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Original Research Article

Difference of post COVID health complications among infection and reinfection patients: a comparative study

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ABSTRACT

Background: The novel coronavirus disease 2019 (COVID-19) caused by the SARS-CoV-2 virus emerged as a global pandemic in December 2019, leading to significant health concerns. As the pandemic progressed, the post-recovery manifestations in survivors became a growing issue. Therefore, this comparative study aimed to assess the post-COVID health complication difference between infection and reinfection patients.
Methods: This cross-sectional study was conducted in the department of project and research, Dhaka Community Medical College Hospital, Dhaka, Bangladesh, from December 2023 to December 2024. In this study, we included 244 patients who got their treatment from Dhaka Community Medical Hospital.
Results: The study found that reinfection patients had higher percentages of complications, with pain reported in 15% of reinfection cases. Weakness was present in 33% of infection patients and 37% of reinfection patients. The mental health complications also seen in respondents like anxiety accounted for 30% of infection respondents and 19% of reinfection respondents. Depression was reported in 12% of infection cases and 7% of reinfection cases. Household factors like gender, BMI, religion, marital status, residence, living conditions, and smoking habits are significantly associated with both infection and reinfection patients.
Conclusions: This study found that the occurrence of post-COVID complications among patients with infection and reinfection was significantly different. Gender, marital status, living conditions, and smoking habits were the significant factors associated with differences in post-COVID complications among patients with infection and reinfection.

Keywords: COVID-19, Infection, Post COVID complications, Reinfection

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) caused by the SARS-CoV-2 virus has become a pandemic with a growing number of cases globally beginning in December of 2019.[1] The causative agent for COVID-19 had been identified as a new RNA virus from the beta-coronavirus family; the transmission rate was considered high because it was transmitted through respiratory droplets and close contact. The World Health Organization (WHO) categorized COVID-19 as a pandemic infection since the respiratory illness caused by the COVID-19 was highly contagious because of the novelty of the virus, its fast spread, and the lack of therapeutic and preventative strategies.[2,3]

Although the severe course of the disease had caused concern since the beginning of the pandemic, as time passed, the appearance of many post-recovery manifestations in survivors became another cause for concern. Numerous reports from various parts of the world have shown that COVID-19 had long-term effects on almost all systems including respiratory, cardiovascular, gastrointestinal, neurological, psychiatric, and dermatological systems.[4] The COVID-19 situation in Bangladesh was worsening day by day. High population density, poor personal hygienic practices, and poor economic conditions make Bangladesh particularly vulnerable to this virus. Even after more than a year of the COVID-19 pandemic, we still learn much about this complex disease. Many aspects, like how often complications occur or what factors increase the risk of them, remain poorly understood.[5,6] Defining what constitutes long-COVID-19 or post-COVID-19 syndrome (LCS) has also been challenging.[7-9] Currently, post-COVID-19 syndrome is described as persistent clinical signs and symptoms that develop during or after COVID-19 illness and last for more than 12 weeks, without an alternative diagnosis to explain them.[10-13]

The syndrome includes affectation of respiratory, cardiovascular, neurological, gastrointestinal, and musculoskeletal systems, psychiatric/psychological issues, ear, nose, throat, and dermatological symptoms, and general status impairment.[8-11,14-16]

Although the severe course of the disease had caused concern since the beginning of the pandemic, as time passed, the appearance of many post-recovery manifestations in survivors became another cause for concern. Numerous reports from various parts of the world have shown that COVID-19 had long-term effects on almost all systems including respiratory, cardiovascular, gastrointestinal, neurological, psychiatric, and dermatological systems.[4] A considerable part of patients, up to 87.5%, recovering from acute infection continue to suffer from a variety of symptoms including dyspnea, cough, myalgia, fatigue, and headache.[11,17,18] Evidence shows that even people with mild illness or no symptoms during their initial COVID-19 infection can experience long-term symptoms. This suggests the disease may cause more extensive damage than is immediately apparent. However, the terminology used to describe these ongoing symptoms and the timeframes for their classification vary across studies and institutions, including the Centers for Disease Control and Prevention (CDC) and the National Institute for Health and Care Excellence (NICE).[4,19-21] Greenhalgh et al. defined ongoing symptoms beyond 3 weeks from the disease onset as post-acute COVID-19 and beyond 12 weeks as chronic COVID-19.[11] CDC proposed dividing the disease into three periods such as acute COVID-19 (the first 2 weeks from symptom onset), post-acute hyperinflammatory illness (between 2 and 4 weeks from symptoms onset), and late sequelae period (more than 4 weeks from symptom onset) based on the population-based framework.[19] The NICE guideline suggests using the long-term term to describe signs and symptoms that persist for more than four weeks without an alternative explanation. For the symptoms that continue beyond 12 weeks after infection, the guideline recommends the term post-COVID syndrome.[20] Therefore, we conducted a comparative study to assess the post-COVID health complication difference between infection and reinfection patients.

METHODS

This cross-sectional study was conducted in the department of project and research, Dhaka Community Medical College Hospital, Dhaka, Bangladesh, from December 2023 to December 2024. In this study, we included 244 patients who got their treatment from Dhaka Community Medical Hospital.

These are the following criteria to be eligible for enrolment as our study participants: patients aged more than 20 years; patients with COVID-19 infection; patients treated at Dhaka community medical college and hospital were included in the study and patients with any other infection; patients with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, COPD, etc); patients who were not willing to participate were excluded from our study.

Data collection and analysis

Informed written consent was taken from the participants. The telephonic interview was conducted with a structured questionnaire after explaining the study objectives. All data were recorded systematically in the preformed data collection form. Quantitative data was expressed as mean and standard deviation; qualitative data was expressed as frequency distribution and percentage. Descriptive statistics will be calculated for socio-demographic characteristics. The data will be analysed by using SPSS 22 (Statistical Package for Social Sciences) for Windows version 10. A p value <0.05 was considered as significant. This study was approved by the ethical review committee of Dhaka Community Medical College Hospital.

RESULTS

Table 1 shows that the respondents were grouped into 3 age-related categories (24 individuals of 26 years old, 45 individuals between 27-37 years old, and 175 individuals between 38-48 years old). About 95% of individuals had the notion of Islam and 4.9% of individuals were of the Hindu religion. About 61.5% and 38.5% of the respondents belonged to urban and rural areas respectively where they either lived with their families (56.1%) or lived away from their families (43.9%). About 66.8% of the respondents were non-smokers while 24.2% were currently smoking.

Table 1: Socio-demographic characteristics of the respondents.

Variables	Categories	Frequency	Percentage
Age (years)	26	24	9.8
	27-37	45	18.4
	38-48	175	71.7
Religion	Islam	232	95.1
	Hinduism	11	4.9
Residence	Urban	150	61.5
	Rural	94	38.5
Living condition	With family	137	56.1
	Away from family	107	43.9
Smoking habit	Never smoker	163	66.8
	Former smoker	22	9.0
	Current smoker	59	24.2

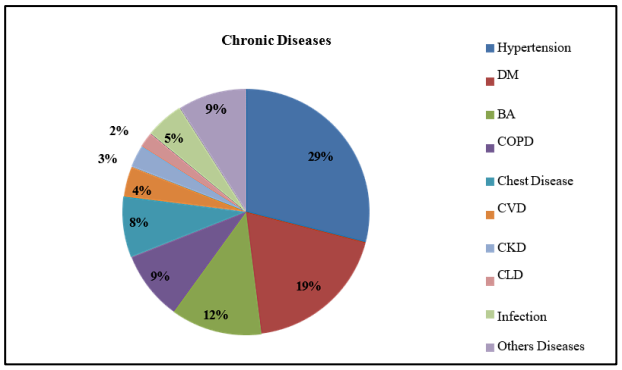

Figure 1: Percentage of chronic diseases among infection and reinfection patients.

Among 244 respondents, 29% had hypertension and 19% had diabetes mellitus during the reinfection phase. Significant respiratory conditions were also reported, including bronchial asthma (12%), COPD (9%), and other chest diseases (8%). Additionally, 4% experienced neurological issues, 5% had infections, 3% had chronic kidney disease (CKD), 2% had chronic liver disease (CLD), and 9% had other illnesses.

Among female respondents, fatigue was reported by about 20% during the infection phase and 22% during the reinfection phase, involving a total of 218 individuals. Male respondents reported fatigue less frequently, accounting for 140 individuals. The study also found that pain affected 5% of respondents during the infection phase and increased to 15% during reinfection. Weakness was another common symptom, reported by 33% of respondents during the infection phase and 37% during reinfection. Mental health complications were also notable, with anxiety affecting 30% of respondents during infection and 19% during reinfection. Depression was less common, reported in 12% of infection cases and 7% of reinfection cases, representing the lowest percentages observed.

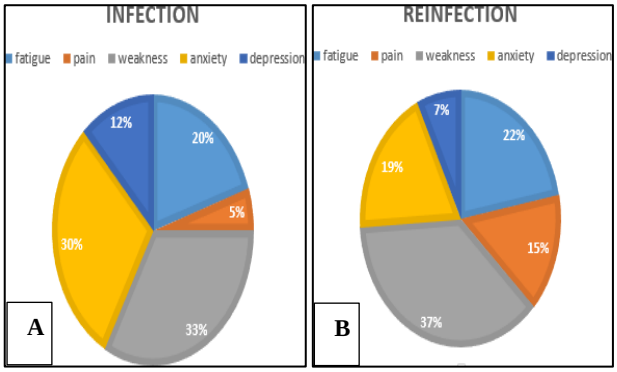

Figure 2: Health complications difference between infection (A) and reinfection (B) patient.

In Tables 2 and 3, binary logistic regression analysis revealed several factors associated with infection and reinfection among respondents respectively. Gender, residence, living conditions, and smoking habits were linked to initial infections, while gender, religion, living conditions, and smoking habits were associated with reinfections. Female respondents were 0.804 times less likely to experience an initial infection but 1.705 times more likely to be reinfected compared to males. Hindu respondents were 0.421 times less likely to contract an initial infection but 0.822 times more likely to experience reinfection than Muslim respondents. Married individuals were 0.351 times less likely to get infected initially but 0.667 times more likely to be reinfected than single individuals. Those living in rural areas were 0.409 times less likely to contract an initial infection and 0.534 times less likely to be reinfected compared to those living in urban areas. Respondents living far from their families were 1.104 times more likely to get infected and 1.204 times more likely to be reinfected than those living with their families. Smokers had a significantly higher likelihood of infection, being 2.641 times more likely to contract an initial infection and 1.456 times more likely to be reinfected compared to non-smokers.

Table 2: Association between sociodemographic characteristics and health complications between infection and reinfection patient.

Variables	Categories	AOR	P value	95% CI for AOR
Gender	Male	1		
	Female	0.804	0.010	514-2.164
Religion	Muslim	1		
	Hindu	0.422	0.987	0.328 -0.861
Marital status	Single	1		
	Married	0.351	0.154	0.178-0.771
Residence	Urban	1		
	Rural	0.409	0.004	0.145-0.605
Living condition	Living with family	1		
	Away from family	1.103	0.001	0.718-2.241
Smoking habit	Nonsmoker	1		
	Current smoker	2.641	0.009	1.242-3.046

Table 3: Association between sociodemographic characteristics and health complications among reinfection respondents.

Variables	Categories	AOR	P value	95% CI for AOR
Gender	Male	1		
	Female	1.703	0.05	0.893-2.672
Religion	Muslim	1		
	Hindu	0.822	0.003	44501.173
Marital status	Single	1		
	Married	0.667	0.643	0.417-1.360
Residence	Urban	1		
	Rural	0.533	0.532	0.325-1.352
Living condition	With family	1		
	Away from family	0.778	0.001	338-1.039
Smoking habit	Nonsmoker	1		
	Current smoker	1.456	0.001	0.812-2.160

DISCUSSION

The burden of post-COVID-19 complications continues to be a significant global concern as researchers highlight the long-term impact of COVID-19 on several organ systems and overall quality of life. People have been shown to have a range of persistent symptoms and outcomes across all demographic groups and severity levels of the original disease.

In the current study, we found that infected patients usually have more complications. The above study evaluated that adverse outcomes of post COVID-19 complications both infection and reinfection patients add an extra burden to our health care system. Most of the reference articles show that mental health complications are more in infected patients, But, mental health complications are also seen in respondents like anxiety accounted more in infection respondents than reinfection respondents. Depression also has been found in this study accounted more in infection patients than reinfection respondents which was comparatively lowest percentages among respondents. The re-infection rate of post COVID-19 survivors was likely to have seen the highest percentages of infection patients. The percentages of chronic diseases are also higher in reinfection cases than in infection cases. Household factors like gender, BMI, religion, marital status, residence, living conditions, and smoking habits are significantly associated with both infection and reinfection patients. This study found that the difference in health complications between infection and reinfection patients was comparatively higher in females than males. Many of the reference papers also show that post-COVID health complications are found more in female patients than males. Respondents who lived with family are less likely to be re-infected than the respondents who lived away from the family. Single respondents were seen as less likely to be re-infected than the respondents who were married though that is not significantly associated. Respondents who were non-smokers were seen with less infection and re-infection rate than the respondents who were current smokers.

One single-center questionnaire study reported that nearly half of the participants (47.5%) experienced persistent symptoms, with fatigue, myalgia, and weight loss being

the most frequent. Respiratory symptoms were also common, and severe acute COVID-19, hospitalization, and preexisting comorbidities were identified as risk factors for prolonged symptoms.[21] Another study focusing on patients six months post-infection found that one-third suffered from at least one complication, with fatigue, hair loss, loss of smell or taste, and headaches being prevalent. Notably, female sex, older age, B blood group, smoking, and prior exposure to COVID-19 were identified as significant risk factors for complications, while male sex and younger age were associated with better recovery.[22] A scoping review of 34 studies shed light on the extensive range of post-COVID-19 health issues, from physical challenges like fatigue (reported in 28% to 87% of patients), myalgia, and reduced physical functioning, to mental health concerns such as anxiety, depression, and post-traumatic stress disorder. Women and patients who required intensive care were more likely to report these complications, with overall quality of life significantly reduced up to three months post-infection.[12]

The CDC has emphasized that while many patients recover fully, a subset experiences persistent symptoms for weeks or months after acute infection. Common issues include weakness, shortness of breath, joint and chest pain, and cognitive impairments such as “brain fog”. Long-term complications affecting multiple organ systems- such as inflammation, blood clots, and cardiac issues- have also been documented.[23]

Organ-specific complications are a critical concern. For instance, studies report that 74% of patients hospitalized for severe COVID-19 continued to experience symptoms like breathlessness and fatigue 12 weeks post-recovery. Abnormal chest x-rays and impaired lung function were observed in most of these patients, underscoring the long-term impact on respiratory health. Additionally, systemic inflammation and cytokine release syndrome (cytokine storm) have been implicated in severe cases, causing widespread damage to multiple organ systems.[24,25] Neurological symptoms such as headaches, vertigo, and cognitive difficulties, as well as cardiac complications like myocarditis, myocardial infarction, and blood clot formation, further illustrate the multifaceted nature of post-COVID-19 syndrome.[26-28]

This study’s findings emphasize the importance of ongoing monitoring, long-term care, and comprehensive rehabilitation programs for COVID-19 survivors. Developing targeted strategies to address both physical and mental health is crucial, especially for high-risk groups like older adults, women, smokers, and individuals with preexisting health conditions.

Our study was a single-center study. We took a small sample size due to our short study period. After evaluating those patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

CONCLUSION

The COVID-19 pandemic poses a great threat to the existence of human beings. The patient recovered from this threatening condition and also suffered from several post-COVID-19 complications after recovering from the disease. We can conclude that the occurrence of post-COVID complications among patients with infection and reinfection is significantly different. Gender, marital status, living conditions, and smoking habits are the significant factors from socio-demographic characteristics that are associated with differences in post-COVID complications among patients with infection and reinfection. As infectious agents are increasing and identified worldwide in various forms the result of the study should be followed up.

Recommendations

Further studies with a prospective and longitudinal study design including a larger sample size need to be done to tackle the agents as preventive measures for human beings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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