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Short-Term and Long-Term Outcomes among COVID-19 Survivors: A Multi-Center Prospective Observational Study

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Abstract

Background: Since the outbreak of the COVID-19 pandemic caused massive case fatalities across the world, people have been left with significant physical and mental disabilities, which has had an adverse impact on their quality of life. The objective of this study is to measure the short-term and long-term outcomes among COVID-19 survivors. **Methods:** This is a six-month-long multicentre prospective observational study, carried out in four specialized hospitals in the capital city Dhaka, where six hundred participants were enrolled by non-probability convenience sampling. Data were collected through three structured interviews, and follow-ups were done during discharge, at 1st month, and 6th month. An analytical study was done on demographic variables, socio-economic conditions, physical findings and outcomes. Data were analysed using Statistical Package for Social Sciences (SPSS). **Results:** A total

of 600 participants were enrolled. The mean age was 49.83. Many participants belong to the age range of 31 to 40 years. More than two-thirds (72.7%) of participants were male, whereas 27.30% were female. Most patients admitted had mild and moderate COVID-19 symptoms (40% and 58%, respectively). Among short-term COVID complications, it was found that 43.3% of the participants complained of fatigue, 32.6% of depression, 24.7% of sleep disturbance, 19% of anxiety and, 5% memory loss. In long-term COVID complications the number reduced significantly: 5% of the participants complained of fatigue, 10% of depression, 2.7% of sleep disturbance, 7.3% of anxiety and, 2.7% memory loss. The severity of lung parenchymal disease also reduced in long term COVID symptoms. The study found a statistically significant relationship between age groups and CT severity index (χ^2 = 9.458, p = 0.032). Most patients (29.2%) in the under-30 age group had a CT Severity Index score of 2 & 3 (29.2%). The important CT Severity Index scores for individuals aged 30 to 60 years were 3 and 4, accounting for 37.7% and 33.3%, respectively. In the over-60 age group, 40.8% of patients showed a CT Severity Index score of 4, showing a range of 51% - 75%. **Conclusion:** This study found that fatigue, depression, and sleep disturbances are prevalent among COVID-19 survivors; however, these symptoms generally reduce over time. Lung problems improved; however, some patients suffered from persistent effects. Older patients, especially those with pre-existing conditions, suffer from more severe outcomes. These findings underscore the need for ongoing care for COVID-19 survivors.

Keywords

COVID-19 Survivors, Short-Term and Long-Term Outcomes, Lung Complications, COVID-19 Outcomes, Long-Term Complications

1. Introduction

Up until December 2022, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) caused the global pandemic of coronavirus disease 2019 (COVID-19), resulting in approximately 672 million cases and 6.74 million deaths. Till December 2022, around 2.01 million cases and 29,440 deaths from COVID-19 have been reported in Bangladesh [1]. COVID-19 symptoms range from fever, cough, and dyspnoea in mild cases to severe acute respiratory syndrome (SARS) and respiratory failure in critically ill patients requiring hospitalization [2]. Respiratory symptoms may also be accompanied by cardiac, gastrointestinal, renal, hepatic, neurological, cutaneous, haematological, olfactory, and gustatory manifestations [3]. The epidemiological and clinical characteristics, pathogenesis, and complications of patients with COVID-19 in the acute phase have been clearly explained but the long-term consequences of the illness remain largely unclear [4] [5]. Long-term follow-up studies on persistent symptoms, lung function, and physical and psychological problems in discharged patients are urgently required [6]. Only a

few studies with limited sample sizes have been published, with the longest follow-up duration of 3 months following discharge from the hospital and some persisting symptoms, such as fatigue and dyspnea impaired pulmonary function and chest image abnormalities were reported in patients following hospital discharge, but the full spectrum of post-discharge characteristics is still unknown [7]-[12]. An Italian study revealed that 32% of the previously hospitalized patients complained of the persistence of one or two COVID-19-associated symptoms, while 55% reported three or more symptoms even two months after being discharged [7]. Of these post-COVID-19 symptoms, fatigue (53.1%) and dyspnoea (43.4%) were the most widely reported [7]. The prevalence of these symptoms, also known as "long-term COVID," is in alignment with the post-discharge manifestations experienced by the survivors of the SARS outbreak in 2002 and the Middle East respiratory syndrome (MERS) outbreak in 2012 [13] [14]. In this study, "long-term COVID" refers to persistent symptoms and complications that continue beyond three months post-recovery. These may include physical and psychological effects, as seen in conditions such as fatigue, respiratory issues, and mental health challenges like anxiety and depression. This timeframe aligns with widely accepted definitions in COVID-19 literature and clinical guidelines, including those from the National Institute for Health and Care Excellence (NICE) and the Centers for Disease Control and Prevention (CDC), which specify symptoms lasting beyond the acute recovery phase of COVID-19 as indicators of long-term or post-acute COVID-19 [15] [16].

In addition to physical ramifications such as reduced exercise capacity and lung function, survivors of SARS and MERS also experienced mental health impairments such as anxiety and depression. However, with most current literature focused on the acute management of COVID-19, data regarding post-COVID-19 manifestations are sparse. An ambi-directional cohort study by Huang C. *et al.* found that fatigue or muscle weakness (63%), and sleep difficulties (26%) were the most common symptoms [17]. Anxiety or depression were found by 23% of the individuals. However, the majority of present study focusses on the early treatment of COVID-19, and there is limited data including post-COVID-19 symptoms. This study aims to assess the short-term and long-term outcomes of patients who have recovered from COVID-19. To add to that, we have some specific objectives to pursue, such as: to assess the demographic characteristics and impact of key comorbidities (Diabetes Mellitus, Hypertension, Ishchaemic heart disease) of COVID-19 patients and their association with disease severity, and to evaluate the influence of treatment modalities on the outcomes of the hospitalized COVID 19 patients.

2. Rationale of This Study

Since December 2019, COVID-19 has been spreading across globe. Despite the increasing death toll, numerous patients are recuperating from the disease. We now recognise COVID-19 as a multi-organ disease with a broad spectrum of

manifestations. Similarly, post-acute viral syndromes are described in survivors of other virulent coronavirus epidemics, and there are increasing reports of persistent and prolonged effects after acute COVID-19.

Important active and future research includes the identification and characterization of key clinical, serological, imaging, and epidemiologic features of COVID-19 in the acute, subacute, and chronic phases of the disease, which will help us better understand the natural history and pathophysiology of this new disease entity. The presence of post-COVID-19 manifestations is related to comorbidities and disease severity. The long-term COVID syndrome is like the post-discharge symptoms experienced by survivors of prior SARS and MERS pandemics. Every day, the hospital discharges an increasing number of COVID-19 survivors; however, the long-term effects of COVID-19 on survivors after hospital discharge remain largely unexplored. In this regard, we conducted this study to observe the short- and long-term outcomes of patients recovered from COVID-19.

3. Methods and Materials

We conducted this prospective observational study over six months in four hospitals in Dhaka: Shaheed Suhrawardy Medical College Hospital, the National Institute of Cardiovascular Diseases, Dhaka North City Corporation Hospital (DNCC), and Bangladesh Specialized Hospital (BSH). The non-probability convenience sampling method included a total of 600 participants who were COVID-19 survivors and RT-PCR positive for the SARS Cov-2 infection. The study excluded subjects who were under 18 years old, pregnant, experienced acute MI, congestive cardiac failure with functional class NYHA IV, CVD, CKD stage IV or above, had a malignancy, or had a severe psychiatric illness. We obtained sociodemographic data and clinical, laboratory, and imaging information through face-to-face or telephone interviews using questionnaires.

We reached out to the recovered COVID-19 patients use data from the specified hospital registry. Patients were given information at three different periods: at discharge, 30 days post-discharge, and six months following recovery. Specialised diagnostic procedures, including HRCT and chest X-rays, were done.The major short-term variables included persistent physical symptoms, different test findings, and results from investigations. The long-term variables consisted of persistent physical symptoms, findings from follow-up physical tests, and results from subsequent repeated investigations.

We used the Statistical Package for Social Sciences (SPSS), to analyze the data. We used descriptive statistics to present categorical and continuous variables, assigning values to frequencies and percentages for categorical data and mean and standard deviation (SD) for continuous data. We categorised continuous variables based on scientifically relevant parameters or cut-off values, as applicable. We then used the chi-square test to examine the associations between the newly categorised variables and other categorical variables.

Statistical significance was defined as a p-value of less than 0.05. We obtained

ethical approval from the four selected hospitals prior to data collection and analysis.

4. Result

We enrolled 600 participants in this study, with 436 (72.7%) males and 164 (27.3%) females. The age distribution reveals that 54 (12.4%) males and 16 (9.8%) females were in the 18 - 30 age group, 264 (60.6%) males and 110 (67.1%) females in the 31-60 age group, and 118 (27.1%) males and 38 (23.2%) females were aged ≥ 60 years. There are significant differences ($p = 0.016$) in body mass index (BMI), with women being more likely than men to be obese (29.3% vs. 15.6%). Mild cases are found in 170 (39.5%) males and 70 (42.7%) females; moderate cases in 260 (59.5%) males and 92 (56.1%) females; and severe cases in 6 (1.4%) males and 2 (1.2%) females. The percentage of ischaemic heart disease in females is higher than that in males and males use oxygen therapy at a higher rate than females (Figure 1).

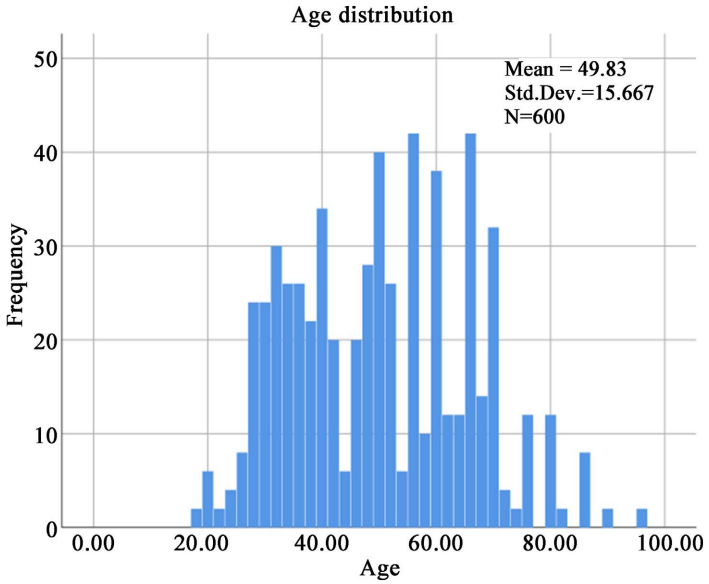

Figure 1. The histogram illustrates the age distribution within a sample of 600 individuals. The mean age is 49.83 years, with a standard deviation of 15.667 years.

Table 1 shows significant relationships among different age groups. There were no underweight patients in the <30-year group; however, there were 30 (8.0%) in the 30 - 60-year group and 18 (11.5%) in the >60-year group ($p < 0.005$). The severity of the disease shows a significant difference, with 36 (51.4%) mild cases in the <30-year group, 162 (43.3%) in the 30 - 60-year group, and only 42 (26.9%) in the > 60-year group, but moderate cases increased with age ($p < 0.005$). Diabetes mellitus was present in 10 (14.3%) of those <30 years, 136 (36.4%) in the 30 - 60 years group, and 72 (46.2%) in the >60 years group ($p < 0.005$). Similarly, hypertension showed a significant increase with age, from 8 (11.4%) in the <30 years group to 110 (29.4%) in the 30 - 60 years group and 50 (32.1%) in the >60 years

Table 1. Demographic and clinical characteristics of COVID-19 patients across age categories.

Variable	Less than 30 years old (%) n = 70	30-60 years n = 374	More than 60 years old n = 78	p-Value	Total n = 600
Sex					
Male	54 (77.1%)	264 (70.6%)	118 (75.6%)	0.575	436 (72.7%)
Female	16 (22.9%)	110 (29.4%)	38 (24.4%)		164 (27.3%)
Body Mass Index (BMI)					
Underweight	0 (0.0%)	30 (8.0%)	18 (11.5%)	<0.005*	48 (8.0%)
Normal	26 (37.1%)	126 (33.7%)	76 (48.7%)		228 (38.0%)
Overweight	30 (42.9%)	134 (35.8%)	44 (28.2%)		208 (34.7%)
Obese	14 (20.0%)	84 (22.5%)	18 (11.5%)		116 (19.3%)
Severity of Disease					
Mild	36 (51.4%)	162 (43.3%)	42 (26.9%)	<0.005*	240 (40.0%)
Moderate	34 (48.6%)	204 (54.5%)	114 (73.1%)		352 (58.7%)
Severe	0 (0.0%)	8 (2.1%)	0 (0.0%)		8 (1.3%)
Co-morbidities					
Smoking	10 (14.3%)	44 (11.8%)	28 (17.9%)	0.407	82 (13.7%)
Diabetes Mellitus	10 (14.3%)	136 (36.4%)	72 (46.2%)	<0.005*	218 (36.3%)
Hypertension	8 (11.4%)	110 (29.4%)	50 (32.1%)	<0.005*	168 (28.0%)
Ischemic Heart Disease	8 (11.4%)	46 (12.3%)	26 (16.7%)	0.597	80 (13.3%)
Bronchial Asthma	2 (2.9%)	46 (12.3%)	12 (10.0%)	0.170	30 (10.0%)
Stroke	0 (0.0%)	8 (2.1%)	12 (7.7%)	<0.005*	20 (3.3%)

*p value calculated using Pearson Sq. Test, keeping p value ≤ 0.05 as significant.

group ($p < 0.005$). The group of patients under 30 years old had no history of any strokes, but the group of patients between 30 and 60 years old had 8 (2.1%) and the group of people over 60 years old had 12 (7.7%), with a p-value more than 0.005.

Table 2 shows that several significant associations among patients with different disease severities. Disease severity varied significantly across genders and age groups. Mild cases included 170 (39.5%) males and 70 (42.7%) females, moderate cases 260 (59.5%) males and 92 (56.1%) females, and severe cases 6 (1.4%) males and 2 (1.2%) females. All severe cases were in patients aged 31 to 60 years ($p = 0.023$). Notably, older age groups showed a higher percentage of moderate and severe cases, suggesting that age may significantly influence the progression to more severe COVID-19. The use of anticoagulants increased with severity, rising from 205 (85.8%) patients in the mild group to 342 (97.2%) in the middle group and reaching 8 (100.0%) in the severe group ($p = 0.001$). Oxygen therapy showed

Table 2. Comparison of clinical parameters across severity levels in COVID-19 Patients.

Variable	Mild (n = 240)	Moderate (n = 352)	Severe (n = 8)	p Value	Total (n = 600)
Gender					
Male	170 (70.8%)	260 (73.9%)	6 (75.0%)	0.843	436 (72.7%)
Female	70 (29.2%)	92 (26.1%)	2 (25.0%)		164 (27.3%)
Age Group					
18 - 30	36 (15.0%)	34 (9.7%)	0 (0.0%)		70 (11.7%)
31 - 60	162 (67.5%)	204 (58.0%)	8 (100.0%)	0.023*	374 (62.3%)
≥60	42 (17.5%)	114 (32.4%)	0 (0.0%)		156 (26.0%)
Anticoagulant	205 (85.8%)	342 (97.2%)	8 (100.0%)	0.001*	555 (92.7%)
Oxygen Therapy	180 (75.0%)	304 (86.4%)	08 (100.0%)	0.028*	492 (82.0%)
Comorbidities					
Diabetes Mellitus	76 (31.7%)	136 (38.6%)	6 (75.0%)	0.041*	218 (36.3%)
Hypertension	64 (26.7%)	98 (27.8%)	6 (75.0%)	0.106	168 (28.0%)
Ischemic Heart Disease	40 (16.7%)	34 (9.7%)	6 (75.0%)	0.000*	80 (13.3%)
Stroke	6 (2.5%)	12 (3.4%)	2 (25.0%)	0.044*	20 (3.3%)
Body Mass Index (BMI)					
Underweight	5 (4.2%)	19 (10.8%)	0 (0.0%)		24 (8.0%)
Normal	41 (34.2%)	71 (40.3%)	2 (50.0%)	0.038*	114 (38.0%)
Overweight	41 (34.2%)	61 (34.7%)	2 (50.0%)		104 (34.7%)
Obese	33 (27.5%)	25 (14.2%)	0 (0.0%)		58 (19.3%)
Outcome					
IHD	-	71 (20.2%)	06 (75.0%)	0.068	77 (12.8%)
HF		-	04 (50.0%)	0.183	04 (0.67%)
Stroke		13 (3.7%)	02 (0.25%)	0.423	15 (2.5%)
Kidney Disease		14 (3.9%)	02 (0.25%)	0.174	16 (2.67%)
Anxiety	84 (24.2%)	146 (41.5%)	8 (100.0%)	0.011*	238 (39.7%)
Depression	121 (54.3)	280 (79.5%)	08 (100.0%)	0.001*	409 (68.2%)
Sleep Disturbance	76 (31.9%)	118 (33.0%)	06 (75.0%)	0.197	200 (33.3%)

*p value calculated using Pearson Sq. Test, keeping p value ≤ 0.05 as significant.

a similar pattern, with 180 (75.0%) patients in the mild group, 304 (86.4%) in the moderate group, and 8 (100.0%) in the severe group (p = 0.028). 76 (31.7%) patients in the mild group, 136 (38.6%) in the moderate group, and 6 (75.0%) in the severe group had diabetes mellitus (p = 0.041). Furthermore, the use of oxygen therapy was higher in males, indicating possible gender-based physiological differences in response to the disease. There was a significant increase in the number

of cases of ischemic heart disease, with 40 (16.7%) patients in the mild group, 34 (9.7%) patients in the moderate group, and 6 (75.0%) patients in the severe group.

Stroke was observed in 6 patients (2.5%) in the mild group, 12 (3.4%) in the moderate group, and 2 (25.0%) in the severe group ($p = 0.044$). Underweight status was more prevalent in the moderate group 19(10.8%) patients, compared to the mild group 5(4.2%) patients, and no severe cases were underweight ($p = 0.038$). Anxiety and depression were also significantly more common as severity increased, with anxiety in 84 patients (24.2%) in the mild group, 146 (41.5%) in the moderate group, and 8 (100.0%) in the severe group ($p = 0.011$), and depression in 121(54.3%) patients, 280 (79.5%), and 8 (100.0%) respectively ($p = 0.001$). Overall, this table shows important differences in a number of factors based on the severity of the disease. Higher rates of comorbidities, including diabetes mellitus, hypertension, and ischaemic heart disease, have been found in older age social groups, which could contribute to the increased disease severity in these groups. Diabetes mellitus was observed in 14.3% of individuals under 30 years, 36.4% in the 30–60 years group, and 46.2% in those over 60 years ($p < 0.005$). This smaller rise shows that elderly people with previous illnesses are at greater risk of severe COVID-19 outcomes.

Table 3 provides useful insights into the duration of COVID-19 symptoms, showing both immediate and long-term effects on those who are affected. During the acute period, a significant number of patients experience various symptoms such as a persistent cough, weariness, palpitations, and respiratory distress, which indicate the virus's effect on pulmonary function. Simultaneously, radiographic results demonstrate significant abnormalities in the lung tissue, namely ground glass opacities, crazy-paving patterns, and fibrotic alterations, highlighting the seriousness of the acute respiratory condition.

Post-COVID symptoms were prevalent across follow-up periods, with fatigue, depression, and sleep disturbances being persistent even at six months. This persistence of symptoms underscores the need for ongoing clinical support for COVID-19 survivors, particularly those with significant comorbidities or severe initial illness.

Table 4 shows significant differences in treatment types and hospital stay durations across age groups. For treatments, 62 (88.6%) patients under 30 years old, 340 (90.9%) in the 30 - 60 years group, and 146 (93.6%) over 60 years old received injectable treatments, with no significant age-related difference ($p = 0.412$). However, The age group was shown to have a strong correlation with oxygen therapy., with 14 (77.1%) patients under 30 years, 250 (80.2%) in the 30-60 years cohort, and 128 (88.5%) beyond 60 years receiving treatment ($p < 0.005$).

Regarding hospital stay, 44 (62.9%) patients under 30 years stayed 1 - 7 days, compared to 170 (45.5%) in the 30 - 60 years group and 44 (28.2%) over 60 years, with significant differences across age groups ($p < 0.005$). The number of patients who stay 8 - 14 days, on the other hand, is significantly increasing in age, from 22

Table 3. Patients clinical outcome related to time of follow up.

Variable	During Hospitalization	Short COVID-19 (3 months)	Long COVID-19 (6 months)
Post COVID persistant symptoms (n = 600)			
Persistent Cough	334 (55.7%)	16 (2.7%)	14 (2.3%)
Fatigue	416 (69.8%)	260 (43.3%)	60 (5.0%)
Palpitation	242 (40.6%)	78 (13.0%)	16 (2.7%)
Shortness of breath	216 (36.2%)	44 (7.3%)	00(0.0%)
Pains and aches	124 (20.9%)	16 (2.7%)	05(0.8%)
Anxiety	234 (39.4%)	114 (19.0%)	44 (7.3%)
Depression	268 (44.7%)	194 (32.6%)	60 (10.0%)
Sleep Disturbances	200 (33.1%)	148 (24.7%)	16 (2.7%)
Pain Attack	98 (16.3%)	12 (2.0%)	00 (0.0%)
Memory loss	54 (9.0%)	32 (5.3%)	16 (2.7%)
Lung parenchymal disease from chest X-ray (n = 180)			
Ground glass opacity	122 (66.7%)	57 (9.5%)	20 (3.3%)
Crazy-paving-pattern	117 (19.5%)	42 (7.0%)	10 (1.6%)
Pleural thickening	136 (22.7%)	66 (11.0%)	23 (3.8%)
fibrosis	141 (23.5%)	50 (8.3%)	18 (3.0%)

Table 4. Age-related treatment modalities and hospitalization duration among COVID-19 Survivors.

Treatment	Less than 30 years old (%) n = 70	30-60 years n = 374	More than 60 years old n = 78	p-Value	Total n = 60
Injectable	62 (88.6%)	340 (90.9%)	146 (93.6%)	0.412	548 (91.3%)
Oral	6 (8.6%)	14 (3.7%)	2 (1.3%)		22 (3.7%)
Oxygen Therapy	14 (77.1%)	250 (80.2%)	128 (88.5%)	<0.005*	392 (65.3%)
Hospital Stay					
1 - 7 days	44 (62.9%)	170 (45.5%)	44 (28.2%)	<0.005*	258 (43.0%)
8 - 14 days	22 (31.4%)	140 (37.4%)	82 (52.6%)		244 (40.7%)
15 - 21 days	2 (2.9%)	52 (13.9%)	26 (16.7%)		80 (13.3%)
More than 21 days	2 (2.9%)	12 (3.2%)	4 (2.6%)		18 (3.0%)

*p value calculated using Pearson Sq. Test, keeping p value ≤ 0.05 as significant.

(31.4%) under 30 years old to 82 (52.6%) over 60 years old. Among the patients who stayed between 15 and 21 days, only 2 (2.9%) were younger than 30 years old, 52 (13.9%) were between the ages of 30 and 60, and 26 (16.7%) were older than 60. Only 2 (2.9%) patients under 30 years and 12 (3.2%) in the 30 - 60 years group stayed more than 21 days (Figure 2).

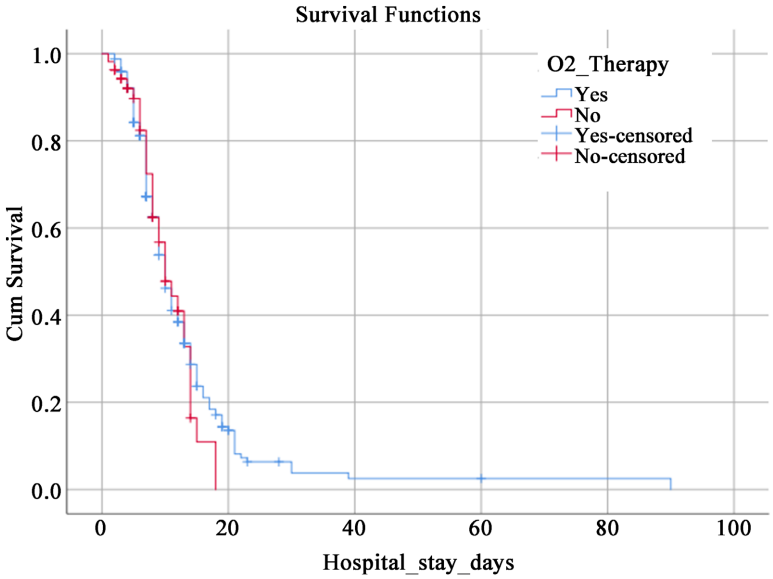

Figure 2. The Kaplan-Meier survival plot shows average survival probabilities, indicating the proportion of hospitalised patients over time. This study compares patients having oxygen therapy ("Yes") with those not receiving it ("No"). The blue curve represents patients who received oxygen therapy, whereas the red curve indicates those who did not receive oxygen therapy. The reduced rate of the blue curve indicates that patients getting oxygen therapy mostly suffer longer hospital stays. The censored data points, indicated by crosses, represent patients who completed the study until the end of the observation period. This finding indicates that oxygen therapy may confer benefits during long-term hospitalisation, potentially reflecting more effective treatment of severe cases.

Table 5. Association between CT severity Index and Age Group.

CT Severity Index	Less than 30 years (n = 24)	30 - 60 years (n = 114)	More than 60 years (n = 49)	p Value
Score 1 (<5%)	02 (8.3%)	00 (0.0%)	01 (2.0%)	
Score 2 (<5% - 25%)	07 (29.2%)	16 (14.0%)	08 (16.3%)	
Score 3 (<26% - 50%)	07 (29.2%)	43 (37.7%)	18 (36.7%)	0.032*
Score 4 (<51% -75%)	06 (25.0%)	38 (33.3%)	20 (40.8%)	
Score 5 (>75%)	02 (8.3%)	17 (14.9%)	02 (4.1%)	

*p value calculated using Pearson Sq. Test, keeping p value ≤ 0.05 as significant.

Among 188 patients who underwent High-Resolution CT (HRCT), significant associations were observed between CT Severity Index scores and age groups (χ^2 = 9.458, p = 0.032). Notably, younger patients (<30 years) mostly presented with lower CT Severity Index scores (29.2% scored 2 or 3), suggesting milder lung involvement. In contrast, patients aged 31 - 60 years showed an increase in moderate lung involvement, with 37.3% scoring 3, and individuals over 60 years had a higher incidence of severe lung findings, with 51% scoring a 4 (Table 5). These findings indicate that older age groups are at higher risk of severe pulmonary

impact from COVID-19, underscoring the importance of age as a risk factor for more extensive lung damage. Clinically, this underscores the need for heightened monitoring and potentially more aggressive treatment for older COVID-19 patients to prevent severe respiratory complications.

5. Discussion

Among 600 COVID-19 patients, this study analyzed demographic, clinical, and severity-related data to help explain the relationships between age, comorbidities, and illness severity. A higher proportion of men (72.67%) experienced symptoms, an increase consistent with results by Smith *et al.*, who observed higher COVID-19 sensitivity and severity in men across different populations [18]. The difference could have something to do with changes in hormone levels and immune responses, this subject calls for more research.

5.1. Age-Related Severity Patterns

Our analysis identified significant age-dependent differences in health outcomes and disease severity. Patients in older age groups demonstrated higher rates of severe disease, aligning with Sami R *et al.*, who highlighted age as a major predictor of COVID-19 progression [19]. While only 26.9% of elderly patients exhibited mild cases, 51.4% of younger patients had mild symptoms, underscoring the protective effects of younger age against severe manifestations. Comorbidities such as diabetes and stroke, which increase with age, improve health outcomes in elderly patients, according to Brown *et al.* in their investigation of metabolic disorders in COVID 19 patients [20] [21].

5.2. Influence of Comorbidities on Severity

Our findings emphasize the role of pre-existing conditions in determining COVID-19 severity. Diabetes mellitus was notably more prevalent among patients with severe disease (75.0%) than in mild (31.7%) or moderate cases (38.6%), in line with Zhang *et al.*, who reported diabetes as a critical factor in severe COVID-19 complications [22]. Ischemic heart disease and stroke rates also increased with severity, corroborating Terzic CM *et al.*'s conclusions on the relationship between cardiovascular conditions and COVID-19 prognosis [23]. This underscores the need for targeted interventions for high-risk groups, particularly the elderly with comorbidities. One the other hand, Ischeamic heart disease patients had significant difference with a higher rate of severe group (75.0%) compared to the mild (16.7%) and moderate (9.7%) groups ($p = 0.000^*$). This finding is similar with the study of Li *et al.* (2020) regarding cardiovascular issues in COVID-19 patients [24]. The finding of this study showed the complicated connection between the severity of the disease and several health factors in COVID-19 patients.

5.3. Therapeutic Interventions and Severity Levels

This study found significant differences in therapeutic requirements across severity

levels. Oxygen therapy was necessary in 86.4% of moderate and 100% of severe cases, consistent with Ouyang L *et al.*, who emphasized respiratory support's importance in critically ill COVID-19 patients [25]. Anticoagulant use was also markedly higher in moderate and severe cases, underscoring its role in preventing thrombotic complications in patients with heightened disease severity [26]. These findings point to the need for anticipatory resource allocation, especially during peak healthcare demands.

5.4. Psychological Impact of COVID-19 Severity

Psychological comorbidities such as anxiety and depression were significantly more prevalent among severe cases. This aligns with Fleischmann E *et al.*, who noted that severe COVID-19 can amplify psychological distress, potentially due to prolonged isolation and more intensive treatment experiences [27]. However, sleep disturbances did not vary significantly by severity, mirroring Jahrami HA *et al.*'s findings that sleep issues may stem from broader pandemic-related stressors rather than disease severity alone [28].

5.5. Post-COVID-19 Persistent Symptoms

Our results indicated a high prevalence of post-COVID symptoms, such as fatigue, shortness of breath, and cognitive symptoms, mirroring Garrigues E and Li *et al.*, who observed similar long-term effects [29] [30]. The persistence of these symptoms suggests a protracted recovery phase for many patients, highlighting the importance of post-COVID care frameworks. These symptoms affect patients' quality of life and suggest potential underlying issues, such as systemic inflammation or organ damage, that persist beyond the acute phase of infection.

5.6. Lung Parenchymal Abnormalities in Follow-Up

Lung imaging of post-COVID patients revealed prevalent abnormalities, notably ground-glass opacity and fibrosis, consistent with Li *et al.* and Ghayda RA *et al.*, who reported similar findings in long-term COVID-19 lung studies [30] [31]. These conditions were especially common in older patients, underscoring age as a factor in lingering respiratory issues. Such findings underscore the need for continued pulmonary monitoring and rehabilitation in recovering patients, particularly those with prior lung abnormalities.

5.7. Correlation Between Age and CT Severity Index

A significant correlation emerged between age and CT Severity Index scores, with older age groups demonstrating higher scores. This pattern reflects findings by Francone *et al.* and Li K *et al.*, who reported greater lung involvement in older COVID-19 patients [32] [33]. The CT Severity Index's alignment with age supports the idea that older patients are at higher risk for extensive pulmonary damage, reinforcing age as a critical factor in treatment prioritization.

This study highlights the relationship between demographic factors, comorbi-

dities, and COVID-19 severity. Age and comorbid conditions such as diabetes and cardiovascular disease significantly impact outcomes, while post-COVID-19 symptoms and lung abnormalities call for enhanced post-acute care. These findings offer essential insights for public health and clinical practice, particularly in managing high-risk patient groups and optimizing resource allocation during future healthcare crises.

6. Limitations

A primary limitation of this study is the use of non-probability convenience sampling, which constrains the generalizability of our findings. This sampling approach may introduce bias, as participants were selected based on accessibility rather than randomization, possibly leading to an over-representation of certain demographic or clinical characteristics within the Dhaka hospital setting. Such bias can skew the results, potentially impacting the accuracy of insights into COVID-19's broader impact across varied populations. This limitation is not fully mitigated within the study, and thus, caution is advised in generalizing these findings. Future research should employ randomized sampling across diverse regions and healthcare settings to increase the representativeness and validity of findings, ultimately offering a more comprehensive understanding of COVID-19's long-term effects.

7. Conclusion

Our study has important findings into the persistent health issues found by COVID-19 survivors, especially regarding pulmonary and mental health outcomes. Our data found that age and comorbidities, including diabetes and ischaemic heart disease, significantly impact the severity of post-COVID outcomes, while a few patients have health problems such as fatigue and lung problems. On the other hand, most of the patients have improved in their symptoms over a period. Treatment and monitoring are important for COVID-19 survivors to address persistent health problems and improve their quality of life as recovery progresses.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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