Development of a Model One Stop Approach to Post-COVID-19 and other Rehabilitation Conditions

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ABSTRACT

Background

Post-COVID-19 cases can cause severe disabling symptoms and functional disabilities. WHO recognizes the severity of the condition and publishes a standardised Case Report Form to inform clinical management and public health response.

Objective

To determine the post-COVID-19 case load. A multidisciplinary team including a diverse team were composed and priority intervention areas were identified through a transdisciplinary approach eventually developing a Model One Stop Approach to post-COVID-19 and other Rehabilitation Conditions.

Method

The COVID-19 cases recorded at Dhulikhel Hospital were monitored through phone calls to post-COVID-19 complications. Patients were then invited for additional clinical assessments. A diverse team conducted these assessments to identify the needs for expanding a post-COVID-19 clinic and devised rehabilitation services based on predefined criteria.

Result

A total of 550 respondents were included in the study. The proportion of males (51.7%) was slightly higher than females (48.3%) with the majority of them being Brahmin/Chettri. The primary comorbidities identified were diabetes (10.55%) and hypertension (11.4%). Of the participants, about 50.73% experienced persistent symptoms. About 17.8% reported lasting muscle-related problems, 12.1% had persistent joint pain, and 33% faced temporary cardiac issues. Less than 10% experienced enduring health problems related to vision, hearing, and sleep patterns.

Conclusion

After COVID-19, patients experienced cardiac and muscle-related issues, increasing morbidity, financial burdens, and pressure on healthcare systems. With the need of sustainable rehabilitation training package, Dhulikhel Hospital serves as a model for a One-Stop Approach to post-COVID-19 and other rehabilitation conditions.

KEY WORDS

Model, Persistent, Post-COVID-19, Rehabilitation, Symptoms

INTRODUCTION

Post-COVID-19 patients may experience persistent or new symptoms despite clinical recovery. This can be attributed to organ damage, neurobehavioral effects, or intensive care strategies.[1]

WHO has recognized the seriousness of "the post-COVID-19 condition" calling for more research and rehabilitation with "3Rs" recognition, research, and rehabilitation. Recognition of the condition has increased, but not enough research is being carried out.[2]

The study sought to assess the post-COVID-19 case load, involving a diverse team of healthcare professionals. They identified priority intervention areas and developed comprehensive training packages. This initiative aimed to create a Model One Stop Approach for post-COVID-19 and other Rehabilitation Conditions by training healthcare staff across different levels of healthcare centres.

METHODS

Dhulikhel Hospital with its strong medical, nursing and physiotherapy team including other rehabilitation experts like clinical psychologists, speech and language therapists, prosthetist, orthotist, occupational therapist assessed and determined the priorities interventions areas for post-COVID-19 care and rehabilitation to establish a model one stop rehabilitation clinic for post-COVID-19 cases. Following the assessment, a comprehensive post-COVID-19 management and rehabilitation training and essential service delivery package was developed for post-COVID-19 rehabilitation conditions at 3-tier levels (primary, secondary, tertiary) health care centres with focus on referral linkages, education, social and livelihood services.

The team developed a transdisciplinary training and essential service package (with priority interventions) that incorporated a holistic approach of managing the post-COVID-19 cases. The team then conducted workshops to train the health personnel at three different levels of hospitals (primary, secondary, tertiary) on post-COVID-19 management and rehabilitation based on the developed training package and in line with WHO Rehabilitation agenda towards Nepal. A manual of training and service package, information flyers on post-COVID-19 conditions, management and rehabilitation were drafted by Dhulikhel multidisciplinary team.

Dhulikhel Hospital had set up a post-COVID-19 management and rehabilitation clinic where COVID-19 cases who had received health care service through the COVID care center and remote ward system, telemedicine service was followed up through telephone to assess the post COVID sequelae and called over to Dhulikhel for further clinical assessment. These cases were assessed for their post-COVID-19 conditions by the physician and referred for the respective rehabilitation needs of the post-COVID-19 cases based on the three-tier management protocol developed by the multidisciplinary team.

A rapid assessment of Dhulikhel Hospital was done using the One National Tool Kit for comprehensive hospital safety assessment (with disability inclusion and rehabilitation components) to determine the gaps in facilities, information and services for persons with disabilities and other rehabilitation conditions. An action plan was prepared to address the priority gaps which includes accessible signage and patient education sheets.

A retrospective study was conducted among COVID-19 patients, with data collection taking place from February 15 to April 15, 2023. COVID-19 patients admitted to Dhulikhel Hospital and those monitored through the remote ward (reWard) system during 2020 and 2021 were contacted. Out of all the patients contacted, 550 patients responded to the interview and details about the post-COVID-19 symptoms were taken during the interview.

The data collection and entry was done in excel. The categorical data were reported as frequency and percentage. After the descriptive analysis of the general and clinical characteristics of the patients, odds ratios (OR) and their 95% confidence intervals (CI) was estimated by using unconditional logistic regression for the binary outcome of either having post-COVID-19 or not having post-COVID-19. Bivariate analysis was performed to measure the factors associated with post-COVID-19. The statistical analysis was carried out in STATA 13.

RESULTS

We studied 550 patients from the COVID-19 care center and remote ward (reWard) list. The mean age of the respondents were 37 years with (standard deviation: [SD] 18.7). The proportion of males (51.7%) was slightly higher than females (48.3%) with the majority of them being Brahmin/Chettri (51.5%), Janajati (41.6%) and others (6.9%). Smoking history indicated 86.9% never smoked, and 13.0% previously smoked. Alcohol/substance use was reported by 6%. Majority of the participants were engaged in agriculture (31.5%). Occupations vary, with 31.5% in agriculture, 12.0% in business, 14.2% as health professionals, 11.5% homemakers, and 30.6% in other professions.

The majority of participants (93.6%) had no comorbidities. Among those with comorbidities, diabetes (10.5%) and hypertension (11.6%) were common. While 80.7 % didn't develop new post-COVID-19 symptoms, 50.7% experienced persistent symptoms. Over 90% didn't have lingering COVID-related symptoms, indicating recovery with time. However, 17.8% of participants dealt with muscle-related problems, with persistent symptoms of muscle fatigue. Also, the participants experienced joints pain (12.1%) for a certain

Table 1. Socio-demographic characters (n =550)

Characteristics	Frequency (n)	Percentage (%)
Age		
< 30	206	37.4
30-59	259	47.0
60-74	61	11.0
75-95	24	4.4
Mean (±SD)	37.7(18.7)	
Gender		
Female	266	48.3
Male	284	51.7
Ethnicity		
Brahmin / Chhetri	283	51.5
Janjati	229	41.6
Others	38	6.9
Smoking		
Never done	478	86.9
Previously done	72	13.0
Alcohol/ Substance Abuse		
No	517	94
Yes	33	6
Occupation		
Agriculture	173	31.5
Business Enterprises	66	12.0
Health Professional	78	14.2
Home maker	63	11.5
Other professional	168	30.6

Table 2. Clinical Characteristics (n=550)

Characteristics	Frequency(n)	Percentage (%)
Comorbidities		
No	515	93.6
Yes	35	6.4
Types of Co-morbidities		
Diabetes	58	10.5
High Blood Pressure	64	11.6
Other	35	6.4
New symptoms after COVID-19		
No	444	80.7
Yes	106	19.3
Persistent symptoms after COVID-19		
No	271	49.3
Yes	279	50.7
COVID-19 related symptoms		
No	537	97.6
Yes	13	2.4
Muscle related symptoms		
No	452	82.2
Yes	98	17.8
Persistent fatigue	98	17.8

	Frequency	Percentage
Joint pain/swelling		
No	464	84.3
Yes, but not Present anymore	67	12.1
Yes	19	3.4
Neurological symptoms		
No	546	99.3
Yes	4	0.7
Cardio respiratory symptoms		
No	366	66.5
Yes	184	33.4
Chest Pain		
No	406	73.8
Yes, but not Present anymore	115	20.9
Yes	29	5.2
Pain on breathing		
No	465	84.5
Yes, but not Present anymore	64	11.6
Yes	21	3.8
Shortness of breath		
No	452	82.1
Yes, but not Present anymore	77	14
Other persistent symptoms		
No	519	94.4
Yes	31	5.6
Vaccination status		
Yes	441	80.2
No	109	19.8
Treatment received		
Telemedicine	332	60.4
Hospitalised in Hospital	218	39.6
Severity		
No	419	76.2
Yes	131	23.8

period of time. Over 90% of participants didn't experience neurological symptoms. Approximately 33% reported cardiac issues, including chest pain, breathing difficulties and shortness of breath for a specific duration. Less than 10% encountered other persistent health problems related to vision, hearing, and sleep patterns. A significant majority (80.2%) received vaccination. Telemedicine was utilized by 60.4% for treatment. More than half of the respondents didn't experience severe condition (76.2%).

The study showed significant association between smoking and post-COVID-19 and revealed that previously who smoked (OR =0.44, 95% CI: 0.27-0.73, p-value 0.001) were less likely to develop post-COVID-19 symptoms compared to those who never smoked. This association might be due to the proportional imbalance in the sample of never and previous smoker. There was a significant association between occupation and post-COVID-19. There was higher risk of having post-COVID-19 symptoms among

Table 3. Factors associated with post-COVID-19 conditions (n=550)

Characteristics	Frequency	Percent	OR	CI	p-value
Age Category					0.14
<30	206	37.4	1	1	
30-59	259	47.0	0.216	0.87-1.84	
60-74	61	11.0	0.660	0.49-1.56	
75-95	24	4.3	0.15	0.22-1.25	
Gender					0.63
Female	266	48.3	1	1	
Male	284	51.6	0.64	0.77-1.52	
Ethnicity					0.75
Brahmin / Chhetri	283	51.4	1	1	
Janjati	229	41.6	0.61	0.76-1.56	
Others	38	6.9	0.51	0.62-2.54	
Smoking					0.001
Never done	478	86.9	1	1	
Previously done	72	13.0	0.44	0.27-0.73	
Alcohol/ Substance Abuse					0.60
No	517	94	1	1	
Yes	33	6	0.82	0.40-1.67	
Occupation					<0.001
Agriculture	173	31.5	1	1	
Business Enterprises	66	12.0	2.81	1.56-5.08	
Health Professional	78	14.2	4.68	2.56-8.52	
Home maker	63	11.5	2.80	1.54-5.12	
Other professional	168	30.6	2.85	1.84-4.43	
Comorbidities					0.007
No	515	93.6	1	1	
Yes	35	6.4	0.38	0.19-0.78	
Vaccination status					< 0.001
No	109	19.8	1	1	
Yes	441	19.8	0.42	0.27-0.65	
Types of Treatment received					< 0.001
Telemedicine	332	60.3	1	1	
Hospitalised	218	39.6	5.66	3.77-8.50	
Severity					0.10
No	419	76.2	1	1	
Yes	131	23.8	1.17	0.96-1.44	
New symptoms after COVID-19					< 0.001
No	444	80.7	1	1	
Yes	106	19.3	1.63	1.28-2.08	
Persistent symptoms after COVID-19					0.008
No	271	49.3	1	1	
Yes	279	50.7	1.78	1.15-2.77	
COVID-19 related symptoms					0.43
No	537	97.6	1	1	
Yes	13	2.4	1.58	0.48-5.21	
Muscle related problem					< 0.05
No	452	82.2	1	1	
Yes	98	17.8	2.06	1.27-3.34	
Other persistent symptoms					0.29
No	519	94.4	1	1	
Yes	31	5.6	1.49	0.69-3.24	

Businessman (OR =2.81, 95% CI: 1.56-5.08, p-value <0.001), Health professional (OR =4.68, 95% CI: 2.56-8.52, p-value < 0.001), Home makers (OR =2.80, 95% CI: 1.54-5.12, p-value < 0.001) and other Professionals (OR =2.85, 95% CI: 1.84-4.43, p-value < 0.001) compared to those engaged in Agriculture. Health professionals' increased risk is linked to their direct exposure to patients, while businessmen face heightened risk due to frequent interpersonal interactions.

There was a significant association between post-COVID-19 symptoms and comorbidities. There was less likely risk of having post-COVID-19 symptoms among those who had comorbidities (OR =0.38, 95% CI: 0.19-0.78, p-value 0.007) compared to those who do not had comorbidities. The reasons behind lower risk among post-COVID-19 patients were possibly due to enhanced medical management or unique immune responses associated with pre-existing health conditions. A noteworthy link exists between post-COVID-19 symptoms and vaccination status, indicating a reduced risk for those vaccinated (OR = 0.42, 95% CI: 0.27-0.65, p-value < 0.001) compared to those not vaccinated. Additionally, there is a significant association between post-COVID-19 symptoms and the type of treatment received, with a higher risk for those hospitalized (OR = 5.66, 95% CI: 3.77-8.50, p-value < 0.001) compared to those utilizing telemedicine for treatment. New (OR =1.63, 95% CI: 1.28-2.08, p-value < 0.001) and persistent symptoms (OR =1.78, 95% CI: 1.15-2.77, p-value 0.008) after COVID-19 increase the risk of post-COVID-19 symptoms.

The risk of having muscle-related symptoms was 2 times higher among those having post-COVID-19 symptoms (OR =2.06, 95% CI: 1.27-3.34, p-value < 0.05) compared to those who do not post-COVID-19 symptoms.

DISCUSSION

In our study, participants average age was 37 years (SD: ±18.7), while in similar study, Shah et al. reported a mean age of 46.6 years among post-COVID-19 patients. Comparable to the study, Bastola et al. found a mean age of 49.7 ± 15.01 years.[3,4] Males slightly outnumbered females at 51.7%. In Shah et al.'s hospital-based study, males (56%) surpassed females (44%) in post-COVID-19 syndrome.[4] Bastola et al. found a 2.2:1 male-to-female ratio, with 68.6% males and 31.4% females.[3,4] In an online

survey, Ziauddeen et al. found participants had a similar average age of 46.5 years (standard deviation 11 years). However, contrary to expectations, there were more females (82.8%) than males (79.9%).[5] This study identified 86.91% had never smoked, and 13.09% had previously smoked. No any major relationship had been established to be found between smoking and post-COVID-19. Majority of the participants were engaged in agriculture (31.57%). Occupational diversity is evident, with 31.57% in agriculture, 12.04% in business, 14.23% as health professionals, 11.50% homemakers, and 30.66% in other professions. According to study conducted by Kromydas et al. varied risk factors regarding the profession was seen among post-COVID-19 cases with much odds of risk among the sectors like teaching, healthcare.[6] Moreover, a study by Perlis et al. further revealed the presence of post-COVID-19 condition that was associated with a lower likelihood of working full-time (OR=0.71, 95% CI, 0.63-0.80); adjusted (OR=0.84,95% CI, 0.74-0.96) and with a higher likelihood of being unemployed (OR=1.45 95% CI, 1.22-1.73).[7]

The current study identified diabetes (10.55%) and hypertension (11.4%) as prevalent comorbidities. Comparable to this findings, Shah et al. showed that 62.7% of patients had at least one of seven comorbidities, with hypertension (28.7%) and diabetes mellitus (18.3%) being common.[4] About 50.73% of participants dealt with persistent symptoms, and 17.8% experienced muscle-related issues, primarily fatigue. A hospital-based study by Shah et al. showed fatigue (33.1%) as second common persistent complain along with shortness of breath (40.7%), dyspnea (40.7%), chest heaviness (28%), and cough (27.1%). In an Italian study by Carfi et al., post-COVID-19 patients commonly reported fatigue (53.1%) and dyspnea (43.4%) over a 60-day follow-up.[8] Interestingly, a similar study in Korea identified fatigue as the most prevalent long-term effect of acute COVID-19, reported by 26.2% (253) of participants.[9] Around 33% reported cardiac issues, while less than 10% faced persistent problems related to vision, hearing, and sleep, with insomnia rates at 26.45% in Nepal. A Systematic Review and Meta-analysis done by Nasiri et al. noted 10% of COVID-19 patients experience eye problems, and conjunctivitis which can signal an initial COVID-19 infection.[10]

The study showed that comorbidities had low risk of having post-COVID-19 symptoms (OR =0.38, 95% CI: 0.19-0.78, p value 0.007). The reasons behind lower risk among post-COVID-19 patients were possibly due to enhanced medical management or unique immune responses associated with pre-existing health conditions. Contrasting to the finding, Falsetti et al. found higher risk of developing a post-COVID-19 syndrome (OR=6.06, 95% CI: 3.16-11.61; p < 0.0001).[11] A noteworthy link exists between post-COVID-19 symptoms and vaccination status, indicating a reduced risk for those vaccinated (OR = 0.42, 95% CI: 0.27-0.65, p value < 0.001) compared to those not vaccinated. Similar findings done by Lewis et al. suggested that risk of SARS-CoV-2

reinfection after recovery from COVID-19 was relatively high among individuals who remained unvaccinated.[12]

Additionally, risk of muscle-related symptoms are two times higher among those having post-COVID-19 symptoms (OR = 2.06, 95% CI: 1.27-3.34, p value < 0.05) compared to those who do not have post-COVID-19 symptoms. A study done at 6 months post discharge in a cohort of COVID-19 survivors showed significant drop in muscle strength or a performance status score of 2 or higher which indicates noticeable decline in physical abilities or moderate impairment in daily activities as a consequences of post-COVID-19.[13] The post-COVID-19 syndrome displayed reduced physical performance. The study found that participants, experiencing moderate to high fatigue (FAS score 35.0±7.4), exhibited significant reductions in aerobic fitness, walking distance, and both physical and mental aspects of quality of life compared to norms. Severe fatigue (FAS score ≥ 35) was associated with even greater declines in walking distance and physical well-being. Age, sex, mental and physical health-related quality of life, and walking ability were identified as factors linked to fatigue levels.[14] This findings further suggest for the restoration of the muscular performance by rehabilitation is indispensable.

Rehabilitation is a problem-solving process, similar to medical care, backed by evidence. It begins with a diagnostic assessment to identify the patient's main issues, understand their origins, and find ways to improve them.[15] Rehabilitation is vital for individuals with COVID-19, improving function and quality of life. It also helps manage post-COVID-19 issues, preventing the need for emergency or hospital services.[16]

A multidisciplinary team developed a comprehensive approach for post-COVID-19 and other WHO rehabilitation conditions. This included training modules and referral packages for tertiary and secondary healthcare workers. At Dhulikhel Hospital, a pulmonary rehabilitation model was tailored to meet post-COVID-19 patient needs, featuring a three-tier care model and seven training modules covering various aspects of rehabilitation. A scoping review for post-COVID-19 rehabilitation care models underscores the need for multidisciplinary teams, coordinated care, people-cantered approaches, and shared decision-making between clinicians and patients. The care model should include standardized symptom assessment, telehealth, and a follow-up system in care models. Integrate rehabilitation services across all health system levels, from primary to tertiary care, with a multidisciplinary team, primarily comprising physiotherapists, occupational therapists, and psychologists is much required.[17]

The generalization of the health problems and its association was based on only the post-COVID-19 patients receiving treatment at Dhulikhel Hospital. The one stop approach to post-COVID-19 and other rehabilitation is accessible to the nearby population of Dhulikhel Hospital

and the services of rehabilitation are not fully embedded in rest of the districts of the country.

CONCLUSION

Following COVID-19, patient often experience muscle fatigue, cardiorespiratory issues, and problems with hearing and vision. These long-term effects can increase morbidity, strain financial resources, and increase burden to healthcare systems. To address this, a sustainable training package is essential for a multi-level rehabilitation approach. In response to this, Dhulikhel Hospital team developed a transdisciplinary package for post-COVID-19

management and now serves as a center providing rehabilitation services to those affected for the long term post-COVID-19 conditions.

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