https://doi.org/10.3329/cbmj.v13i2.75301

Long Term Health Problems and Associated Factors among COVID-19 Recovered Patients

*Sarker AK[1], Alam KS[2], Ema FA[3], Ali MY[4]

Abstract

A cross-sectional, descriptive study was conducted among 181 individuals recovered from COVID-19 infection and had been missing infection (negative rt-PCR test) or signs-symptoms for minimum three months. The study aims determine newly developed health problems in patients, which was conducted at Post-COVID Unit of Anwer Khan Modern Medical College Hospital, Dhaka, Bangladesh, between July 2021 and June 2022. Through convenient sampling, data were collected by face-to-face interview and history of signs/ symptoms during the infection were recorded from reviewing prescription and interview as well by using a semi-structured questionnaire. The mean age of the participants was 39.56±6.92 years and male-female ratio was 1.45:1. The mean monthly family income of the participants was 36,022.09±4130.56 BDT which represents lower middle to middle class family in terms of Bangladesh context. During COVID-19 infection most of the (97%) respondents had fever, and 87%, 79% of the patients had sore throat and cough respectively as common symptoms; in addition, more than one-third (34%) had diarrhea. Several constitutional symptoms also recorded during their course of illness like headache (74%) and malaise (54%). More than one-third (34%) of the respondents required admission in hospital. During the course of infection, 41%, 26% and 31% participants were suffered from mild, moderate and severe form of COVID-19 illness. Most of the respondents developed long term health problems following COVID infection and post-viral fatigue was the most prevalent (85%) among the post COVID individuals and this long-term health problem-post viral fatigue was found to be associated with monthly income and it was statistically significant ($p<0.05$). Others long term health problems including shortness of breath (74%), loss of memory (38%), difficulty in concentration (41%), loss of hair (30%), fast beating or pounding heart (33%) were also noticed. Insomnia (56%), persistent cough (35%), loss of taste (32%) and change of bowel habit (28%) were other health problems revealed in this study. Association between loss of memory and gender ($p<0.0001$), diabetes mellitus and severity of COVID-19 ($p<0.05$), sore throat, cough and severity of COVID-19 ($P<0.05$) were also found significant. diabetes mellitus (35%), hypertension (34%) and bronchial asthma (24%) were observed to be most common comorbidities. Shortness of breath – one of the post-COVID consequence was found significantly associated with diabetes mellitus and bronchial asthma ($p<0.05$). Our study found that persistence of various signs and symptoms from COVID-19 infection and newly yield complications in individual who recovered from COVID-19 infection are collectively comprise long term health problems of post-COVID patients. This long-term health problem of post-COVID people is a major public health concern. Fatigue, dyspnea, difficulty to concentrate, memory loss, persistent cough, fast beating or pounding heart, loss of smell, loss of taste, insomnia are the most common long term health problems in COVID-19 recovered people. Long-term follow up may be recommended to understand future consequences of COVID-19 patients and well-being for the post-COVID people.

CBMJ 2024 July: vol. 13 no. 02 P:158-168

Keywords: COVID-19, long-term health problem, post-COVID unit

1. *Dr. Abu Kawser Sarker, Assistant Professor, Dept. of Community Medicine, Anwer Khan Modern Medical College (AKMMC), Dhaka.
2. Dr. Kazi Shafiul Alam, Professor & Head, Dept. of Epidemiology, National Institute of Preventive and Social Medicine (NIPSOM), Dhaka.
3. Dr. Fateha Akter Ema, Research Fellow, International Centre for Diarrheal Disease Research, Bangladesh (Icddr,b), Dhaka.
4. Dr Md Yunus Ali, Professor of Community Medicine, Community Based Medical College Bangladesh (CBMCB), Mymensingh.

Address of Correspondence:
Email: yunusali62@gmail.com

Introduction

The COVID-19 virus was first detected and reported in Wuhan city, China in December 2019.[1] Corona virus disease 2019 (COVID-19) is a communicable disease caused by a newly found strain of corona Virus i.e. novel severe acute respiratory syndrome corona virus 2 (SARS-CoV2).[2] Following a reported incubation period of 1–14 days, the disease commonly presents through symptoms of fever, cough, fatigue, breathing difficulties, loss of taste and smell. The mainstream symptoms of COVID-19 patients are, however, either asymptomatic or only have mild symptoms; while a few may develop acute respiratory distress syndrome (ARDS), which can be life-threatening or even fatal.[3] Since its inception, the virus has spread globally and was declared as a global pandemic by World Health Organization (WHO) on 11 March, 2020. There are several strains of Corona virus has been detected before. But, SARS-CoV-2 differs from previous strains of corona virus infections (SARS and MERS) due to its high infectivity (reproduction value, R0, typically 2–4) and preclinical or asymptomatic transmission, properties that have contributed to the current global Covid-19 pandemic.[4] In addition to this, rapid change in the viral strains has brought variations not only its clinical presentation but also in the post COVID consequences as well. Although clinical manifestations of COVID-19 ranges from asymptomatic to fulminant of symptoms and fatal cases as well but severe cases of COVID infection can develop pneumonia, acute respiratory distress syndrome, sepsis and even multiple organ failure. More seasoned individuals, and those with clinical issues like cardiovascular sickness, diabetes, ongoing respiratory infection, and malignancy are bound to foster genuine ailment.[5] Like many other viral diseases, most of the COVID-19 patients usually recovered within 14 days of following infection. On the contrary, some patient may lead to various complications such as ARDS, thromboembolic manifestations, acute kidney injury and additional viral and bacterial infections as well.[6] Apart from this, some patients may have some persistent symptoms as well. Following recovery from illness some COVID-19 infected patients may not cease undergoing symptoms long after their COVID-19 rt-PCR test turns negative; this is commonly referred to as “post COVID-19 syndrome” or “long COVID”.[3] Post-COVID-19 syndrome has become an increasingly common challenge, as the pandemic evolves. The latest estimates suggest that 10% to 20% of the SARS-CoV-2 patients who undergo an acute symptomatic phase are expected to experience an effects of the disease beyond 12 weeks after diagnosis due to post COVID consequences.[7]

As per guidelines by the National Institute for Health and Care Excellence (NICE), Post COVID-19 syndrome is defined as, “signs and symptoms that develop during or after an infection consistent with COVID-19, continuing for more than 12 weeks (3 months), and not explained by an alternative diagnosis.

A prospective cohort study conducted at tertiary level hospital of Bangladesh reveals that, 46% patients developed post-COVID-19 symptoms, with post-viral fatigue being the most prevalent symptom in 70% cases and female are most vulnerable to develop post COVID symptoms.[8] Although Bangladesh has shifted from developing country to least developed countries in the recent past. Still, we do have so many challenges particularly in the health sector.

Furthermore, limited resources have made more difficult to combat these challenges. In particular, the effective long-term management of the effects of post-COVID-19 syndrome is a challenge that requires much and more awareness. Since beginning of the year 2021, Bangladesh government has widened the vaccination program even up to grass root level. Some patients are presenting with wide range of ongoing, new or returning health problems which people can experience four or more weeks after first being infected with COVID-19 and that can worsen with physical and mental stress as well. This could be an emerging threat in the upcoming days. Although the number of symptoms have been shown to decline from acute COVID-19 infection to follow- up. Several previous studies demonstrated that a large number of patients continue to experience persistent symptoms regardless of the severity of the initial illness.[9] The most common symptoms persisting after COVID-19 infection are post viral fatigue, palpitations, dyspnea, persistent cough, headache, loss of hair, loss of memory, smell and taste dysfunction etc.[10] Another study reveals myalgia, sleep disturbances and mental health issues like Severe post-COVID anxiety and depression as post COVID complications.[11] A systematic review and meta-analysis of 15 publications revealed 55 long term complications following COVID-19 infections and five most common symptoms were fatigue (58%), headache (44%), attention disorder (27%), hair loss (25%), and dyspnea (24%) respectively.[12]

Few identified risk factors for disease severity of COVID-19 and death from this particular infection include older age, male sex, diabetes, obesity/high BMI and hypertension as well.[4] Hypertensive patients are more vulnerable to develop Post COVID complications. One of the possible reasons is components of the renin-angiotensin system (RAS), which are critically involved in the pathophysiology of hypertension, are also implicated in COVID-19 as well.[13] Apart from this, COVID-19 has also been shown to affect other organs, including the brain, and recently reports on neurological symptoms due to COVID-19 infection are emerging day by day. A variety of factors were found associated with higher risk of psychiatric symptoms and/or low psychosocial well-being including female gender, poor self-related health and relatives with COVID-19.[14]

This study aims to find out long term complications of the COVID patients at least one-month after being negative which includes persistence of any symptoms while suffering from COVID-19 or even new onset of any symptoms which he/she haven't experienced before. In addition to this, the focus of this study was to explore associated factors predisposing to develop these long-term complication following recovery from COVID-19.

Methods

This study was a descriptive type of cross-sectional study conducted in Post-COVID Unit of Anwer Khan Modern Medical College Hospital, Dhaka, Bangladesh, between July 2021 and June 2022. The study population was the COVID-19 recovered patients after 3 months to one year of being negative with COVID-19 attending at post COVID unit of Anwer Khan Modern Medical College (AKMMC). Sampling technique used in this study was convenient type of non-probability sampling. After ensuring inclusion criteria a total number of 181 COVID-19 recovered patients were interviewed. A pretested semi-structured

questionnaire was used to collect data from the respondents. Data were collected by face to face interview and reviewing previous medical records/ prescriptions.

Results

The mean age of the participants was 39.56±6.92 years and male-female ratio was 1.45:1. The mean monthly family income of the participants was 36,022.09±4130.56 BDT which represents lower middle to middle class family in terms of Bangladesh context. During COVID-19 infection most of the (97%) respondents had fever, and 87%, 79% of the patients had sore throat and cough respectively as common symptoms; in addition, more than one-third (34%) had diarrhea. Several constitutional symptoms also recorded during their course of illness like headache (74%) and malaise (54%). More than one-third (34%) of the respondents required admission in hospital. During the course of infection, 41%, 26% and 31% participants were suffered from mild, moderate and severe form of COVID-19 illness. Most of the respondents developed long term health problems following COVID infection and post-viral fatigue was the most prevalent (85%) among the post COVID individuals and this long-term health problem-post viral fatigue was found to be associated with monthly income and it was statistically significant (p<0.05). Others long term health problems including shortness of breath (74%), loss of memory (38%), difficulty in concentration (41%), loss of hair (30%), fast beating or pounding heart (33%) were also noticed. Insomnia (56%), persistent cough (35%), loss of taste (32%) and change of bowel habit (28%) were other health problems revealed in this study. Association between loss of memory and gender (p<0.0001), diabetes mellitus and severity of COVID-19 (p<0.05), sore throat, cough and severity of COVID-19 (P<0.05) were also found significant. diabetes mellitus (35%), hypertension (34%) and bronchial asthma (24%) were observed to be most common comorbidities. The results are given below:

Table-I: Distribution of the COVID-19 patients by age (n=181)

Age (in years)	Frequency	Percentage(%)
<25	37	20
25-35	50	28
35-45	29	16
45-55	28	15
55-65	23	13
>65	14	8
Total	181	100%
(Mean ± SD)	**(39.56 ± 6.92)years**	

Table-II: Distribution of the respondents by Occupation (n=181)

Occupation	Frequency	Percentage (%)
Service	61	34
Business	40	22
Doctor	20	11
Housewife	33	18
Farmer	4	2
Others (Lawyer, Engineer, Day laborer etc.)	23	13
Total	**181**	**100%**

Fig. 1: Distribution of the respondents by educational qualification (n=181)

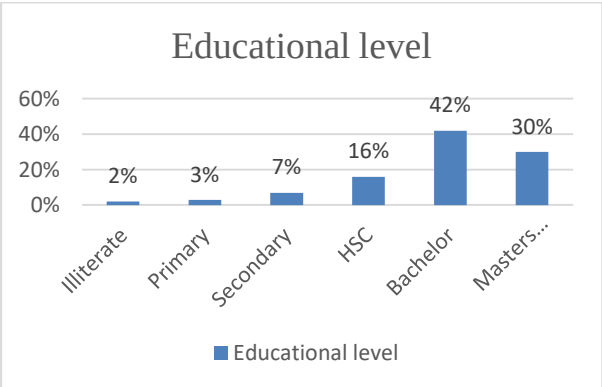

Table-III: Distribution of the respondents by predominant COVID-19 symptoms (n=181) (Multiple response)

COVID-19 symptoms	Frequency (f)	Percentage (%)
Fever	176	97
Sore throat	159	87
Headache	135	74
Diarrhea	62	34
Loss of smell sensation	150	82
Cough	144	79
Malaise	92	51
Vomiting	26	14
Loss of taste sensation	145	80
Shortness of breath	103	56

Table- IV: Distribution of the respondents by their mode of treatment received by the patients during course of illness. (n=181)

Mode of treatment	Frequency	Percentage (%)
Home management	36	20
By MBBS doctor	45	25
By specialist doctors	86	48
Alternative medical care	6	3
Pharmacy shopkeeper	8	4
Total	181	100%

Fig. 2: Distribution of the respondents by feature of Chest X-ray Findings

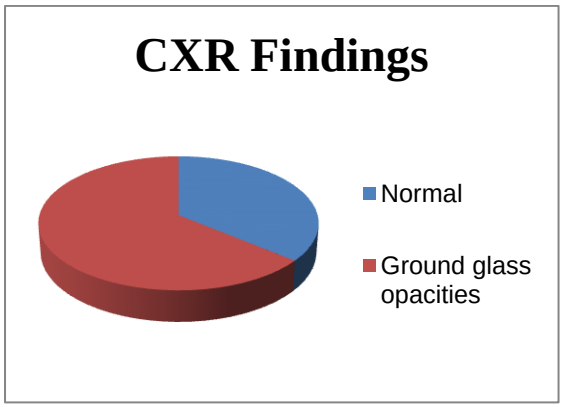

Fig. 3: Distribution of the respondents by feature of HRCT Findings

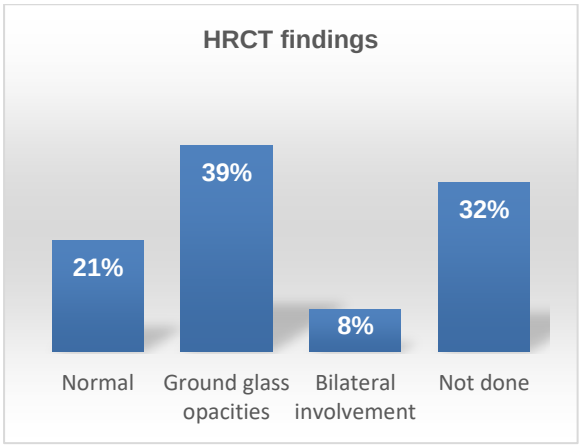

Table-V: Distribution of the respondents by post COVID-19 long term health problems: (n= 181) (Multiple response)

Post COVID-19 long term health problems	Frequency (f)	Percentage (%)
Post viral fatigue	155	85
Chest pain	42	23
Shortness of breath	135	74
Loss of memory	70	38
Persistent cough	64	35
Difficulty in concentration	74	41
Loss of smell	55	31
Headache	76	42
Loss of hair	54	30
Dizziness	60	33
Loss of taste	58	32
Joint or muscle pain	66	36
Fast beating or pounding heart	60	33
Change in bowel habit	51	28
Insomnia	101	56
Stroke	37	21

Table-VI: Distribution of the respondents by associated comorbidities: (n=181) (Multiple response)

Co-morbidities	Frequency (f)	Percentage (%)
Diabetes Mellitus	64	35
COPD	11	6
Bronchial Asthma	43	24
Hypertension	60	34
Ischemic Heart Disease (IHD)	14	8
Chronic Kidney Disease (CKD)	45	25
Cerebrovascular Disease (CVD)	9	5

Table-VII: Association between respondent having Bronchial Asthma & severity of COVID-19.

Bronchial Asthma	Severity of COVID-19				p-Value (χ^2 test)
	Mild f (%)	Moderate f (%)	Severe f (%)	Total f (%)	
Present	11 (26%)	13 (30%)	19 (44%)	43 (100%)	p=0.04 df=2
Absent	63 (46%)	35 (25%)	40 (29%)	138 (100%)	

Fig. 4: Distribution of the respondents by Severity of COVID-19

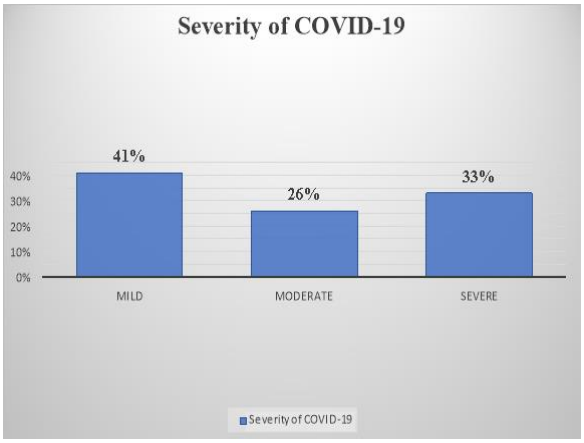

Table-VIII: Association between socio-demographic variable & severity of COVID-19

SD variables	Severity of COVID-19			p-Value
	Mild	Moderate	Severe	
Age group (in years)				
<25	19 (26%)	13 (27%)	5 (9%)	χ^2=36.593 df =5 **p=0.0001**[a]
25-35	31 (62%)	10(20 %)	9 (18%)	
35-45	10 (34%)	8 (27%)	11 (38%)	
45-55	8 (29%)	20(71 %)	11 (38%)	
55-65	7 (25%)	9 (32%)	12 (43%)	
>65	0 (00%)	3 (21%)	11 (79%)	
Gender				
Male	40 (38%)	29 (27%)	37 (35%)	χ^2=1.106 df =1 p=0.575[b]
Female	34 (45%)	19 (25%)	22 (30%)	
Marital Status				
Married	44 (36%)	29 (23%)	50 (41%)	χ^2=13.687 df =2 **p=0.004**[a]
Unmarried	30 (54%)	18 (32%)	8 (14%)	
Widowed	0 (00%)	1 (50%)	1 (50%)	
Educational status				
Illiterate	2 (67%)	0 (0%)	1 (33%)	χ^2=15.352 df =5 p=0.093[a]
Primary	2 (33%)	2 (33%)	2 (34%)	
Secondary	4 (31%)	2 (15%)	7 (54%)	
HSC	9 (31%)	6 (21%)	14 (48%)	
Bachelors	40 (53%)	20 (26%)	16 (21%)	
Masters & above	17 (31%)	18 (33%)	19 (35%)	

a=Fisher Exact test, b=Chi-square test, bold p value indicated significant p value

Table-IX: Association between comorbidities & long term health problem (Shortness of breath) of COVID-19 recovered individual

Comorbidities	Long term health problem (Shortness of breath)		p value
	Present	Absent	
Diabetes Mellitus			
Present	35 (55%)	29(45%)	χ^2=7.805
Absent	39 (33%)	78 (67%)	**p= 0.007** [b]
Hypertension			
Present	32 (50%)	31(49%)	χ^2= 3.926
Absent	42 (35%)	76 (65%)	p= 0.06 [b]
Bronchial Asthma			
Present	25 (58%)	18 (42%)	χ^2= 6.948,
Absent	49(35%)	89 (65%)	**p=0.012**[b]
COPD			
Present	7 (64%)	4 (36%)	χ^2=2.509,
Absent	67 (39%)	103 (61%)	p=0.127[a]
Ischemic Heart Disease			
Present	11 (78%)	03(22%)	χ^2 =8.917
Absent	63 (38%)	104(62%)	**P = .004**[a]
Chronic Kidney Disease			
Present	16 (69%)	7 (31%)	χ^2= 5.742
Absent	29 (40%)	42 (60%)	**P = .029** [b]

a=Fisher Exact test, b=Chi-square test, bold p value indicated significant p value.

Discussion

Post COVID is a condition occurring in patients with a history of probable or confirmed SARS -CoV-2 infection, which typically develops 3 months from the onset of symptoms, persists for at least 2 months, and cannot be explained by any other alternative diagnoses.[15] The symptoms may develop after initial recovery from an acute SARS-CoV-2 infection or persist from the original disease, fluctuate or even relapse over time. Male (59%) predominate over female (41%) was observed in our study. 80% study subjects were above 25 years. Mean age of the respondents was 39.56±6.92 years. Age group and mean age almost similar to the finding of a study conducted in Germany (mean age was 49.8 ±16.9 years, and 82% of the patients were within the age range of 18–64 years)[16] and does not correlate with the mean age of respondents a study conducted by Swapna et al (mean age was 59.9 years).[17] Although all age groups have been suffered by COVID-19, the median age appears to be around 47–59 years, and usually higher among severe cases and non-survivors.[18] The association between age & level of severity of COVID-19 was found statistically highly significant (p<0.00001). Majority of the study respondents (85%) were found Muslim.

Around 7%, 16% & 30% of the respondents were educated up to SSC, HSC, master's and above respectively and no significant association found between educational status and COVID -19 infection. 69% of the participants were married and rest were unmarried. The mean monthly family income of the respondents was 36,022.09±4130.56 BDT. About 34%, 22% and 18% respondents Occupation were Service, Business and housewife respectively. In this particular study majority of the respondents (72%) were from nuclear family and rest were from joint or extended family (28%). Trends of nuclear family increasing day by day in Bangladesh due to sociodemographic factors. Very first COVID-19 patients had a direct contact history with a local Chinese seafood and wildlife market, suggesting a common-source zoonotic exposure as the main mode of transmission. Later, human-to-human transmission established as well.[19] Currently, it is evident that the virus can be mainly transmitted through droplets, direct contact and aerosols. A subject can also get infected by touching a surface or object contaminated with the virus and subsequently touching his/her mouth, nose, or eyes as well.[20] The most commonly reported symptoms were fever, cough, fatigue, sputum production and shortness of breath. However, headache, upper respiratory symptoms (e.g., sore throat and rhinorrhea) and gastrointestinal symptoms (e.g., nausea and diarrhea) occur less often.[21] Although smell and taste disorders (e.g., anosmia and dysgeusia) were not described initially in the initial Chinese studies, have also been found frequently in patients with COVID-19 later on.[22] During the course of illness of COVID-19 respondent's symptoms were also evaluated retrospectively by taking interview from the COVID-19 recovered people and also by evaluating their previous medical records. Almost cent percent (97%) of the respondents had fever as their initial symptoms. Subsequently, around 87% & 79% of the patients had sore throat and persistent cough respectively. In addition to these, few GI symptoms found as well i.e. diarrhea (34%). Initially study participants had few constitutional symptoms for example headache (74%) and Malaise (54%). These findings are quite similar to those as reported in previous studies.[21,22] Most importantly 80% of the respondent has got loss of taste sensation. On the contrary, only 14% of the participants had vomiting during their COVID-19 illness. More than half (56%) of the study subjects had shortness of breath as well. As in many low- and middle-income countries (LMICs), Bangladesh has experienced the wide range burden of the COVID-19 pandemic, since the identification of the first case on 8 March 2020.[23] Like many other countries lock down concept was also implemented in Bangladesh as well. In addition to this initial anxiety and fear regarding COVID-19 was visibly evident. For this reason, those who were affected in COVID-19, their mode treatment was variable from individual to individual. In this study we have also evaluated people's mode of seeking treatment during their course of illness. Almost half of the respondents were treated by specialist or by consultant. Around 24% of the respondents took home management only. Surprisingly, 2% of the respondents took medicine from local pharmacy without any physician advice. In this study we have also evaluated the hospital admission rate of the study participants due to COVID-19 illness. Around 34% of the respondents required hospital admission due to COVID-19 and its

consequences and rest of 66% took medication staying at home. By interviewing the respondents and also evaluating their previous medical records we have found that around 41% of hospital admitted patients had features of shock and 43% of the admitted patients had features of respiratory failure respectively. Findings of X-ray chest of the respondents reveals normal 36%, ground glass opacities 54%. On the contrary, 39% of the respondent's High-resolution computed tomography (HRCT) findings revealed ground glass opaque shadow in their lung field and around 21% of HRCT findings have no abnormality. Oxygen saturation level of the respondent was an important prognostic factor and also early diagnostic tool for hospital admission. By reviewing medical records of patients, it has found that oxygen saturation level was below 90% in an around 38% of the respondents and in 78% of the respondents it was above 90%. In this study, it has operationalized the long COVID or post COVID syndromes 3 months after new onset of symptoms after recovering from illness due to COVID-19. Around (66%) of the respondent has become declared as COVID-19 negative following infection at least one month of suffering from infection. Percent of post-COVID sequelae found to be higher than the findings of study conducted by Androula *et al*.[24] Most prevalent post COVID symptoms in this study were post-viral fatigue (85%), shortness of breath (74%), loss of memory (38%), difficulty in concentration (41%), loss of hair (30%), fast beating or pounding heart (33%), insomnia (56%). Around 35%, 32% & 28% of the respondents developed persistent cough, loss of taste and changes in bowel habit respectively which are co-relate with the study conducted by Addison *et al*.[25] By analyzing various previous studies, it is already proven that associated comorbidities have a significant effect on respondent's mortality and morbidity in COVID-19 infection. In this study, it has also been evaluated associated comorbidities as well. Comorbidities of the study participants were diabetes mellitus (35%) which was found to be associated with the severity of COVID-19 ($p<0.05$), hypertension (34%), bronchial asthma (24%) and statistically significant association found between bronchial asthma and severity of COVID-19 ($P<0.05$), chronic kidney disease (25%), ischemic heart disease (8%). The most frequent long term health problem post viral fatigue was found to be associated with monthly family income and it was statistically significant ($p<0.05$).

Conclusion

Long term health problems followed by COVID-19 infection were not only continuing among patients with severe form of COVID-19 infection who had required hospital admission, but also determined among the patients who had mild to moderate form of COVID-19 infection as well. The shortness of breath was importantly persisted in post-COVID individuals and others cough, anosmia, ageusia were found to be soothed. Fatigue in post-COVID individuals were found as most frequent long term health problem and it is statistically significant with income; other emerging health problems like dyspnea, difficulty to concentrate, memory loss, fast beating or pounding heart, insomnia are the most common long term health problems in COVID- 19 recovered individuals. Each of the comorbidity diabetes mellitus and hypertension was presented among more than one-third of the

post-COVID individuals; where nearly one-fourth of them had bronchial asthma. One of the long term post-COVID consequences shortness of breath was found significantly associated with diabetes mellitus and bronchial asthma.

References

1. *Malik P, Patel K, Pinto C, Jaiswal R, Tirupathi R, Pillai S, et al. Post-acute COVID-19 syndrome (PCS) and health-related quality of life (HRQoL)-A systematic review and meta-analysis. J Med Virol. 2022;94(1):253-62.*
2. *Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. JAMA. 2020;323(13):1239-42.*
3. *Suvvari TK, Kutikuppala LVS, Tsagkaris C, Corriero AC, Kandi V. Post-COVID-19 complications: Multisystemic approach. J Med Virol. 2021;93(12):6451-5.*
4. *Muniangi-Muhitu H, Akalestou E, Salem V, Misra S, Oliver NS, Rutter GA. Covid-19 and Diabetes: A Complex Bidirectional Relationship. Front Endocrinol (Lausanne). 2020;11:582936.*
5. *Barek MA, Aziz MA, Islam MS. Impact of age, sex, comorbidities and clinical symptoms on the severity of COVID-19 cases: A meta-analysis with 55 studies and 10014 cases. Heliyon. 2020;6(12):1-24.*
6. *Zheng KI, Feng G, Liu WY, Targher G, Byrne CD, Zheng MH. Extrapulmonary complications of COVID-19: A multisystem disease? J Med Virol. 2021;93(1):323-35.*
7. *Jimeno-Almazán A, Pallarés JG, Buendía-Romero Á, Martínez-Cava A, Franco-López F, Sánchez-Alcaraz Martínez BJ, et al. Post-covid-19 syndrome and the potential benefits of exercise. Int J Environ Res Public Health. 2021;18(10):5329.*
8. *Mahmud R, Rahman MM, Rassel MA, Monayem FB, Sayeed SKJB, Islam MS, Islam MM. Post-COVID-19 syndrome among symptomatic COVID-19 patients: A prospective cohort study in a tertiary care center of Bangladesh. PLoS One. 2021;16(4):e0249644.*
9. *Aiyegbusi OL, Hughes SE, Turner G, Rivera SC, McMullan C, Chandan JS, et al. Symptoms, complications and management of long COVID: a review. J R Soc Med. 2021;114(9):428-42.*
10. *Yong SJ. Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and treatments. Infect Dis (Auckl). 2021;53(10):737-54.*
11. *Pai MY Bin, Park ASH, Chen BFL, Toma JT, Pai HJ. Health Complications in Patients Recovering from COVID-19: A Narrative Review of Post-COVID Syndrome. J Adv Med Med Res. 2021;33(10):115-29.*
12. *Lopez-Leon S, Wegman-Ostrosky T, Perelman C, Sepulveda R, Rebolledo PA, Cuapio A, et al. More than 50 long-term effects of COVID-19: a systematic review and meta-analysis. Sci Rep. 2021;11(1):1-12.*
13. *Touyz RM, Boyd MOE, Guzik T, Padmanabhan S, McCallum L, Delles C, et al. Cardiovascular and Renal Risk Factors and Complications Associated With COVID-19. CJC Open. 2021;3(10):1257-72.*
14. *Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. Brain Behav Immun. 2020;89:531-42.*

15. Soriano JB, Murthy S, Marshall JC, Relan P, Diaz J V. A clinical case definition of post-COVID-19 condition by a Delphi consensus. Lancet Infect Dis. 2022;22(4):e102-7.

16. Lemhöfer C, Sturm C, Loudovici-Krug D, Best N, Gutenbrunner C. The impact of Post-COVID-Syndrome on functioning – results from a community survey in patients after mild and moderate SARS-CoV-2-infections in Germany. J Occup Med Toxicol. 2021;16(1):1-9.

17. Mandal S, Barnett J, Brill SE, Brown JS, Denneny EK, Hare SS, et al. Long-COVID': A cross-sectional study of persisting symptoms, biomarker and imaging abnormalities following hospitalisation for COVID-19. Thorax. 2021;76(4):396-8.

18. Hussain A, Bhowmik B, do Vale Moreira NC. COVID-19 and diabetes: Knowledge in progress. Diabetes Res Clin Pract. 2020;162:108142.

19. Jalava K. First respiratory transmitted food borne outbreak? Int J Hyg Environ Health. 2020;226:113490.

20. Adhikari SP, Meng S, Wu YJ, Mao YP, Ye RX, Wang QZ, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: A scoping review. Infect Dis Poverty. 2020;9(1):1-12.

21. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020;323(11):1061-9.

22. Guastalegname M, Vallone A. Could chloroquine / hydroxychloroquine be harmful in coronavirus disease 2019 (COVID-19) treatment? Clin Infect Dis. 2020;71(15):888-9.

23. Ahmed T, Pooja SD, Nandonik AJ, Mostafa S, Kabir ZN. Sociodemographic, economic, physical, and mental health status of previously hospitalised patients with COVID-19 symptoms in Bangladesh: Protocol for a mixed-method study. Front Public Health. 2023;10:763812.

24. Pavli A, Theodoridou M, Maltezou HC. Post-COVID Syndrome: Incidence, Clinical Spectrum, and Challenges for Primary Healthcare Professionals. Arch Med Res. 2021;52(6):575-81.

25. Addison AB, Wong B, Ahmed T, Macchi A, Konstantinidis I, Huart C, et al. Clinical Olfactory Working Group consensus statement on the treatment of postinfectious olfactory dysfunction. J Allergy Clin Immunol. 2021;147(5):1704-19.