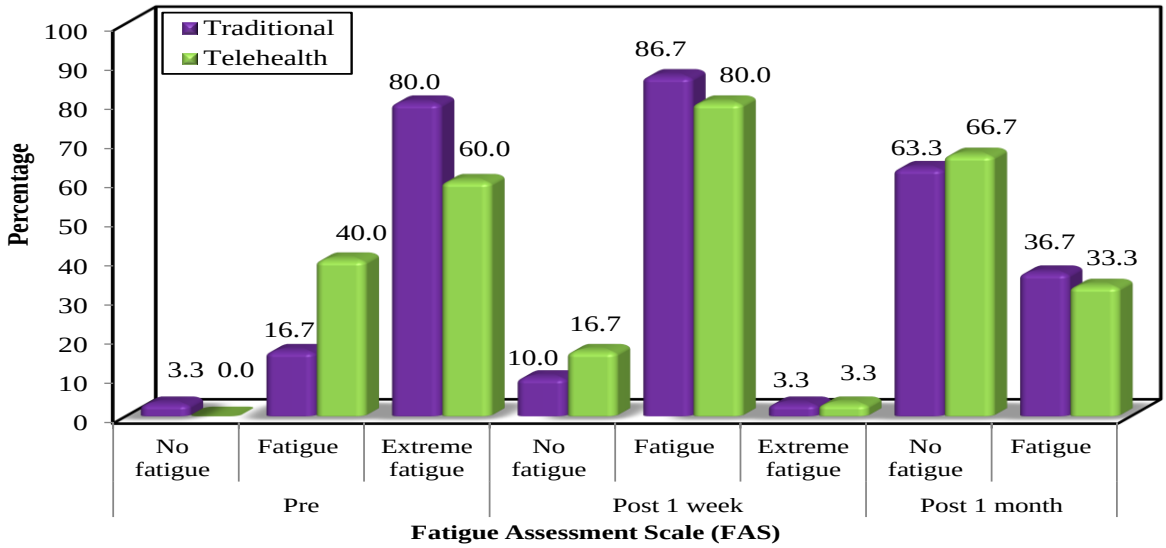

Figure (3): Distribution of the studied groups according to total score of Fatigue Assessment Scale (FAS).

Table (3): Distribution between the studied groups according to Modified Borg Scale (MBS)

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Tool (IV) Modified Borg Scale (MBS)	Traditional(n = 30)						Telehealth (n = 30)						$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$
	Pre		Post 1 week		Post 1 month		Pre		Post 1 week		Post 1 month				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
At rest															
Nothing at all (0)	0	0.0	0	0.0	1	3.3	0	0.0	0	0.0	2	6.7			
Very very slight (0.5)	0	0.0	0	0.0	0	0.0	0	0.0	2	6.9	5	16.7			
Very slight (1)	0	0.0	2	6.7	7	23.3	0	0.0	3	10.3	7	23.3			
Slight (2)	0	0.0	7	23.3	12	**40.0**	7	23.3	11	37.9	8	**26.7**	13.887*	5.263	6.607
Moderate (3)	8	26.7	14	**46.7**	8	26.7	8	26.7	11	**36.7**	7	23.3	(^{MC}p=	(^{MC}p=	(^{MC}p=
Somewhat sever (4)	13	**43.3**	5	16.7	2	6.7	14	**46.7**	3	10.3	1	3.3	0.002)	0.369)	0.237)
Sever (5–6)	9	**30.0**	2	6.7	0	0.0	1	3.3	0	0.0	0	0.0			
Very sever (7–8)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0			
Very very sever (9)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0			
Maximal (10)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0			
During exercise															
Nothing at all (0)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0			
Very very slight (0.5)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0			
Very slight (1)	0	0.0	0	0.0	1	3.3	0	0.0	2	6.7	3	10.0			
Slight (2)	0	0.0	0	0.0	7	23.3	0	0.0	0	0.0	11	**36.7**	9.077*	5.303	4.680
Moderate (3)	0	0.0	6	20.0	11	**36.7**	0	0.0	12	**40.0**	7	23.3	(^{MC}p=	(^{MC}p=	(^{MC}p=
Somewhat sever (4)	1	3.3	7	23.3	6	20.0	8	26.7	5	16.7	7	23.3	0.022)	0.244)	0.450)
Sever (5–6)	15	**50.0**	13	**43.3**	4	13.3	16	**53.3**	9	30.0	1	3.3			
Very sever (7–8)	9	30.0	4	13.3	1	3.3	5	16.7	2	6.7	1	3.3			
Very very sever (9)	5	16.7	0	0.0	0	0.0	1	3.3	0	0.0	0	0.0			
Maximal (10)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0			

Table (4):Correlation between Modified Borg Scale (MBS) with chronic respiratory disease questionnaire (CRQ) and fatigue assessment scale.

	Modified Borg Scale (MBS) (during exercise)			
	Traditional (n = 30)		Telehealth (n = 30)	
	r_{s1}	P_1	r_{s2}	P_2
Chronic Respiratory Disease Questionnaire (CRQ) (HRQL)				
Pre	-0.475	0.008	-0.442	0.014
Post 1 week	-0.590	0.001	-0.473	0.008
Post 1 month	-0.654	<0.001	-0.540	0.002
Fatigue Assessment Scale (FAS)				
Pre	0.580	0.001	0.396	0.030
Post 1 week	0.315	0.091	0.717	<0.001
Post 1 month	0.574	0.001	0.487	0.006

Discussion

The most frequent long-term COVID-19 squeals, known as Post COVID Syndrome (PCS), include fatigue, dyspnea and poor health-related quality of life. After 12 weeks following infection, these symptoms may still be present. Despite the fact that healthcare systems may be overburdened and rehabilitation may be disrupted, early and effective rehabilitation interventions are urgent.[29] Telerehabilitation is defined as rehabilitation services that provided at a distance using communication technologies. Telerehabilitation primarily developed to provide a suitable access to individuals who are geographically remote, to improve the quality of rehabilitation health care , to optimize the timing, intensity and duration of therapy that is often not possible within the constraints of face-to-face treatment protocols in current health systems [13,14,15] So this study was aimed to evaluate the effect of implementing telerehabilitation versus traditional pulmonary rehabilitation program on the clinical outcomes of patients post covid-19. **Concerning to Socio demographic characteristics of the studied groups, it revealed that** less than half of the studied groups were in the age group (50 ≤60 years) and more than half of them were female and the most were married. **As regard to residence, occupation and educational level,** more than two third of the studied groups were lives in rural areas, while less than half of them were employee. **Also,** less than half of telehealth group were bachelor degree, while about one third of the traditional group were diploma. This finding may be attributed to covid-19 can affect more old adult due to decrease the immunity level, physiological change and presence of chronic disease such as DM and hypertension. The current result was in agreement with **keating (2020)** [30] who stated that coronavirus effect on the young and old people in Italy the median age of the population is 46.5 years . **Also, this finding was consistent** with **Purba (2021)** [31] that described marriage and quality of life during the Covid-19 pandemic where the majorities were female ,while **this findings wasn't in the same line with Li (2021)**[32] who recorded that more than half

were males diagnosed with Covid -19 during early transmission. **Also, Lawal (2020)**[33] reported that married : single ratio of approximately 2:1 throughout the explanation of differential effect of marital status and education on mental health during covid-19.**In addition to, this finding wasn't consistent** with **Parizad (2021)**[34] who found that about two third of confirmed covid-19 cases lives in urban area . **Moreover,** this result was in the same line with **Rozenfe (2020)** [35] who reported that less than half of the studied group affected by Covid-19 were employed and health care provider. **Furthermore,** this finding was in agreement with **Parizad (2021)** [34] who reported that one quarter of patients with covid-19 were diplome.

Regarding hospitalized period , smoking , vaccination and body mass index, the current study results revealed that more than two third of the studied groups were hospitalized <10 days and the most of studied groups were nonsmoker, while more than half of studied groups were vaccinated in addition to , less than half of studied groups have over body weight, this result similar to **Shah (2022)**[36] who reported that the average length of hospital stay for Covid -19 patients was (8.1±5.9) days and the majority of their studied sample of covid-19 patients were nonsmokers. **Also**, **this result was in the agreement with Patel (2022)**[37] who reported that the majority of studied groups were vaccinated in her study about long-term protection associated with covid-19 vaccination and prior infection . **Furthermore,** the study result wasn't in the same line with **Betschart (2021)**[38] **and Dalbosco-Salas (2021)** [39] who reported that the body mass index mean and SD were (25 ± 4) and (30.7 ± 5.3) in covid-19 patients respectively.

As regard to chronic respiratory disease questionnaire which measure health related quality of life the result of study revealed that less than half and about two third of them were have poor quality of life among the telehealth and traditional group pre implementing the pulmonary rehabilitation program respectively, while **one month** after implementing the pulmonary rehabilitation program shows that more than two third in telehealth group comparing to more than half in traditional have good quality of life according to chronic respiratory disease questionnaire were have good quality of life respectively. This improvement may be due to the effect of the rehabilitation program via using the information technology such as (whatsapp text messaging, video and audio calls) , most of telerehablitation group were health care provider and highly educated in addition to, using the traditional colored educational booklet with clear, attractive and simple written information and sending the colored educational photo and recorded video to the studied group .**This finding was in agreement with Malik (2021)**[10] **, Arab-Zozani (2020)** [11] and **Navarro (2020)**[40] who stated that more than half of the post-COVID-19 patients had reported poor quality of life. **This finding was in agreement with Li (2021)** [18] who reported that HRQOL also improved in post-discharge COVID-19 patients by using telehealth. **Moreover, Gilmutdinova (2021)**[41] who stated that the well-being improved in the majority of patients who participated in an intervention involving telerehabilitation and telemonitoring after COVID-19. **Also, Betschart (2021)** [38] and **Benzarti (2022)** [42] who reported that there was a statistically significant improvement in HRQoL from more than half before the program to the majority after implementing the program in

postcovid-19 patients through traditional method.

Regarding the fatigue. the study results revealed that more than half and the majority were suffering from extreme fatigue among telehealth and traditional group pre implementing the program respectively. **Meanwhile, one month** after implementing the program about two third in telehealth group and more than half in traditional were have no fatigue. This finding may be attributed to the effect of Covid-19 on the respiratory system that affect lung tissue and decrease o2 saturation so, patients complain from extreme fatigue.**Additionally**, this improvement may be due to the effect of the rehabilitation program via using the information technology such as (whatsapp text messaging, video, and audio calls) , most of telerehablitation group were health care provider and highly educated in addition to, using the traditional colored educational booklet with clear, attractive and simple written information and sending the colored educational photo and recorded video to the studied group. **Moreover,** this finding was in consistence with **Graham (2021)**[43] and **de Sire (2022)** [44] who reported that the most of post covid-19 patients experienced fatigue. **Meanwhile, in telehealth group one month after implementing the pulmonary rehabilitation program** the finding was in agreement with **Bickton (2021)** [45] who reported that the fatigue score was decrease to normal fatigue level in post-acute COVID-19 who utilized the qualified physiotherapist's supervision via whatsapp text messaging, video and audio calls for (telerehablitation) for 3 weeks. **Furthermore, in traditional group** the finding was in the agreement with **de Sire (2022)** [45] who reported that after the rehabilitation program in post-covid-19 patients for three to five weeks more than two third didn't have fatigue.

Regarding dyspnea level during exercise, the result of the study revealed that more than half and half have severe dyspnea during exercise among telehealth and traditional group pre implementing the pulmonary rehabilitation program. **Moreover, one month after implementing the pulmonary rehabilitation program** showed that less than half have slight dyspnea in telehealth group and less than half have moderate dyspnea in traditional group. This results because of the effect of Covid-19 on the respiratory system. **Additionally** , this improvement may be due to the effect of the rehabilitation program via using the information technology such as (whatsapp text messaging, video, and audio calls) , most of telerehablitation group were health care provider and highly educated ,in addition to ,using the traditional colored educational booklet with clear, attractive and simple written information and sending the colored educational photo and recorded video to the studied group. **This finding was in consistence with Fernández-de-las-Peñas (2021**)[46] who reported that dyspnea as main persistent post-covid-19 symptoms. **Furthermore, Prescott (2021)**[47] who reported that less than half to half of patients suffering from dyspnea post-COVID-19. **Additionally, Bastola (2021)** [48] **and Carfì (2020)**[49] who reported that less than half of patients complain from dyspnea post-COVID-19. **Additionally, Calvo-Paniagua (2022)** [50] who found that dyspnea severity with using telehealth rehabilitation program improves self-perceived exertion in covid-19 survivors experiencing post-covid. **Moreover,** in traditional group the finding was in agreement with **Zampogna (2021)**[51] **and Spielmanns (2021)**[52] who reported that pulmonary rehabilitation program is possible

and effective in reducing dyspnea level in patients recovering from COVID-19 .**The result of current study revealed that** there was significant positive correlation between dyspnea and fatigue pre implementing, week and one month after implementation of the program. This results in the same line with **Fernández-de-las-Peñas (2021**) [(46)] who found that there was a significant positive correlation between the presence of fatigue/dyspnea (either at rest or with activity). In addition to those patients with higher levels of fatigue or dyspnea exhibited more severe limitations on daily living activities (HRQOL) according to the chronic respiratory disease questionnaire.

Conclusion and recommendations

Based on the findings of the current study, it can be concluded that the pulmonary rehabilitation through telerehablitation effective in reducing dyspnea, fatigue and improving health related quality of life than who received traditional pulmonary rehabilitation program through the traditional method. **It was recommended that** nurses should follow pulmonary rehabilitative program as a routine care for patients based on each individual needs and limitations during physical exercise

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