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Post COVID-19 Symptoms and their Associations: A Cross-Sectional Study at One Month After Acute COVID-19 Infection

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ABSTRACT

Introduction: Post-COVID-19 symptoms have been identified among a considerable proportion of individuals following acute COVID-19. This study cross-sectionally analyzed the post-COVID-19 symptoms of confirmed COVID-19 patients, between April – September 2021 who visited the post-COVID clinic, Teaching Hospital, Peradeniya, Sri Lanka. **Methods:** Patients' clinical course of COVID-19 was classified as mild, moderate, and severe based on the peripheral oxygen saturation. Chi-square tests were performed to test the differences in the prevalence of persistent symptoms, and logistic regression to investigate the association between persistent symptoms and the variables examined. **Results:** The sample comprised 212 patients (55.17% females) with a mean age of 52.8 (SD±14.75) years. At baseline, 74.40%, 16.91%, and 8.70%, respectively, had mild, moderate, and severe COVID-19. One month after acute COVID-19, 98.11% of patients still had at least one persistent symptom with fatigue (65.57%), dyspnoea when climbing stairs (61.79%), and dyspnoea when walking a short distance (56.13%) being the most common. Females were more likely to develop persistent feverishness (aOR = 9.01; 95%CI: 1.13-71.98) and joint pain (aOR = 2.06; 95%CI: 1.15-3.69). Age (≥60) was associated with an increased risk of persistent depressed mood (aOR = 3.00; 95%CI: 1.06-8.45). Among comorbidities, chronic wheezers were more likely to experience fatigue (aOR = 3.81; 95%CI: 1.07-13.49), dyspnoea when climbing stairs (aOR = 6.71; 95%CI: 1.51-29.77), dyspnoea when walking a short distance/30m (aOR = 3.96; 95%CI: 1.27-12.33), and cold (aOR = 3.05; 95%CI: 1.14-8.21). **Conclusion:** Post COVID-19 symptoms had a high prevalence in this population, where fatigue, dyspnoea, feverishness and arthralgia were the most prevalent. Depressive symptoms were common among females. These findings may empower clinicians to counsel and investigate patients appropriately and suggest the need for further research to raise understanding and public awareness.

Keywords: Asia, Post COVID-19 condition, Post COVID-19 symptoms, Prevalence, SARS-CoV-2

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INTRODUCTION

Three years after SARS-CoV-2 emerged in Wuhan, China, over 500 million confirmed cases have been reported, including more than 60 million in South Asia (1). Initially, most COVID-19 infected individuals had mild diseases, but concerns arose about long-term complications in survivors. Based on previous viral outbreaks, lingering systemic, neurologic, lung function issues, decreased exercise ability, and mental health problems were expected (2-4). Studies identified prevalent symptoms in survivors, leading to "post COVID-19 condition" (5-7), a term describing persistent symptoms in individuals with confirmed COVID-19 within three months of onset not explained by other diagnoses, as defined by the WHO (8).

There is growing evidence of long-term symptoms following acute COVID-19, with initial UK estimates suggesting one in ten individuals had symptoms lasting over 12 weeks (9). Multiple studies indicate that many individuals experienced persistent symptoms six months post-COVID-19 (10-12), including fatigue, dyspnea, muscle pain, cough, palpitation, cognitive impairment, anxiety, and depression (5,13). These ongoing symptoms have resulted in significant health burdens and increased healthcare utilization (14,15).

The burden of post COVID-19 symptoms in Sri Lanka could be substantial, with 517,882 cases reported by September 30th, 2021 (18), but has received less attention due to a lack of awareness. Local research is crucial to understand the range of symptoms contributing to post COVID-19 condition, inform clinical management, and identify at-risk individuals. This study aims to quantify and evaluate post COVID-19 symptoms in patients diagnosed with COVID-19 one month after infection.

MATERIALS AND METHODS

Study Design and sample selection

A cross-sectional study was conducted using data from the post-COVID medical clinic database at Teaching Hospital, Peradeniya (THP) to identify patients admitted with SARS-CoV-2 infection. The study period was from April to September 2021, during which all confirmed COVID-19 patients were institutionalized and reviewed one-month post-infection. Data included demographic characteristics and self-reported persistent symptoms. The sample consisted of patients aged 18 or older with a confirmed COVID-19 diagnosis via PCR or rapid antigen testing. Exclusions were made for missing records and those attending the clinic after one month of infection, resulting in a final sample of 212 patients. The study was approved by the Ethics Review Committee, Faculty of Allied Health Sciences, University of Peradeniya (AHS/ERC/2022/003, 27th January 2022).

Procedures

Clinical data for the acute phase were extracted from paper SpO_2 based medical records, including peripheral oxygen saturation (SpO_2) which was measured by a trained physician on admission, and comorbidities. Patients' initial COVID-19 severity was classified into three categories based on SpO_2 level in accordance with the criteria laid in "Provisional Clinical Practice Guidelines on COVID-19 suspected and confirmed patients in Sri Lanka" (19). Patients were defined as having mild COVID-19 infection if their oxygen saturation (SpO_2) was >94% during the acute illness. Those with SpO_2 of >90% and <94% were considered to have a moderate illness, whereas those with room air SpO_2 of <90% were classified as severe acute COVID-19.

Outcomes

Symptom outcome data were obtained from the post COVID medical clinic database, gleaned from responses to a questionnaire during patients' clinic visits for treatment purposes. The assessed 19 clinical outcomes included fatigue, dyspnoea (when climbing stairs), dyspnoea (when walking a short distance/30m), anosmia, ageusia, joint pain, muscle pain, headache, feverishness, cough, numbness, gastritis, frequent urination, cold, diarrhea, leg swelling, stress, depression, and skin rash.

Statistical Analysis

Categorical data were expressed as frequencies and percentages. The means and standard deviations were assessed for continuous data. Descriptive statistics were performed for all variables. Frequency distribution tables and graphs

were used to describe demographics and the prevalence of symptoms. Differences in the prevalence of persistent symptoms (dependent variable) by gender, age groups, comorbidities, and initial infection severity (independent variable) were assessed using the Chi-square test. Given that dependent variables were always binary in this sample, logistic regression was conducted. Univariate logistic regression and multivariable-adjusted logistic regression models were used to estimate the odds ratios (ORs) and 95% confidence interval for associations. Variables with p values <0.05 in the Chi-square test were included in the regression model. Variables used for association with the outcomes in the logistic regression models were age (<60 and ≥60), gender, comorbidities (diabetes mellitus, hypertension, and chronic wheezing) initial infection severity (mild and moderate to severe). Age and gender were identified as confounders through literature and multivariate models were used to adjust for confounders. No assumptions were made for missing data. Data were evaluated at a significance level of <0.05. All statistical analyses were conducted using Stata Version 16.0 (StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC) software.

RESULTS

Descriptive statistics

Of the COVID-19 recovered patients presented to the post COVID outpatient clinic of THP between April 24th to September 15th, 2021, a total of 450 got information collected on their post COVID-19 symptoms, of whom 212 were included. Excluded were the patients who did not meet the inclusion criteria. The proportion of 44.83% men (91/203) and 55.17% females (112/203) was approximately balanced. The age of patients ranged from 18 to 90 years. The mean age was 52.83 (SD±14.75) years. Patients under 39 years of age were 17.92%, whereas 49.53% were between the ages of 40 to 59, and 32.55% were 60 years or older. Among the included, 74.64% of patients (156/212) initially presented with mild infection. Only 16.75% (35/212) and 8.61% (18/212) of all patients experienced moderate or severe infection, respectively. In this sample, 76.89% (163/212) of patients were hospitalized due to COVID-19. Only 23.11% of all patients were treated in Intermediate Care Centres (ICCs). Any comorbidities prior to COVID-19 infection were reported in 59.90% of patients (127/212). Of these, the most frequent were diabetes mellitus 32.55% (69/212), followed by hypertension 31.60% (67/212), and chronic wheezing 11.32% (24/212) (Table 1).

Prevalence of post-COVID-19 symptoms

The five most common persistent symptoms at one month of infection were fatigue in 65.57% (139/212), dyspnoea (when climbing stairs) in 61.79% (131/212), dyspnoea (when walking a short distance on level ground/30m) in 56.13% (119/212), anosmia in 46.70% (99/212), and ageusia in 43.40% (92/212). Additionally, 98.11% (208/212) of patients had at least one symptom, and 93.40% reported having two or more symptoms. While 1.89% (4/212) of patients reported no symptoms at one month of initial COVID-19 infection. The mean number of symptoms was 6 (SD±3) (Table 2).

Females (99.11%) had a higher percentage of any symptom than males (96.70%). Having two or more symptoms in females and males was 93.75% and 92.31%, respectively. Fatigue was the most commonly reported post-COVID-19 symptom followed by dyspnoea (when climbing stairs) in both males and females. The prevalence of fatigue in females was 67.86% and 61.54% in males. The prevalence of persistent dyspnoea (when climbing stairs) in females was 65.18% and 57.14% in males (Online Resource 1).

Females had a significantly higher prevalence of some post-COVID-19 symptoms compared to males; feverishness (8.93% vs. 1.10%; p = 0.01), joint pain (46.43% vs. 29.67%; p = 0.02), and muscle pain (42.86% vs. 29.67%; p = 0.02). Notably, a significantly lower prevalence of persistent skin rash than did males (7.14% vs. 16.48%; p = 0.04) (Online Resource 1).

Table 1: Demographics, initial COVID-19 severity, and comorbidities of patients after one month of acute COVID-19 infection

	N	%
Gender		
Male	91	44.83
Female	112	55.17
Total*	203	100.00
Age (yrs) ¶		
<39	38	17.92
40-59	105	49.53
≥60	69	32.55
Total	212	100.00
Age (yrs)		
≥60	69	32.55
≥60	143	67.45
Total	212	100.00
Initial infection Severity ¶		
Mild	156	74.64
Moderate	35	16.75
Severe	18	8.61
Total*	209	100.00
Initial infection Severity		
Mild	156	74.64
Moderate to severe	53	25.36
Total*	209	100.00
Pre morbidities		
Diabetes mellitus	69	32.55
Hypertension	67	31.60
Chronic wheezing	24	11.32
None	85	40.09
Any comorbidities	127	59.90
≥2 comorbidities	67	31.60
Hospitalized	163	76.89
Treated in ICC	49	23.11

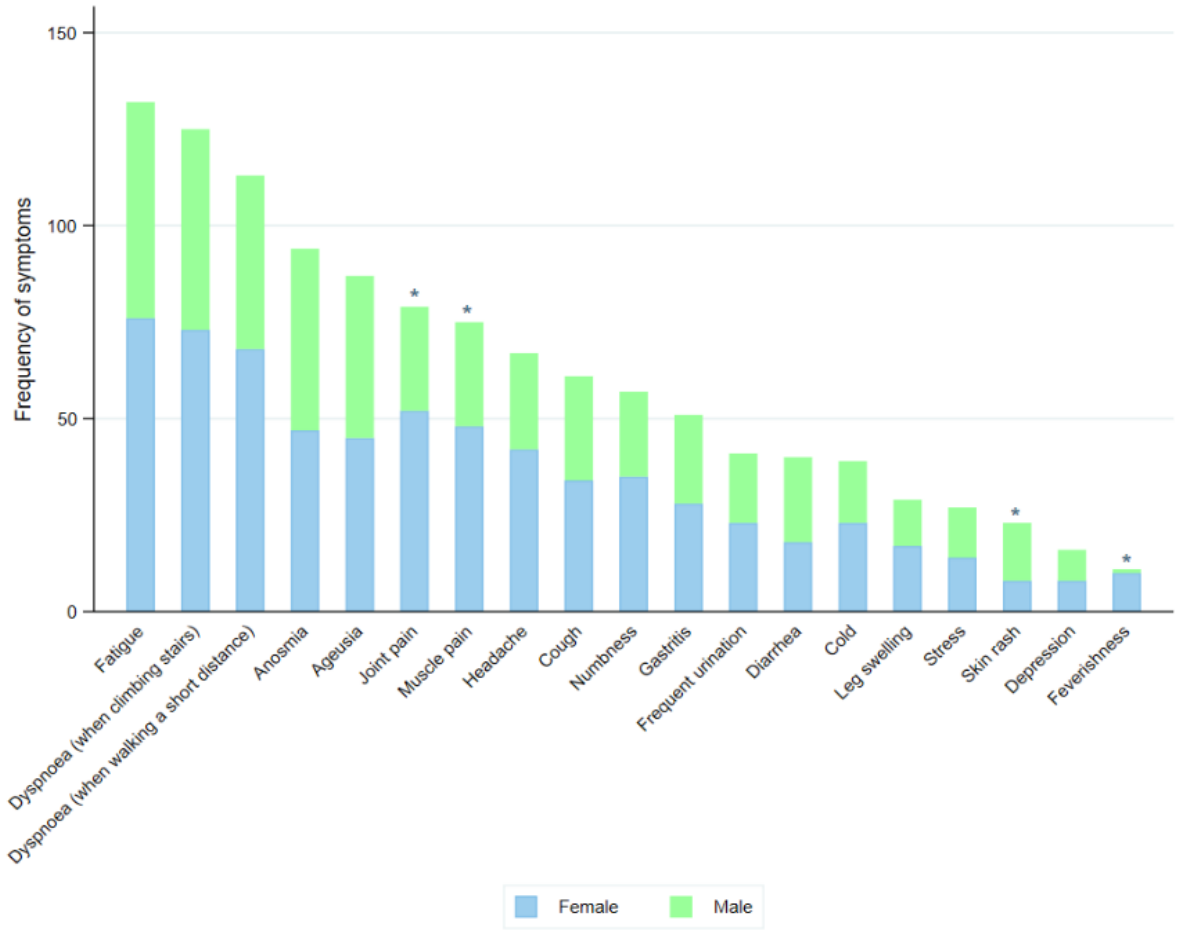
Age means ± SD 52.83±14.75. * Indicates the total patients in the respective row, different totals indicate missing data. ¶ Due to the limited number of patients, the three age groups and the three initial infection severity groups were collapsed into two separate age and severity groups

Table 2: Prevalence of patient-reported persistent symptoms of COVID-19 patients after one month of acute COVID-19 infection

Post COVID-19 symptoms	n	%
No symptoms	4	1.89
At least one symptom	208	98.11
≥2 symptoms	198	93.40
Fatigue	139	65.57
Dyspnoea (when climbing stairs)	131	61.79
Dyspnoea (when walking a short distance/30m)	119	56.13
Anosmia	99	46.70
Ageusia	92	43.40
Joint pain	83	39.15
Muscle pain	80	37.74
Headache	71	33.49
Cough	65	30.66
Numbness	61	28.77
Gastritis	54	25.47
Frequent urination	44	20.75
Cold	41	19.34
Diarrhea	41	19.34
Leg swelling	31	14.62
Stress	29	13.68
Skin rash	24	11.32
Depression	18	8.49
Feverishness	11	5.19

*No. of post COVID-19 symptoms (means ± SD 5.94±3.26). n is the total number of patients in the respective column

At least one persistent symptom was more frequent in patients younger than 39 years. The frequency of developing two or more persistent symptoms slightly increased with age. Fatigue (65.57%) and dyspnoea (when climbing stairs) (61.79%) were by far the most prevalent persistent symptoms in all age categories. Ten of the 19 symptoms assessed were more frequently observed in patients above 60 years (Table 3). Patients with chronic wheezing exhibited a significantly greater prevalence of fatigue, dyspnoea (when climbing stairs), dyspnoea (when walking a short distance), cold, and stress than those with diabetes mellitus and hypertension (respectively, $p = 0.02$, $p = 0.01$, $p = 0.05$, $p = 0.01$, and $p < 0.001$).



* Indicates significant gender differences

Figure 1: Frequency of persistent symptoms by gender after one month of acute COVID-19 infection

The association between predicting factors and post-COVID-19 symptoms

In logistic regression models adjusted for age (<60 and ≥60) and gender, females were more likely to develop persistent feverishness (aOR = 9.01; 95%CI: 1.13-71.98) and joint pain (aOR = 2.06; 95%CI: 1.15-3.69) and less likely to get skin rash (aOR = 0.39; 95%CI: 0.16-0.96). In addition, older age 60 or above years was associated with an increased risk of suffering persistent depressed mood one-month following infection compared to those aged lower than 60 (aOR = 3.00; 95%CI: 1.06-8.45) Patients with chronic wheezing were at an increased risk of experiencing persistent fatigue (aOR = 3.81; 95%CI: 1.07-13.49), dyspnoea (when climbing stairs) (aOR = 6.71; 95%CI: 1.51-29.77), and dyspnoea (when walking a short distance/30m) (aOR = 3.96; 95%CI: 1.27-12.33), compared to those without chronic wheezing. An increased risk was also observed for patients with chronic wheezing and cold (aOR = 3.05; 95%CI: 1.14-8.21) (Table 4).

Table 3: Differences between persistent COVID-19 symptoms and age group

Post COVID-19 symptoms	Total N = 212	Age group			p-value[a]
		<39 N = 38	40-59 N = 105	≥60 N = 69	
At least one symptom	208 (98.11%)	38 (100.0%)	103 (98.10%)	67 (97.10%)	0.22
Two or more than two symptoms (≥2)	198 (93.40%)	35 (92.11%)	98 (93.33%)	65 (94.20%)	0.92
Fatigue	139 (65.57%)	25 (65.79%)	69 (65.71%)	45 (65.22%)	0.35
Dyspnoea (when climbing stairs)	131 (61.79%)	24 (63.16%)	60 (57.14%)	47 (68.12%)	0.24
Feverishness	11 (5.19%)	1 (2.63%)	5 (4.76%)	5 (7.25%)	0.01*
Dyspnoea (when walking a short distance/30m)	119 (56.13%)	21 (55.26%)	59 (56.19%)	39 (56.52%)	0.11
Cold	41 (19.34%)	10 (26.32%)	22 (20.95%)	9 (13.04%)	0.60
Cough	65 (30.66%)	16 (42.11%)	32 (30.48%)	17 (24.64%)	0.92
Headache	71 (33.49%)	16 (42.11%)	36 (34.29%)	19 (27.54%)	0.13
Depression	18 (8.49%)	2 (5.26%)	5 (4.76%)	11 (15.94%)	0.67
Stress	29 (13.68%)	5 (13.16%)	16 (15.24%)	8 (11.59%)	0.71
Numbness	61 (28.77%)	10 (26.32%)	31 (29.52%)	20 (28.99%)	0.27
Diarrhea	41 (19.34%)	6 (15.79%)	20 (19.05%)	15 (21.74%)	0.15
Gastritis	54 (25.47%)	9 (23.68%)	27 (25.71%)	18 (26.09%)	0.96
Muscle pain	80 (37.74%)	11 (28.95%)	47 (44.76%)	22 (31.88%)	0.05*
Joint pain	83 (39.15%)	11 (28.95%)	42 (40.00%)	30 (43.48%)	0.01*
Leg swelling	31 (14.62%)	3 (7.89%)	15 (14.29%)	13 (18.84%)	0.69
Anosmia	99 (46.70%)	16 (42.11%)	51 (48.57%)	32 (46.38%)	0.17
Ageusia	92 (43.40%)	17 (44.74%)	49 (46.67%)	26 (37.68%)	0.39
Frequent urination	44 (20.75%)	5 (13.16%)	18 (17.14%)	21 (30.43%)	0.89
Skin rash	24 (11.32%)	8 (21.05%)	9 (8.57%)	7 (10.14%)	0.04*

N is the total patients in the respective column, [a]P values indicate differences between <60, and ≥60 age groups, and P < 0.05 was considered statistically significant

Table 4: Factors associated with the development of persistent COVID 19 symptoms

Variable	Persistent COVID-19 symptom			
	Fever	Joint pain	Skin Rash	Depression
	aOR (95% CI) p	aOR (95% CI) p	aOR (95% CI) p	aOR (95% CI) p
Gender				
Male	Ref	Ref	Ref	Ref
Female	9.01 (1.13, 71.98) 0.04	2.06 (1.15, 3.69) 0.02	0.39 (0.16, 0.96) 0.04	0.81 (0.29, 2.28) 0.69
Age				
<60	Ref	Ref	Ref	Ref
≥60	1.93 (0.55, 6.73) 0.30	1.09 (0.59, 2.01) 0.79	0.90 (0.35, 2.33) 0.83	3.00 (1.06, 8.45) 0.04
Severity				
Mild	Ref	Ref	Ref	Ref
Moderate to severe	0.26 (0.03, 2.19) 0.22	1.06 (0.54, 2.07) 0.86	1.00 (0.37, 2.69) 1.00	1.49 (0.50, 4.44) 0.47
Pre morbidities				
Diabetes mellitus	0.80 (0.19, 3.31) 0.76	0.60 (0.31, 1.15) 0.12	1.35 (0.52, 3.48) 0.53	0.46 (0.13, 1.58) 0.21
Hypertension	1.28 (0.35, 4.73) 0.71	1.02 (0.54, 1.93) 0.95	1.33 (0.51, 3.47) 0.57	0.79 (0.25, 2.52) 0.70
Chronic wheezing	2.64 (0.62, 11.16) 0.19	1.17 (0.47, 2.92) 0.73	1.64 (0.42, 6.38) 0.48	1.03 (0.21, 5.03) 0.97
Any comorbidities	1.44 (0.39, 5.29) 0.59	0.88 (0.48, 1.59) 0.66	1.10 (0.44, 2.77) 0.84	0.48 (0.16, 1.45) 0.19
≥2 comorbidities	1.54 (0.36, 6.49) 0.55	0.72 (0.39, 1.52) 0.39	2.37 (0.85, 6.61) 0.10	0.82 (0.23, 2.94) 0.77

aOR, adjusted odds ratio; 95% CI, 95% confidence interval; p, p-value obtained using binary logistic regression; P < 0.05 was considered statistically significant; Ref, reference; univariable analysis using binary logistic regression adjusted for age group

DISCUSSION

This study showed a high prevalence of persistent symptoms in adults with confirmed SARS-CoV-2 infection following one month of infection, with fatigue being the most common persistent symptom, followed by dyspnoea (when walking a short distance), anosmia, and ageusia. In this study, approximately 98% of the patients presented with at least one persistent symptom. This finding is similar to that of another study, which reported that nearly 99% of participants experienced persistence of at least one symptom, particularly fatigue and dyspnea at a much longer follow-up of 3 months disease onset (20). The reported commonest symptoms are in line with the literature showing these symptoms are the most frequent in the post-COVID-19 condition (6,10,21).

Previous studies however, have reported various prevalence rates for persistent symptoms, including 52% at 6 months, 51% at 2-3 months, 87% at 60 days, and 13% at 56 days (6,22,23). Variability in prevalence may be due to differences in participant recruitment procedures, the range of symptoms assessed across studies, differences in enrolled patients from different infection severity levels, the use of different measuring techniques, and the case definition of symptoms.

The presence of fatigue in COVID-19 survivors is consistent with the present data with a high prevalence rate of approximately 66%. A recent study conducted in Sri Lanka which followed up on patients discharged from a hospital after being treated for COVID-19, found that nearly 64% of them experienced persistent fatigue four weeks after their discharge (24). The results of the current study showed that nearly 62% of patients experienced dyspnoea when climbing stairs, whereas only 56% exhibited dyspnoea when walking a short distance. A higher prevalence of dyspnoea can be explained by lingering lung injury. Differentiating these two scenarios may be clinically relevant since dyspnoea while walking a short distance indicates more severe complications linked to lung damage than dyspnoea while climbing stairs. Persistent fatigue is one of the most commonly reported symptoms of post-COVID-19 conditions across studies. The underlying mechanism of persistent fatigue could be multifactorial and might be due to viral infection-related immune system alterations. Psychological and environmental elements are also likely to be involved (25). Despite the fact that COVID-19 has clinically distinct manifestations, similar post-discharge symptoms have also been reported in post-coronavirus epidemics literature (26,27).

mood. This supports the finding from a study revealing that adult COVID-19 survivors aged 65 or older were at an elevated risk for neurological symptoms and mental health conditions, including mood disorders, anxiety, other mental conditions, and substance-related disorders (28). There have been mixed findings on age as a risk factor for post COVID-19 symptoms. Some studies reported an association between age below 65 years and (11,29), developing persistent symptoms (30), some reported that advanced age was a risk factor, while other studies did not find an association between age and the persistence of post COVID-19 symptoms (7).

Female gender was identified as an associated factor for some outcomes, such as fever and joint pain which is in line with most previous studies. In other studies, female gender and post COVID-19 symptoms including fatigue, dyspnoea, and anxiety or depression have been found to have significant associations (11, 31,32). This could be due to lower health-seeking behavior in men and might be less inclined to reveal persistent ill health.

The associations between chronic wheezers and prevalent fatigue, dyspnoea (when climbing stairs), dyspnoea (when walking a short distance), and cold agree with data from an earlier study in non-hospitalized patients with COVID-19 (22). Given that the respiratory tract is the primary target organ for COVID-19, these findings of a link between underlying chronic wheezers and above persistent symptoms are quite predictable.

There are likely several potentially overlapping causes of post COVID-19 symptoms. Multiple hypotheses have been suggested to describe plausible mechanisms and some have been advanced based on prior coronavirus outbreaks and other RNA (Ribonucleic acid) viruses. Evidence has pointed towards possible viral persistence in organs (33,34), immune dysregulation (35,36),

reactivation of underlying pathogens, including Epstein–Barr virus (EBV) (37) and human herpesvirus 6 (HHV-6) (38), and autoimmunity (37, 39,40) as drivers of post COVID-19 symptoms. It has also been suggested that impacts of SARS-CoV-2 on the microbiota (41,42), microvascular blood clotting with endothelial dysfunction (43, 44), and injury to neurons causing dysfunctional signaling (45) as other contributing mechanisms.

The present study's findings lay the basis for future research to be conducted and provide evidence for understanding the post COVID-19 condition in Sri Lanka. It is important that general practitioners and all first-contact doctors need to be aware of this high prevalence of post COVID-19 symptoms, which may even last for several weeks after the acute COVID-19 infection. Hence, the knowledge generated from this study may empower clinicians to counsel patients appropriately and also judiciously investigate them, especially not to over-investigate. Similarly, given the large numbers in the population infected with COVID-19, authentic public awareness amongst post COVID-19 is a rising need. However, there is a lack of knowledge about post COVID-19 condition in the local setting due to a lack of local research in this regard. The findings of this study would bridge this knowledge gap.

Unlike most research available in the post COVID-19 condition literature focusing mainly on hospitalized or severe COVID-19 patients, this study focused on mild COVID-19 patients as well ensuring that the findings would be a more precise assessment of the prevalence of post COVID-19 symptoms in a real context. Although the study design is cross-sectional, initial disease characteristics were gathered during the admission/hospital stay. Therefore, it introduces less reporting/recall bias. The admission policy changed over time and was dependent on the caseload in the community, yet less susceptible to selection bias due to the stratification of initial infection severity based on SpO_2 level.

The study had several limitations. The data set used in this study was obtained from the post COVID medical clinic database. Hence, the data analyses were limited to factors that were present in the data set as the available data had not been collected to test pre-defined hypotheses or for research questions. COVID-19 vaccination status was not considered in this study as data were not available, however, Sri Lanka started vaccination in January 2021 and by August 2021, 50% of those above 30 years of age were vaccinated with second dose (46). Future research on the effects of vaccination on persistent symptoms is warranted to determine if the vaccination impacts lasting symptoms. Furthermore, patients' self-reported symptom outcomes could have resulted in possible over or underestimation of outcomes and recall bias. Selection bias may have occurred if patients who were concerned about their health or exhibiting prevalent symptoms attended the clinic following discharge. This could have biased the results towards a higher prevalence. This study was based on data retrieved from a single medical clinic database which may not be representative of the wider population. Additionally, this study had a small sample size; therefore, in sub-analyses, the number of patients from different strata resulting in inconclusive results on the outcomes examined. Consequently, the power of the study is limited to examining whether statistically significant associations were present between those persistent symptoms and the variables studied. Since the national policy at the time was to institutionalize patients for two weeks, their clinic follow-up time corresponded to one month of infection, and might miss long term developments of post COVID-19 conditions. Also, the study lacked a control group. A longer follow-up using a bigger sample would allow investigation of long-term effects and timing, improving reliability and generalizability and a control group without prior COVID-19 infection could strengthen the analysis of symptom prevalence and disease attribution.

CONCLUSION

This study of the investigation of prevalence and predictive factors of post-COVID-19 symptoms indicates that 98% of the patients had at least one post-COVID-19 symptom one-month following infection. The most frequently experienced post-COVID-19 symptoms were fatigue, dyspnoea (when climbing stairs), dyspnoea (when walking a short distance/30m), anosmia, and ageusia. Female gender, older age (≥60), and patients with underlying chronic wheezing were found to be at increased risk of developing certain persistent

symptoms. Severity. during hospital stay were less likely to be associated with developing post-COVID-19 symptoms. These findings would empower clinicians to counsel patients appropriately and also investigate them judiciously. Furthermore, it highlights the importance of continuing further research in this area to improve understanding and provide the most up-to-date information to clinicians. Additionally, with the high prevalence of post-COVID-19 symptoms identified, the need for raising public awareness about the post-COVID-19 condition arises thereby helping reduce the burden of post-COVID-19 symptoms.

Abbreviations

COVID- 19	Coronavirus Disease 2019
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
WHO	World Health Organization
THP	Teaching Hospital, Peradeniya
ICCs	Intermediate care centers
PCR	Polymerase Chain Reaction
SpO_2	Peripheral oxygen saturation
ORs	Odds ratios
CIs	Confidence Interval
[a]OR	Adjusted odds ratios

Author declaration

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Authors' contributions:
Conceptualization, GB, DY; methodology, LK, GB, DY; analysis, LK; investigation, LK; data curation, LK; writing—original draft preparation, LK; writing—review and editing, GB, DY, LK; supervision, GB, DY; project administration, GB, DY. All authors have read and agreed to the published version of the manuscript

Conflicts of interest:
The authors declare that they have no competing interests.

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Ethics statement:
The study was approved by the Ethics Review Committee, Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka (AHS/ERC/2022/003, 27 January 2022).

Supplementary materials:
The following are available as Online Resources. Online Resource 1: Differences between gender and persistent COVID-19 symptoms, Online Resource 2: Differences between persistent COVID-19 symptoms and number of comorbidities, Online Resource 3. Differences between persistent COVID-19 symptoms and comorbidities, Online Resource 4. Differences between persistent COVID-19 symptoms and initial COVID-19 severity, Online Resource 5. Predictive factors associated with the development of persistent COVID-19 symptoms.

Statement on data availability:
The data supporting the findings of this study are available within the supplementary material provided with this manuscript.

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