https://doi.org/10.5281/zenodo.7601660

Association between Tuberculosis & COVID-19 in the Context of Dhaka City

Sharmin Haque Prima[1], Md. Istiakur Rahman[2] Israt Jahan[3*], Fariha Ifrit[4], Mabud Uz Zaman[5], Tasmim Nisa[6], Syeda Farzana[7,] Md Ranzu Ahmed[8]

[1,2,4,5,7]Department of Public Health, University of South Asia
[3]Department of Occupational and Environmental Health, Bangladesh University of Health Sciences
[6]Department of Nutrition and Food Science, University of South Asia
[8]Department of Chemistry, Bangladesh University of Health Sciences

Abstract

Tuberculosis & COVID-19 are those infectious diseases that share many similarities, from the mode of transmission to the outcome. Bangladesh is one of those TB high-burden countries. The study aims to discover and discover new things about COVID-19 as it is an emerging infectious disease. This cross-sectional study was carried out to evaluate the association between tuberculosis and COVID-19 in Dhaka Metropolitan City. We estimated the sample size through simple random sampling and used a close-ended questionnaire for data collection. Informed consent has taken from all the participants. Then the data analysis was done by using SPSS. We focused on some risk factors, their impact, and disease burden in terms of morbidity. The results showed a strong association between these two infectious killers. The study revealed that some risk factors, including older age, male gender, the onset of TB, comorbidities, vaccination status for COVID-19, and smoking, are highly associated with significant impact & increasing disease burden. Routine TB screening is suggested among suspected or confirmed cases of COVID-19 in Dhaka Metropolitan City due to the worse outcome of COVID-19 on TB patients and the confounding clinical features of these two diseases. TB is strongly associated with COVID-19 in terms of impact & disease burden. For addressing these major public health issues, we have a lot of scope to learn more on this topic.

Keywords: Koch's bacillus; Tuberculosis, COVID-19, Infectious disease

Introduction

Tuberculosis (TB) which is an ancient contagious disease that mainly affects the lungs. The causative organism for this disease is a bacterium that survived over 70000 years (Barberis et al., 2017). In 1882, Robert Koch discovered the organism which is Mycobacterium Tuberculosis (2021) TB spreads by air through respiratory droplets from one to another while coughing, sneezing, singing, talking, etc. (Patterson & Wood, 2019) TB is the world's thirteenth the second leading infectious killer and leading cause of death, trailing only COVID-19 (Coronavirus Disease) but ahead of HIV/AIDS (2021).

In 2021, 1.6 million individuals worldwide lost their lives to TB. Following COVID-19 (behind HIV/AIDS), TB is the second infectious killer in the world and the 13th largest cause of death overall. Globally, 10.6 million tuberculosis (TB) cases have reported in 2021. 6,400,000 males, 3,400,000 women, and 1.2,000,000 kids. TB exists in all nations and across all age groups. However, TB can have treated and controlled (Tuberculosis (TB), 2022).

According to the World Health Organization (WHO), in 2020, TB infected about 10 million people and caused the death of about 1.5 million people worldwide; among them, 86% of the new cases were

from the 30 high TB burden countries (Global tuberculosis report 2021) Bangladesh is one of those TB high-burden countries (World Health Organization. (n.d.) 2021). In Bangladesh, the reported incidence of tuberculosis per 100,000 is 221, and the fatality rate is 24 per 100,000 (Nazneen et al., 2021). Pulmonary tuberculosis accounts for about 80% of all TB cases in Bangladesh (Global tuberculosis report 2018). As per the Global TB Report 2020, TB is one of the significant public health concerns in Bangladesh, where 107 deaths occur from the infectious disease every day, and 987 individuals have been diagnosed with it (Global tuberculosis report 2020).

On the other hand, COVID-19 has caused by a new coronavirus termed SARS-CoV-2, which also affects the lungs (Islam et al., 2020). It has first identified in Wuhan, China, in December 2019(Singhal, 2020). The virus can spread from in small liquid particles an infected person's mouth or nose, when they sneeze, cough, speak, sing or breathe (Rahman et al., 2020). These particles range in size from large respiratory droplets to tiny aerosols. It was declared a pandemic on March 11, 2020, by the WHO (WHO Director, 2021). There have been 281,808,270 confirmed cases of COVID-19 reported to WHO as of January 01, 2022, with 5,411,759 deaths (Covid-19, 2022). On March 08, 2020, Bangladesh saw the first COVID-19 patient (Saha & Gulshan, 2021).

There have been 2,035,240 confirmed cases of COVID-19 in Bangladesh, with 29,423 deaths reported till October 31, 2022 (CSSEGIS and Data). COVID-19 has emerged as one of Bangladesh's most serious public health issues (Islam et al., 2020).

TB and COVID-19 are the leading causes of death from infectious diseases worldwide. Both diseases have some clinical similarities that make diagnosing and treating them difficult. Research suggests that COVID-19 and TB are transmitted chiefly through respiratory droplets, with the lungs as their primary target (Tadolini M, Codecasa LR, García-García J-M, Blanc F-X, Borisov S, Alffenaar J- W, et al, 2020). COVID-19 is a potential risk for tuberculosis, and co-infected patients have a worse prognosis (Mousquer GT, Peres A, Fiegenbaum M, et al, 2020). A study shows COVID-TB patients had a 2.21- and 2.27-times higher chance of dying or developing severe COVID-19, respectively (Song et al., 2021).

Though TB & COVID-19 are both major public health issues, we found only a few studies on TB and COVID-19 association. To get the best of our knowledge, we have yet to see any research on this topic in the context of Dhaka Metropolitan City. Here, we looked over the association between TB & COVID-19.

Because, Although TB is an ancient infectious disease, COVID-19 is an emerging infectious disease. We are learning something new about COVID-19 from time to time. Through this study, we tried to find information related to the baseline association between these two diseases after excluding other probable risk factors. From the findings, we can enrich our knowledge regarding those associations. The data obtained from this study can have used as a basis for further intervention studies. The identified knowledge can be shared with policymakers for different decision-making to reduce these diseases' impact and public health burdens.

Literature Review

Epidemiological knowledge is much more critical to combat a disease creating major public health issues. However, some of the current data related to the epidemiology of TB and COVID- 19 have already discussed. Very few related works have found to the best of our knowledge, on the association between TB and COVID-19, which have presented below.

Philippe Glaziou stated that TB is a poverty-related disease that flourishes where social and economic determinants of poor health exist. It primarily affects young adults in their most productive years; 95% of TB deaths occur in underdeveloped countries. According to the scenario of 2011, he elaborated on the incidence, prevalence & mortality of TB globally (Falzon et al., 2013).

Cemal Bulut pointed out the epidemiology of COVID-19, which spread from person to person via droplets and touch. Still, there should be no uncertainty about airborne, fecal, or intrauterine transmission. COVID-19 has been reported from all aged people with a case fatality rate of 6.3, which may vary from country to

country. An incubation period of 5 days can affect any individual though the mortality rate in an adult is 50% higher (Bulut C, Kato Y, 2020).

In a study, Alkesh Kumar Khurana divided the patients with TB and COVID-19 co-infection into three groups based on their diagnosis. They found that all three subgroups are part of a single group of old/active TB patients who became infected with COVID-19. COVID-19 has most likely only revealed more subtle active TB cases by bringing them to the hospital with a superimposed infection. Their study found a 12.3 mortality rate in patients with dual infection, significantly higher than isolated COVID-19 infection (Khurana & Aggarwal, 2020).

In a systematic review & meta-analysis, Mohitosh Bishwas stated that, compared to females, male COVID-19 patients had considerably more risk of mortality. Patients over the age of 50 had a 15.4-fold increased risk of death when compared to patients under the age of 50. Comorbidities such as kidney disease, cerebrovascular disease, cardiovascular disease, respiratory disease, diabetes, hypertension, and cancer, but not liver disease, were also associated with a significantly increased risk of mortality (Biswas et al., 2020).

Gabriel Tassi Mousquer stated that some clinical features have shared by both COVID-19 & TB that complicate the diagnosis & consequently, treatment. They expressed that active tuberculosis and a history of tuberculosis appear to have been linked to an increased chance of COVID-19 infection and a worsened infection outcome (Mousquer GT, Peres A, Fiegenbaum M, et al, 2021).

Objective of the study

Main objective of this study is to to identify the association between COVID-19 and TB. The specific objectives of this study are to identify the association between the socio-demographics indicators (age, gender, and living condition) and COVID-19 among the TB cases and to find out the association between the period of onset (old and new cases) of tuberculosis and COVID-19 among the TB cases.

Research Methodology

This section's primary goal is to concentrate on research methods appropriate for analysis. This study's analysis aims to identify the association between COVID-19 and TB. The target population is individuals with pulmonary tuberculosis in Dhaka City. These were male and female patients from different TB hospitals in Dhaka, Bangladesh. This approach employed a cross-sectional analysis with 263 patients in different TB hospitals, facilities & COVID dedicated hospitals of Dhaka city, Bangladesh. The study was conducted from around 06 months starting from September 2021 to January 2022. The questionnaire was being used as a data collection tool for this study. The questionnaire we used is available in annex: 01. The predicting factor was to identify the association between COVID-19 and TB. We used a simple random sampling technique in this study. All information collected has taken into account. However, personal identification was anonymous. Data were collected by face-to-face interview or interview over the phone using hard copy questionnaires as per the situation. Data management has done according to a pre-fixed plan, from data collection to interpretation. Then after formatting & combining the data we analyzed the data by using software like SPSS, Excel, etc. Then the findings were noted down for the purpose of data interpretation. For Quality Control and Quality Assurance one researcher physically visited the study site (hospitals or separate facilities) for data collection. There has been No secondary data taken for this study and Third person has not to be allowed in the whole study. The researcher himself compiles and interprets the results. The data has verified and checked for reliability. From the findings of this study, we able to know the association of risk factors of COVID-19 among Tuberculosis patients and the disease burden of COVID-19 on Tuberculosis patients.

Results

Descriptive statistics

Socio demographic characteristics of the participants

Distribution of the participants by gender

This study revealed that among all the participants (n= 270), 58% were male and 42% were female, as shown in the diagram below (Fig: 01).

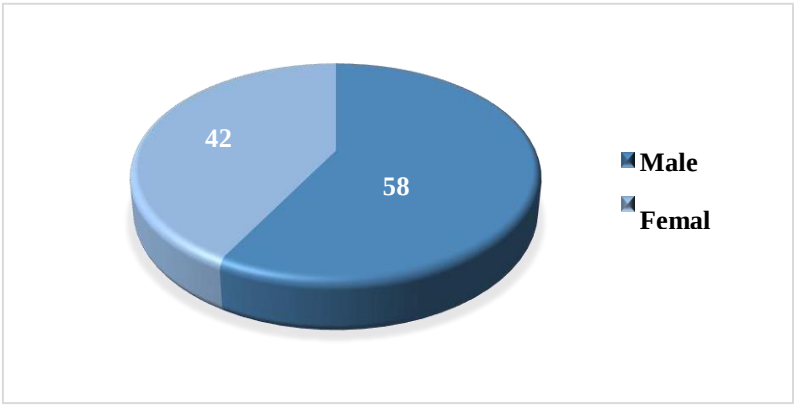

Figure: 01: Distribution of the participants by gender

Distribution of the participants by age

Among the total 270 participants, the lowest age was 21 years, the highest age was 72 years, and the mean age was 46 years. We divided the age of the participants into four groups in which 16.3% (44) were 34 years or younger, 23.3% (63) were 35 to 44 years old, 37.8% (102) were 45 to 54 years old, and 22.8% (61) were 55years or older, as revealed in the table (Tab: 01) below.

Table: 01: Distribution of the participants by age

Age groups	Frequency	Percentage
34 years and below	44	16.3%
35 to 44 years	63	23.3%
45 to 54 years	102	37.8%
55 years and above	61	22.6%
Total	270	100.0%

Distribution of the participants by living condition

All the participants were divided into two groups according to their living conditions in which 39% have formal residence & 61% have informal residence (Fig:02).

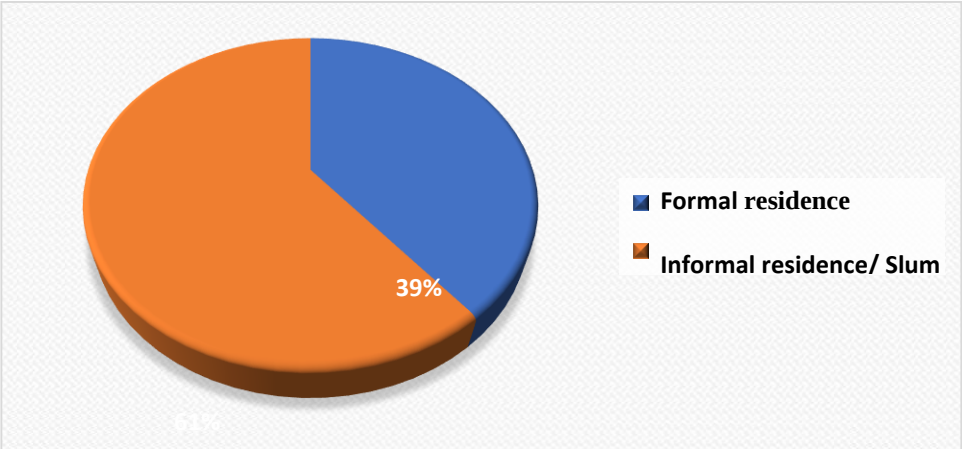

Figure: 02: Distribution of the participants by living condition

Distribution of the participants by TB history.
Distribution of the participants by period of onset of TB

In this study, we separated all the participants (n=270) into three groups. The table (Tab:02) is demonstrating that across all the participants 40 % (108) were diagnosed as a TB patient for more than 02 years, 32% (86) within 01 to 02 years, and 28% (76) were diagnosed for less than 01 year.

Table: 02: Distribution of the participants by period of onset of TB

Group	Frequency	Percentage
>02 years	108	40%
01 to 02 years	86	32%
< 01 year	76	28%
Total	270	100.0%

Distribution of the participants by history of hospitalization for pulmonary TB (PTB)

All the participants were split into two categories in which 61% (165) were hospitalized for pulmonary tuberculosis & 39% (105) didn't hospitalize for pulmonary tuberculosis as demonstrated in the table below (Tab:03).

Table: 03: Distribution of the participants by history of hospitalization for PTB.

Group	Frequency	Percentage
Hospitalized for PTB	165	61%
Didn't Hospitalize for PTB	105	39%
Total	270	100.0%

Distribution of the participants by presence of comorbidities

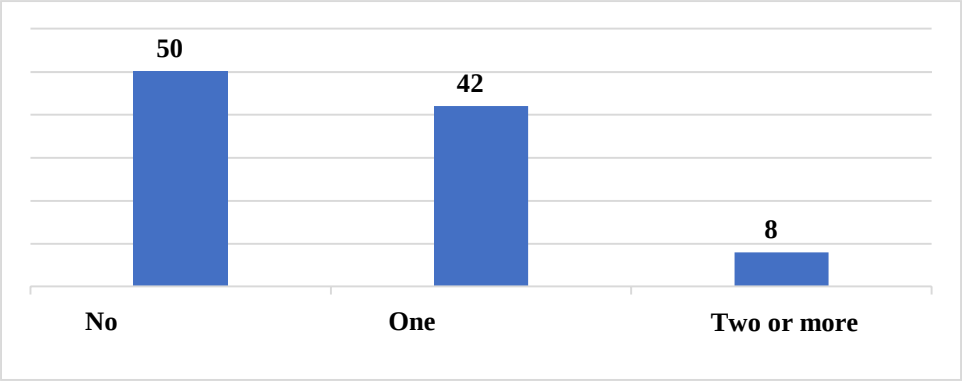

Figure: 03: Distribution of the participants by presence of comorbidities

As shown in the diagram (Fig: 03) below, amongst the participants 50% have no comorbidities, 42% have at least one comorbidity & the rest 08% have two or more comorbidities.
.

Distribution of the participants by smoking history

We categorized the smoking history of all the participants into three groups in which 50% of the participants never smoked, 28% left smoking, and 22% still smoking. Demonstrated in the diagram (Fig: 04) below.

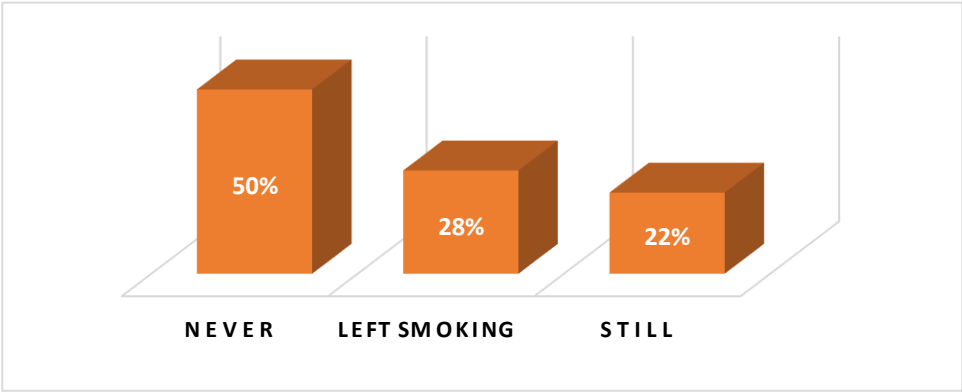

Figure: 04: Distribution of the participants by smoking history

Distribution of the participants by COVID history
Distribution of the participants by COVID vaccination

As clarified in the diagram (Fig:05) below, among all the participants 61% took at least the first dose of COVID vaccine, and the rest 39% didn't take the COVID vaccine.

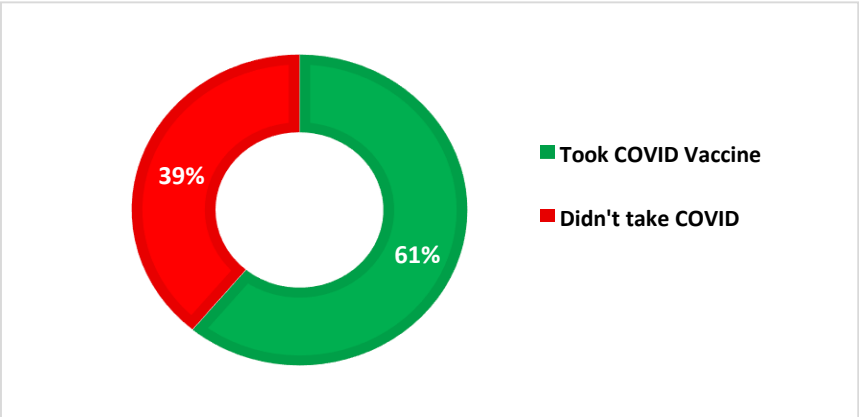

Figure: 05: Distribution of the participants by COVID vaccination

Distribution of the participants by COVID infection.

The diagram below (Fig:06) is demonstrating that among all the participants 67.4% (184) infected with COVID-19 & 32.6% (86) didn't.

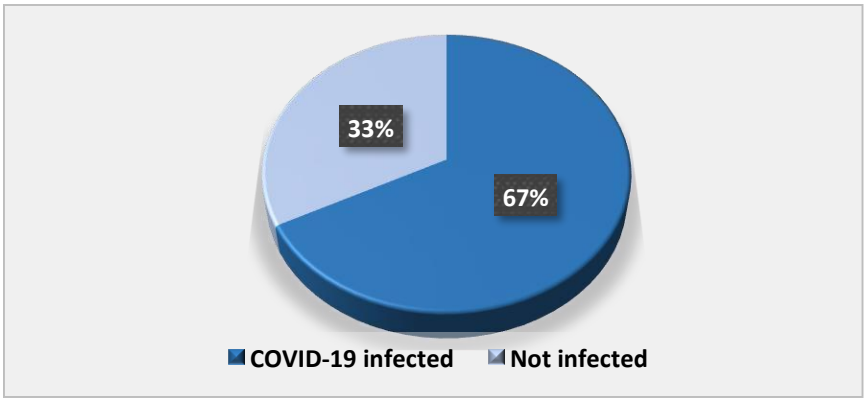

Figure: 06: Distribution of the participants by COVID infection

Inferential statistics

Association between age group & COVID-19 infection

To assess the direction of the linear relationship between these two variables, a bivariate Pearson's product momentum correlation coefficient was (r) was calculated. The bivariate correlation between these two variables was positive & strong, $r(270) = 0.76$, ($p < 0.01$).

The next diagram (Fig: 07) is showing the rate of COVID-19 infection is higher in the older age groups than the younger groups.

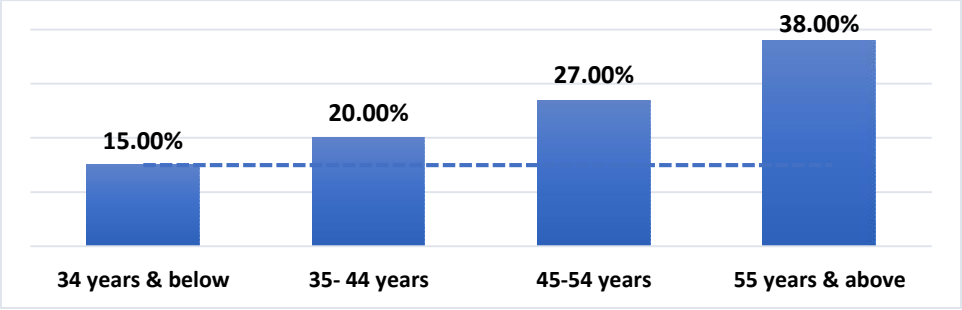

Figure: 07: Association between age group & COVID-19 infection

A chi-square test for independence with α=0.05 was performed for the COVID-19 cases to assess whether the age was related to hospitalization status for COVID-19. Thechi-square test was statistically significant, X^2 (1, n=182)=11.05, P<0.001. As shown in the diagram (Fig:8) below, younger age groups were less hospitalized & the duration of the hospitalization was also less compared to the older age groups.

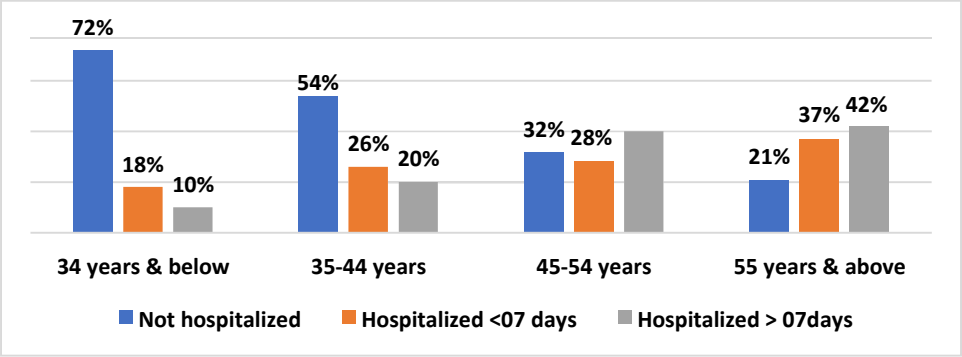

Figure: 08: Association between age group & hospitalization status for COVID-19

Association between history of hospitalization for PTB & COVID- 19 infection

To assess the relationship between the history of hospitalization for PTB & COVID-19 infection we performed the Chi-square test for independence with α=0.05 which was statistically significant X^2 (1, n=270)=17.65, P<0.001, with Phi (φ) coefficient of 0.26, expressing small to medium relationship. As shown in the diagram (Fig:09) below, the patients with a positive history of hospitalization for PTB found more affected with COVID-19, and the patients who were not hospitalized for PTB, were affected less.

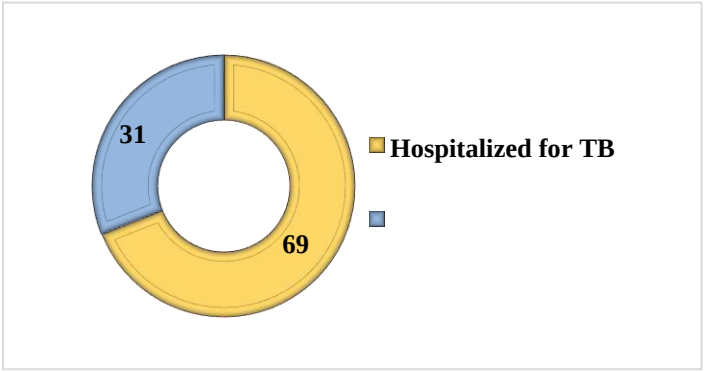

Figure:09: Association between history of hospitalization for PTB & COVID-19 inf.

From the diagram (Fig:10) below, we can see the patients with a positive history of hospitalization for TB was suffered more than the other who didn't hospitalized for TB.

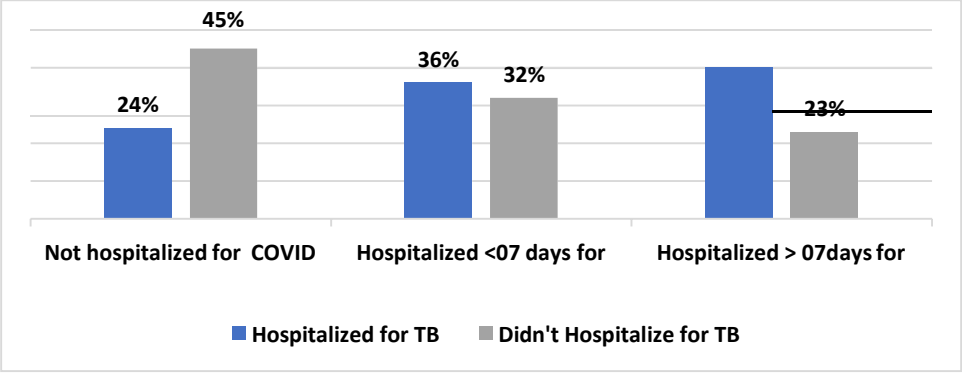

Figure: 10: Association between history of hospitalization for PTB & hospitalization status for COVID-19

Association between comorbidities & COVID-19 infection

To determine whether the comorbidities were related to COVID-19 infection, a chi-square test for independence with α=0.05 was used. The chi-square test was statistically significant, X^2 (1, n=270) =11.52, P<0.003, with Phi (φ) coefficient of 0.205, indicating a small to medium relationship. According to the diagram (Fig:11) below, the individuals with no comorbidity were less affected by COVID-19 and the individuals with at least one or more comorbidities were respectively more affected by COVID-19

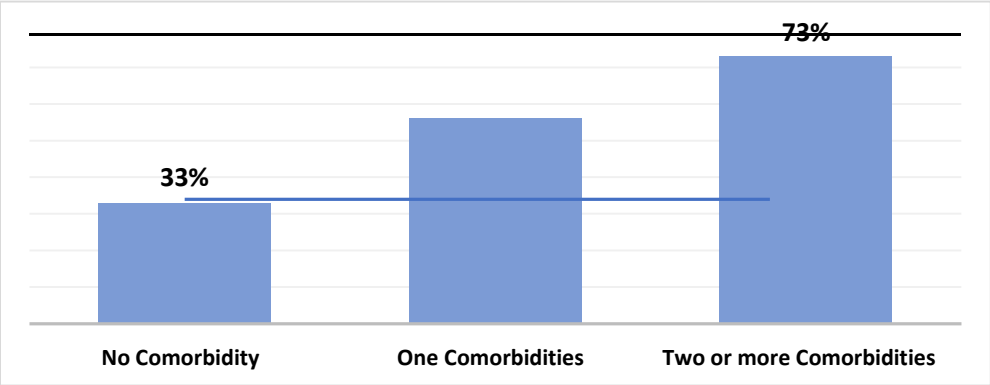

Figure: 11: Association between comorbidities & COVID-19 infection

We also performed the Chi-square test with other variables where we try to specify the association of comorbidities & hospitalization status for COVID-19 among the selected COVID positive patients (n=182). The chi-square test was statistically significant X^2 (1, n=182)=17.37, P<0.001, with Phi (φ) coefficient of 0.4, indicating a medium to strong relationship. The diagram (Fig:12) below is expressing that, among the COVID-19 patients, those who do not have any comorbidity were hospitalized less than those who have one or more comorbidities. The duration of hospitalization for COVID-19 is also higher in the patients with one or more comorbidities than those who do not have any comorbidity.

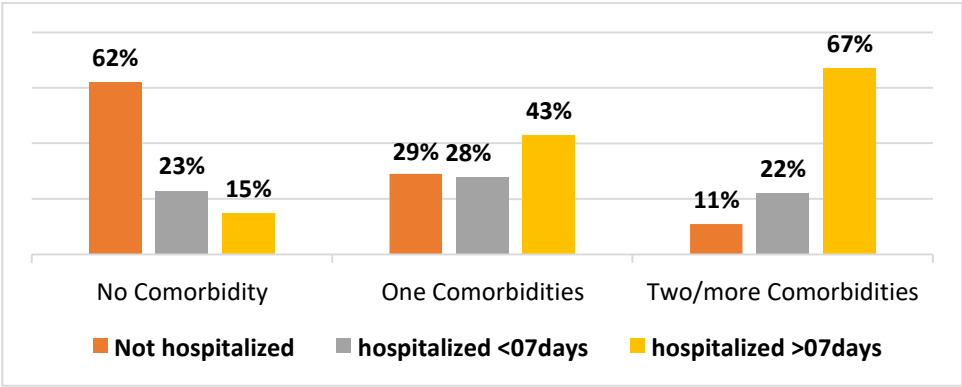

Figure: 12: Association between comorbidities & hospitalization status for COVID

Association between history of smoking & COVID-19 infection

A chi-square test for independence with α=0.05 was used to assess whether the history of smoking was related to COVID-19 infection. Though the chi-square test was not statistically significant, we found that the person who never smoked were less infected by COVID-19 & the person who are previous smoker or current smoker were more affected by COVID-19 as reveals in the diagram (Fig: 13) below.

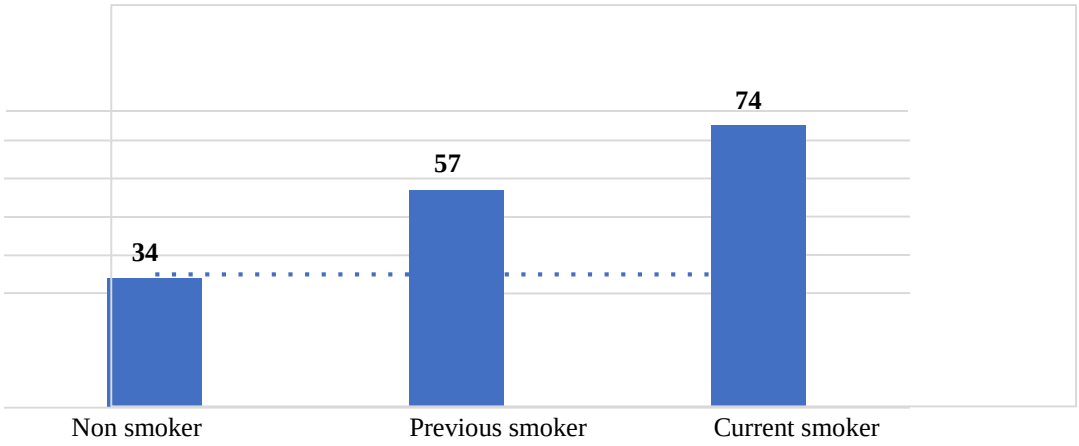

Figure: 13: Association between history of smoking & COVID-19 infection

Then we did the Chi-square test for history of smoking & hospitalization status for COVID- 19, which was statistically significant X^2 (1, n=182)=11.07, P<0.03, with Phi (φ) coefficient of 0.22, indicating small to medium relationship. As shown in the diagram (Fig:14) below, the non-smokers were less hospitalized due to COVID-19 as well as stayed shorter duration than previous & current smokers.

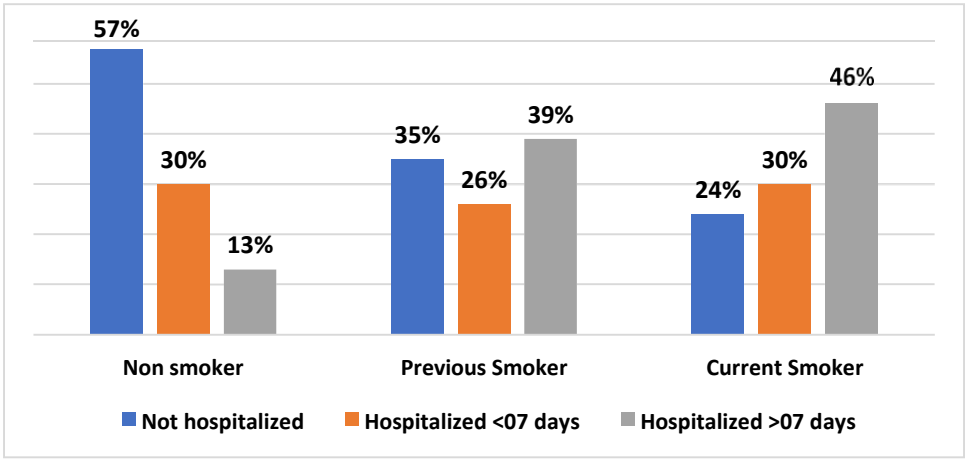

Figure: 14: Association between history of smoking & hospitalization status for COVID-19 infection

Discussion

This cross-sectional study intended to enhance our understanding of the association between tuberculosis and COVID-19. The research was conducted out in Dhaka Metropolitan City's TB hospitals, TB-related health facilities, and COVID dedicated hospitals. A total number of 300 active & old TB cases were interviewed. Following proper data cleaning, a total of 270 data were analyzed. The obtained findings were then compared with the findings of relevant literature reviewed.

The age range of the participants was 21 to 72 years & the average age was 46 years. In this study it was found that a positive & strong relationship between age & COVID-19 infection where older age groups were more prone to COVID-19 infection than younger age groups. From the youngest age group (34 years and below), 15% were infected and from the oldest age group (55 years and above), 38% were infected by COVID-19. It was also assessed that the hospitalization status of the COVID-19 cases where the older age groups were more hospitalized & the duration of hospitalization was also more in comparison to the younger age groups.

Here, the current study revealed that18% of people aged 34 years and below were hospitalized for less than 07 days and only 10% were hospitalized for more than 07 days due to COVID- 19. Whereas from the oldest age group (55 years and above) 37% were hospitalized for less than 07 days and 42% were hospitalized for more than 07 days due to COVID-19 which indicating more severe diseases among the older patients. The joint WHO-China fact-finding mission revealed that older patients were at the greatest risk of developing severe disease (Shahid et al., 2020). Another study said, in older patients, the COVID-19 infection is often vulnerable, with a high fatality rate (Niu et al., 2020). In some other studies, researchers also stated that the older age groups were more prone to COVID-19 infection and the outcome was more severe in comparison to the younger age groups (Davies et al., 2020).

Among all the participants 58% were male & 42% were female. It was found that males were more infected by COVID-19 as well as the duration of hospitalization is also longer due to COVID-19. 60% of males were affected by COVID-19 whereas 40% of females were affected. Of the males 34% were hospitalized for less than 07 days and 31% were hospitalized for more than 07 days due to COVID-19. On the other hand, from the females 28% were hospitalized for less than 07 days and 23% were hospitalized for more than 07 days due to COVID-19. Males, regardless of age, are at increased risk for severity and mortality in COVID-19 patients, according to several recent studies (Patil et al., 2020). A mini review of R Bishwas discovered; COVID-19 seems to be more detrimental to men than it is to women (Biswas, 2020). Another study revealed that the COVID-19 mortality rates were 77% greater in men than in women (Yanez et al., 2020) which is indicating more disease burden among the males. So, in comparison to women, men with COVID-19 have a more severe disease and a higher fatality rate (Lipsky & Hung, 2020).

Across all the participants (n=270) 40 % were diagnosed as a TB patient for more than 02 years, 32% within 01 to 02 years and 28% were diagnosed for less than 01 years. The patients who were diagnosed with PTB more than two years ago were affected less by COVID-19 and the patients who were diagnosed with PTB within one year were affected more by COVID-19. While evaluating the hospitalization status among infected patients we found the patients whose time of onset of TB <01 year suffers more in comparison to them whose time of onset of TB is 01 to 02 years and >02 years. We found the infection rate & sufferings of new/active cases of TB were comparatively higher than the old cases. A study revealed that, Patients with active tuberculosis and COVID-19 are at an elevated risk of severe COVID-19 and COVID-19-related mortality (Aggarwal et al., 2021). Another study revealed that, patients with active or latent tuberculosis were more vulnerable to SARS-CoV-2, and the onset and progression of COVID-19 symptoms were more quick and severe (Chen et al., 2020). 69% of the total participants were hospitalized for TB and the rest 31% were not. The patients with a positive history of hospitalization for PTB were found more affected with COVID-19 and the patients who were not hospitalized for PTB were affected less with COVID-19. It can be assumed that the patient with a positive history of hospitalization for TB was suffered more than the other. More descriptive studies required to know the facts regarding this issue. Comorbidities among the TB patients were significantly associated with COVID-19 infection.

The patients with no comorbidity were affected & suffered less than the patients with one or more comorbidities. 73% of the participants had two or more comorbidities affected by COVID-19, 56% of the participants had one comorbidity, and only 33% of the participants had no comorbidity. But in a meta-analysis researchers stated that there is no association between increased risk for COVID-19 infection and comorbidities such as liver disease, hypertension, cancer, and so on (Wang et al., 2020). Patients with

tuberculosis frequently have underlying co-morbidities and lung damage, which may predispose them to a more severe infection. COVID-19 (Togun et al., 2020). Another study also expressed, patients with COVID-19 disease who have coexisting conditions are more likely to have a more severe disease course and progression (Sanyaolu et al., 2020). Among all the participants 61% took at least the first dose of the COVID vaccine and the rest 39% didn't take the COVID vaccine. The COVID-19 infection rate was higher in those who didn't take any COVID vaccine than those who took it. The patients who took the COVID vaccine were less hospitalized due to COVID-19 as well as stayed shorter duration than those who didn't. Another study revealed patients who got the mRNA COVID-19 vaccine were less likely to be admitted to the hospital and had lower adverse consequences than those who did not (Tenforde et al., 2021).

Of all the participants 50% never smoked, 28% left smoking, and 22% were still smoking. The current study revealed that the persons who never smoked were less infected by COVID-19, and the previous smokers or current smokers were more affected by COVID-19. 34% of the non- smokers, 57% of previous smokers, and 74% of the current smokers were affected by COVID-19. The non-smokers were less hospitalized due to COVID-19 as well as stayed shorter duration than previous & current smokers. But a study revealed that COVID-19 patents hospitalized and killed more former smokers than current or never smokers (Puebla Neira et al., 2021). On the other hand, another study said Current smokers had a higher risk of poor overall outcomes than former/nonsmokers (Pranata et al., 2020). According to other studies, individuals with a smoking history are more likely than non-smokers to develop more severe symptoms of COVID-19 disease.

Conclusion and Recommendation

This study was conducted as the initial effort to determine the association between TB and COVID-19 in the setting of the Dhaka metropolitan area. This study concentrated on a few COVID-19 risk factors among TB cases in an effort to determine the impact and disease burden when taking morbidity into account. In the present study, it was found that male TB patients were affected by COVID-19 more than female TB patients. This study also revealed that the older age group were affected & suffered more by COVID-19. According to the period of onset of TB, the new cases were comparatively more affected & suffered by COVID-19 than the old cases. The TB patients who were hospitalized for TB were more affected & suffered by COVID-19. The TB patients with two or more comorbidities were more affected as well as suffered more by COVID-19. The TB patients who got vaccinated by the COVID vaccine were less affected & suffered by COVID-19. The previous & current smokers were more affected & suffered by COVID- 19 than the patients who never smoked. After correcting all other risk factors, it was found that new TB cases & the patients with a positive history of hospitalization for TB were infected & suffered more due to COVID-19. So, in conclusion, TB is strongly associated with COVID-19 in terms of impact & disease burden. For addressing this major public health issues, we have a lot of scopes to learn more on this topic.

It may be recommended that more elaborate research using the findings of this study. Finally, due to the worse prognosis of COVID-19 on TB patients and the confounding clinical symptoms of these two diseases, routine TB screening is recommended among suspected or confirmed cases of COVID-19 in Dhaka Metropolitan City.

References

1.Barberis I, Bragazzi NL, Galluzzo L, Martini M. The history of tuberculosis: from the first historical records to the isolation of Koch's bacillus. J Prev Med Hyg. 2017;58(1):E9–12.

2.CDC. Tuberculosis (TB) - World TB Day - history [Internet]. Cdc.gov. 2021 [cited 2021 Nov 24]. Available from: https://www.cdc.gov/tb/worldtbday/history.htm

3.Patterson B, Wood R. Is cough really necessary for TB transmission? Tuberculosis (Edinb). 2019;117:31–5. Available from: http://dx.doi.org/10.1016/j.tube.2019.05.003

4.Tuberculosis [Internet]. Who.int. [cited 2021 Nov 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/tuberculosis

5.Global tuberculosis report s [Internet]. Who.int. [cited 2021 Dec 31]. Available from:

https://www.who.int/teams/global-tuberculosis-programme/tb-reports

6.WHO releases new global lists of high-burden countries for TB, HIV-associated TB and drug-resistant TB [Internet]. Who.int. [cited 2021 Dec 31]. Available from: https://www.who.int/news/item/17-06-2021-who-releases-new-global-lists- of-high-burden-countries-for-tb-hiv-associated-tb-and-drug-resistant-tb

7.Nazneen A, Tarannum S, Chowdhury KIA, Islam MT, Islam SMH, Ahmed S, et al. Implementation status of national tuberculosis infection control guidelines in Bangladeshi hospitals. PLoS One. 2021;16(2):e0246923

8.World Health Organization. (2018). Global tuberculosis report 2018. World Health Organization. https://apps.who.int/iris/handle/10665/274453. License: CC BY-NC-SA3.0 IGO

9.Programme GT. Global tuberculosis report 2020 [Internet]. Who.int. World Health Organization; 2020 [cited 2021 Nov 25]. Available from: https://www.who.int/publications/i/item/9789240013131

10.Islam MT, Talukder AK, Siddiqui MN, Islam T. Tackling the COVID-19 pandemic: The Bangladesh perspective. J Public Health Res. 2020;9(4):1794.

11.Singhal T. A review of Coronavirus disease-2019 (COVID-19). Indian J Pediatr [Internet]. 2020;87(4):281–6. Available from: http://dx.doi.org/10.1007/s12098- 020-03263-6

12.Rahman, H. S., Aziz, M. S., Hussein, R. H., Othman, H. H., Salih Omer, S. H., Khalid, E. S., Abdulrahman, N. A., Amin, K., & Abdullah, R. (2020). The transmission modes and sources of COVID-19: A systematic review. International Journal of Surgery Open, 26, 125–136. https://doi.org/10.1016/j.ijso.2020.08.017

13.WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 [Internet]. Who.int. [cited 2021 Nov 25]. Available from: https://www.who.int/director-general/speeches/detail/who-director-general-s- opening- remarks-at-the-media-briefing-on-covid-19 11-march-2020

14.COVID-19 [Internet]. Gov.bd. [cited 2022 Jan 01]. Available from: http://dashboard.dghs.gov.bd/webportal/pages/covid19.php

15.Saha P, Gulshan J. Systematic assessment of COVID-19 pandemic in Bangladesh: Effectiveness of preparedness in the first wave. Front Public Health [Internet]. 2021;9:628931. Available from: http://dx.doi.org/10.3389/fpubh.2021.628931

16.Islam MS, Sujan MSH, Tasnim R, Sikder MT, Potenza MN, van Os J. Psychological responses during the COVID-19 outbreak among university students in Bangladesh. PLoS One. 2020;15(12):e0245083. Available from: http://dx.doi.org/10.1371/journal.pone.0245083

17.Tadolini M, Codecasa LR, García-García J-M, Blanc F-X, Borisov S, Alffenaar J- W, et al. Active tuberculosis, sequelae and COVID-19 co-infection: first cohort of 49 cases. Eur Respir J. 2020;56(1):2001398

18.Mousquer GT, Peres A, Fiegenbaum M. Pathology of TB/COVID-19 Co- Infection: The phantom menace. Tuberculosis (Edinb). 2021;126(102020):102020.

19.Song W-M, Zhao J-Y, Zhang Q-Y, Liu S-Q, Zhu X-H, An Q-Q, et al. COVID-19 and tuberculosis coinfection: An overview of case reports/case series and meta- analysis. Front Med (Lausanne). 2021;8:657006.

20.https://github.com/CSSEGISandData/COVID-19

21.https://www.who.int/news-room/fact-sheets/detail/tuberculosis

22.Glaziou P, Falzon D, Floyd K, Raviglione M. Global epidemiology of tuberculosis. Semin Respir Crit Care Med. 2013;34(1):3–16. Available from: http://dx.doi.org/10.1055/s-0032-1333467

23.Bulut C, Kato Y. Epidemiology of COVID-19. Turk J Med Sci. 2020;50(SI- 1):563–70. Available from: https://journals.tubitak.gov.tr/medical/abstract.htm?id=27232

24.Khurana AK, Aggarwal D. The (in)significance of TB and COVID-19 co- infection. Eur Respir

J. 2020;56(2):2002105. Available from: http://dx.doi.org/10.1183/13993003.02105-2020

25.Mousquer GT, Peres A, Fiegenbaum M. Pathology of TB/COVID-19 Co- Infection: The phantom menace. Tuberculosis (Edinb). 2021;126(102020):102020. Available from: https://www.sciencedirect.com/science/article/pii/S1472979220301876

26.Biswas, M., Rahaman, S., Biswas, T. K., Haque, Z., & Ibrahim, B. (2020). Association of sex, age, and comorbidities with mortality in COVID-19 patients: A systematic review and meta-analysis. Intervirology, 64(1), 1–12. https://doi.org/10.1159/000512592

27.Shahid, Z., Kalayanamitra, R., McClafferty, B., Kepko, D., Ramgobin, D., Patel, R., Aggarwal, C. S., Vunnam, R., Sahu, N., Bhatt, D., Jones, K., Golamari, R., &Jain, R. (2020). COVID-19 and older adults: What we know: COVID-19 in older adults. Journal of the American Geriatrics Society, 68(5), 926–929.https://doi.org/10.1111/jgs.16472

28.Niu, S., Tian, S., Lou, J., Kang, X., Zhang, L., Lian, H., & Zhang, J. (2020).Clinical characteristics of older patients infected with COVID-19: A descriptive study. Archives of Gerontology and Geriatrics, 89(104058), 104058. https://doi.org/10.1016/j.archger.2020.104058

29.Davies, N. G., Klepac, P., Liu, Y., Prem, K., Jit, M., CMMID COVID-19 working group, & Eggo, R. M. (2020). Age-dependent effects in the transmission and control of COVID-19 epidemics. Nature Medicine, 26(8), 1205–1211. https://doi.org/10.1038/s41591-020-0962-9

30.Patil, A., Tripathy, J. P., Deshmukh, V., Sontakke, B., & Tripathi, S. C. (2020). SeXX and COVID-19: Tussle between the two. In Preprints. https://doi.org/10.20944/preprints202006.0159.v1

31.Biswas, R. (2020). Are men more vulnerable to covid-19 as compared to women? Biomedical Journal of Scientific & Technical Research, 27(2). https://doi.org/10.26717/bjstr.2020.27.004481

32.Yanez, N. D., Weiss, N. S., Romand, J.-A., & Treggiari, M. M. (2020). Covid-19 mortality risk for older men and women. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-09826-8

33.Lipsky, M. S., & Hung, M. (2020). Men and COVID-19: A pathophysiologic review. American Journal of Men's Health, 14(5), 1557988320954021.https://doi.org/10.1177/1557988320954021

34.Aggarwal, A. N., Agarwal, R., Dhooria, S., Prasad, K. T., Sehgal, I. S., & Muthu, V. (2021). Active pulmonary tuberculosis and coronavirus disease 2019: A systematic review and meta-analysis. PloS One, 16(10), e0259006. https://doi.org/10.1371/journal.pone.0259006

35.Chen, Y., Wang, Y., Fleming, J., Yu, Y., Gu, Y., Liu, C., Fan, L., Wang, X., Cheng, M., Bi, L., & Liu, Y. (2020). Active or latent tuberculosis increases susceptibility to COVID-19 and disease severity. In bioRxiv (p. 2020.03.10.20033795). https://doi.org/10.1101/2020.03.10.20033795

36.Wang, B., Li, R., Lu, Z., & Huang, Y. (2020). Does comorbidity increase the risk of patients with COVID-19: evidence from meta-analysis. Aging, 12(7), 6049–6057. https://doi.org/10.18632/aging.103000

37.Togun, T., Kampmann, B., Stoker, N. G., & Lipman, M. (2020). Anticipating the impact of the COVID-19 pandemic on TB patients and TB control programmes. Annals of Clinical Microbiology and Antimicrobials, 19(1), 21. https://doi.org/10.1186/s12941-020-00363-1

38.Sanyaolu, A., Okorie, C., Marinkovic, A., Patidar, R., Younis, K., Desai, P., Hosein, Z., Padda, I., Mangat, J., & Altaf, M. (2020). Comorbidity and its Impact on Patients with COVID-19. SN Comprehensive Clinical Medicine, 2(8), 1069–1076. https://doi.org/10.1007/s42399-020-00363-4

39.Tenforde, M. W., Self, W. H., Adams, K., Gaglani, M., Ginde, A. A., McNeal, T., Ghamande, S.,

Douin, D. J., Talbot, H. K., Casey, J. D., Mohr, N. M., Zepeski, A., Shapiro, N. I., Gibbs, K. W., Files, D. C., Hager, D. N., Shehu, A., Prekker, M. E., Erickson, H. L.,… Influenza and Other Viruses in the Acutely Ill (IVY) Network. (2021). Association between mRNA vaccination and COVID-19 hospitalization and disease severity. JAMA: The Journal of the American Medical Association, 326(20), 2043–2054. https://doi.org/10.1001/jama.2021.19499

40.Puebla Neira, D., Watts, A., Seashore, J., Polychronopoulou, E., Kuo, Y.-F., & Sharma, G. (2021). Smoking and risk of COVID-19 hospitalization. Respiratory Medicine, 182(106414), 106414. https://doi.org/10.1016/j.rmed.2021.106414

41.Pranata, R., Soeroto, A. Y., Huang, I., Lim, M. A., Santoso, P., Permana, H., & Lukito, A. A. (2020). Effect of chronic obstructive pulmonary disease and smoking on the outcome of COVID-19. The International Journal of Tuberculosis and Lung Disease: The Official Journal of the International Union against Tuberculosis and Lung Disease, 24(8), 838–843. https://doi.org/10.5588/ijtld.20.0278