A multi-centric, cross-sectional study on COVID-19 in Bangladesh: Clinical epidemiology and short-term outcomes in recovered individuals

Adnan Mannan[1*], H. M. Hamidullah Mehedi[2], Naim Uddin Hasan A Chy[3], Md. Omar Qayum[4], Farhana Akter[5], Abdur Rob[2], Prasun Biswas[6], Sanjida Hossain[7], Mustak Ibn Ayub[8]

[1] Department of Genetic Engineering & Biotechnology, Faculty of Biological Sciences, University of Chittagong, Chattogram-4331, Bangladesh.

[2] Department of Medicine, 250 beded Chittagong General Hospital, Chattogram, Bangladesh

[3] Health Economics Research Group, Department of Economics, Faculty of Social Sciences, University of Chittagong, Chattogram-4331, Bangladesh.

[4] Office of the Director, Institute of Epidemiology, Disease Control & Research (IEDCR), Dhaka, Bangladesh.

[5] Department of Endocrinology, Chittagong Medical College, Chattogram, Bangladesh

[6] Department of Pathology, Mymensingh Medical College (MMC), Mymensingh, Bangladesh

[7] Corona unit, Dhaka Mohanagar General Hospital, Dhaka, Bangladesh.

[8] Department of Genetic Engineering & Biotechnology, University of Dhaka, Ramna, Dhaka-1000, Bangladesh.

*Corresponding Author: Adnan Mannan, adnan.mannan@cu.ac.bd, Phone: +8801716903485.

Running title: Clinical epidemiology of COVID-19 in Bangladesh.

Keywords: Bangladesh, COVID-19, Asymptomatic, Epidemiology, Comorbidities, post COVID-19 complications**.**

1

Author contributions

AM, HMM, FA and AR designed the study. MOQ, MIA, PB and SH reviewed the literature, extracted the data and checked the extracted data. NHC and AM planned and conducted the analysis. MOQ, HMM and MIA wrote the first draft and all authors reviewed and approved the final manuscript paper; approved the final version and agreed to be accountable for the work.

Conflicts of interest:

The authors would like to declare that there is no known contending financial interest or personal relationships that could affect the work reported in this paper.

Abstract

Background: COVID-19 turned into a global pandemic rapidly. This study was aimed to investigate SARS-CoV-2 associated epidemiology and clinical outcomes in Bangladesh in order to understand the future course of COVID-19 pandemic and develop prevention approaches.

Design and Methods: A cross-sectional retrospective study was conducted for a sample of 1,021 RT-PCR confirmed COVID-19 cases admitted in six different hospitals in Bangladesh and who recovered four weeks prior to the interview date.

Results: Of the total sample, 111 (10.9%) cases were asymptomatic while the number of symptomatic cases were 910 (89.1%). Higher prevalence of COVID-19 persisted in the male population (75%), cohorts having B (+) ve blood group (36.3%) and for the 31-40 age group. More than 85% of the sample reported a BCG vaccination mark. Common symptoms observed in our study samples were fever (72.4%), cough (55.9%), loss of taste (40.7%) and body ache (40%); whereas among the biochemical parameters, Neutrophil (46.4%), D-dimer (46.1%), and Ferritin (37.9%) levels were found elevated. Post-COVID complications including pain (31.8%), loss of concentration (24.4%) and anxiety or depression (23.1%) were also found significantly prevalent in the symptomatic cases with commodities.

Conclusion: Our study has shown that adult males aged in between 31-40 in Bangladesh are more vulnerable to being infected with COVID-19. The study also indicates a rising trend of the asymptomatic cases as the pandemic progresses deeper in time, and hence, deployment of interventions to curb further spread of community infection is necessary to avoid the grave outcomes of COVID-19 in Bangladesh.

Keywords: Bangladesh, COVID-19, Asymptomatic, Epidemiology, Comorbidities, post COVID-19 complications**.**

Introduction:

The Coronavirus Disease 2019 or COVID-19 is a contagious disease of the respiratory system.[1] In terms of genetic characteristics, SARS-CoV-2 is significantly diverse from SARS-CoV and MERS-CoV.[2, 3] The virus's rapid progression around the globe has unfolded a variety of clinical manifestations in different geographical locations. Severe prognosis of COVID-19 has been reported to be associated with comorbidities including diabetes, hypertension, cardiovascular disease, chronic obstructive pulmonary disease (COPD), malignancy, and chronic liver disease.[4]

With a population of more than 161 million people, Bangladesh stands eighth among the most populated countries in the world.[5] In Bangladesh, as of 9 October, 2020, infections from SARS-CoV-2 has spiked to nearly 375,870 individuals while the death count figured to 5477 people (https://iedcr.gov.bd/). In regards to the clinical outcomes of COVID-19 and its association with various pathophysiological factors, no comprehensive study has been conducted in Bangladesh. As some of the studies were not conducted for a large sample size,[6-8] understanding a bigger picture of the aforementioned relationship of COVID-19 symptoms with comorbidities and biochemical parameters from previous studies was not possible. Especially, the long-term complications among patients recovered from COVID-19 have not been conducted with necessary rigor and comprehension. Investigating the epidemiological characteristics of individuals diagnosed with COVID-19 in Bangladesh will help in providing a proper insight of the clinical characterization and patterns in progression of the disease. Therefore, it is vital to examine these aspects and factors related to the outcomes of COVID-19 for enacting appropriate means of prevention and treatment.

105   Since to this date, this study is a pioneering approach for the epidemiological characterization of

106   COVID-19 individuals in Bangladesh, data related to the clinical aspects of COVID-19 is scarce,

107   we managed to create a large sample size for our study by collecting data for a consecutive three

108   months during the pandemic. This study aimed to investigate the patterns and array of symptoms

109   in confirmed COVID-19 individuals as well as assess its relationship with the presence of

110   comorbidities and results from biochemical assays with various other preliminary long-term

111   clinical expositions post recovery.

112

113

114

115

116

117

118

119

120

121

122

123

124

Methods

126 *Study design:*

127 A cross-sectional retrospective study was conducted among the cases confirmed to be COVID-

128 19 positive following assessment by RT-PCR using any one of the following samples: throat

129 swabs / nasal swabs /blood. These COVID-19 diagnosed patients were admitted in six different

130 hospitals in Bangladesh. Scrutinization of post COVID-19 clinical characteristics was done upon

131 each subject's discharge from the hospital and after confirming that these subjects were indeed

132 COVID-19 free by conducting two consecutive RT-PCR assays 24 hours apart. Recovered

133 patients (according to RT-PCR negative result) at least four weeks before the interview were

134 considered for this study. We also categorized all positive patients into two categories

135 (symptomatic and asymptomatic) according to the presence of any one of the established

136 symptoms referred by WHO/CDC.

137 *Study sites and sample size:*

138 The study was conducted in six hospitals having specialized units (following government

139 instructions) for isolating and treating COVID-19 individuals from two different divisions of

140 Bangladesh namely Dhaka (Dhaka Mohanogor General Hospital and Narayanganj Sadar

141 Hospital) and Chattogram (Chittagong General Hospital, Chittagong Medical College Hospital,

142 Chattogram Field Hospital and Chandpur Sadar Hospital). The study period started from 1 April

143 2020 and ended on 30 June 2020.

144 *Data collection and case enrollment:*

145 The physicians collected data relevant to the study retrospectively by interviewing 1021 COVID-

146 19 patients over the telephone and all data were recorded into a preset Google Form. After

6

147   double checking each information, the Google Forms were submitted and stored in our database.

148   Medical prescriptions, hospital records were also accessed and matched with patients' data

149   obtained through the interview. Questionnaires included patient's socio-demographic

150   information, clinical manifestations, biochemical parameters, behavioral practice, comorbidities,

151   medications, vitals, laboratory tests, electrocardiogram results, inpatient medications, treatments

152   and outcomes (including length of stay, discharge, re-admission, and mortality).

153   *Exclusion criteria:*

154   In this study, deceased patients and those who were not interested to participate or did not give

155   consent to data collection and usage for research purposes were not included.

156   *Ethical consideration:*

157   The protocol was approved by IRB of 250 bedded General Hospital, Chattogram, Bangladesh.

158   The ethical approval number is 00981.

159   *Statistical analysis:*

160   Descriptive statistical analyses were performed expressing categorical variables with numbers

161   and proportions. They were compared using chi-square test and Fisher's exact test. P values of

162   less than or equal to 0.05 (two-sided) were considered statistically significant. Multivariate

163   logistic regressions were performed to identify the predictors of post-COVID long-term

164   complications. All statistical analyses were performed using Stata/MP 14.0 and GraphPad Prism.

165   The study considered COVID patients showing no symptoms of infection as asymptomatic and

166   those showing at least one of the typical symptoms as symptomatic. Similarly, patients with at

167   least one type of comorbidity were considered comorbid and those with no comorbidity were

168   considered non-comorbid patients.

169 **Results**

170 *Demographic information and vaccination history of COVID-19 patients in the sample:*

171

172 Of 1,021 COVID-19 inpatients, a total of 111(10.9%) were found to be asymptomatic, while the

173 number of symptomatic cases were 910 (89.1%) which was predominant within the sample

174 (Table-1).

175 As shown in Table-1, a subject's age was found to have association with him/her being

176 asymptomatic or symptomatic (p=0.000). Higher proportions of asymptomatic cases were found

177 under the age groups of 0-9 (7.2%), 10-19 (7.2%), and 20-29 (28.8%). Common to both

178 symptomatic and asymptomatic groups, the proportion of males was greater than that of females,

179 the figures being 64.9% and 76.1% respectively (p = 0.01). Individuals in the symptomatic group

180 showed more likelihood towards being overweight (46.4%) and obese (24.6%). A significant

181 bivariate relationship was found (with a p value of 0.009) between blood group and a patient's

182 being symptomatic or asymptomatic. More than 90% of all patients received all required basic

183 vaccines, and almost 85% had a clear BCG scar on their arms. Diabetes was the most prevalent

184 comorbid condition (19.3%), followed by respiratory (8.4%) and cardiovascular (7.7%) diseases

185 within the total sample. An over the time trend in asymptomatic and symptomatic COVID-19

186 cases was also examined. The bar graph in Figure-1 clearly illustrates an upward trend among

187 asymptomatic COVID-19 cases with time while the trend for symptomatic cases remained more

188 or less similar.

189

190

191

8

192   *Clinical manifestations of COVID-19 patients:*

193

194   Table-2 presents counts and proportions of usual signs and symptoms as observed in individuals

195   diagnosed with COVID-19. Of the total sample, 474 (51%) patients experienced a body

196   temperature exceeding 1010 F, while for 368 (39.5%) patients the body temperature ranged from

197   990 F to 1010 F. The oxygen saturation rate went below 90% for 19.3% of the patients, and

198   another 8% patient experienced a low saturation level of 90% to 92.9%. The systolic and

199   diastolic blood pressure measures were found to be greater than 159 mmHg and 99 mmHg,

200   respectively for 4.7% of the total cases. The most prevalent symptoms among the cases in order

201   of prevalence rate were fever (72.4%), cough (55.9%), taste loss (40.7%), body ache (40%),

202   smell loss (36.9%), breathing difficulty (25.9%), and sore throat (23.7%).

203

204   *Biochemical parameters of COVID-19 patients in the sample:*

205

206   For a substantial number of cases within the sample, biochemical assay results were found to be

207   deviant from the normal range for each of the markers measured in the analyte (Figure-2A).

208   Neutrophils and D-dimer were found to be high for about 50% of the patients in the sample

209   while for approximately 40% of patients, the diagnostic tests showed a high level of Glucose,

210   Ferritin, CRP, and SGPT. Among other parameters, Troponin was high for 30% of the patients,

211   while Creatinine, WBC-TC, and ESR were at elevated levels for around 20% of the patients. A

212   low lymphocyte count was found for 40% of the patients while laboratory test results for 10% of

213   the patients reported low platelet count as well.

214

215   *Medication history during the tenure of COVID-19 persistence for cases:*

216

217   Individuals with COVID-19 during the tenure of their SARS-CoV-2 positive status took some

218   day-to-day medications along with antibiotics (Figure-2B). Of the antibiotics, 55.71% of the

219   cases took Azithromycin solely while the number stood at 74% when it was consumed in

220   combination with other therapeutic drugs establishing a higher proportion in terms of intake as

221   compared to the other antibiotics frequently taken. 8.18% of the patients took only Doxycycline

222   and 14.7% took Doxycycline but in combination with other medications, while for Ivermectin

223   the sole consumption and consumption in combination stood at 6.14% and 11.2% respectively.

224   Of the other types of medications, Montelukast was taken by 0.3% and 22.5% of the patients

225   took multiple other types of therapeutic drugs. 6.13% of the patients did not take any

226   medications during COVID-19.

227   *Preliminary long-herm health issues associated with COVID-19:*

228

229   The most prevalent post-recovery complications that were reported included sleep disturbance

230   (32%), pain and discomfort (31.8%), lack of concentration (24.4%), anxiety and depression

231   (23.1%), memory loss (19.5%), and complications with mobility (17.7%), as shown in Table 3.

232   Considering comorbidity as determinant, chi-square tests for post-recovery complications

233   returned significant deviations between individuals having comorbidity and those without for all

234   reported complications but panic attacks. Comorbid patients were found to be more likely to

235   experience mobility problem (26%), problems performing usual activities (14%), pain and

236   discomfort (40%), anxiety and depression (28.5%), sleep disturbances (41.3%), concentration

237   loss (28.5%), and memory loss (24.6%) than those without any comorbid conditions. We

238   observed significant differences in proportion between the two groups for all complications

239   except panic attacks, giving a clear conception on the comparison between the results of the

240   aforesaid cases with those found for comorbid and non-comorbid cases. Columns in Table-4

241   contain estimated results from logit models designed for post-recovery complications. As the

242   adjusted odd ratios indicate, the respiratory disease caused each outcome of memory loss and

243   pain and discomfort at 5% level and sleep disturbance at 1%. Finally, it was found that taking

244   drugs for a long time significantly increased the probability of losing memory, concentration,

245   and having sleep disturbance at 1% level and anxiety and depression at 5% level.

246

247   ***Contact History of the COVID-19 Patients in this Sample:***

248

249   This study also assessed the contact history of patients included in the study sample, focusing on

250   multiple variables representing direct and indirect contacts (Supplementary file, Table-S1). As

251   Table S1 shows 50% of the diagnosed cases came in close contact with other COVID-19 positive

252   individuals, while 40.6% patients of the total sample had family members diagnosed with

253   COVID-19. A total of 608 (62%) patients reported to have an indirect contact, and 466 (48.5%)

254   patients made frequent visits outside their home prior to being infected.

255

256

257

258

259

260

Discussion

261   In the current study, we investigated 1021 COVID-19 inpatients diagnosed through RT-PCR in

263   six different health facilities in Bangladesh. We believe that the current study will be able to shed

264   light on the epidemiological aspects of COVID-19 during the crisis period. While the study

265   revealed facts aligning with those established globally some observations require further follow

266   up and extensive studies in Bangladesh.

267   Our study has revealed that among the age groups, the 20-39 cohorts showed the highest prone to

268   infection rate (54.7%) and in terms of gender, the prevalence of SARS-CoV-2 infection in males

269   (74.9%) was 3 times more than that in females (25.1%). Several studies from across the globe

270   showed higher median age,[9-11] mean age,[12] or age group[9] for SARS-CoV-2 infection. We

271   explained the observations in light of demographic and socio-economic situations in Bangladesh.

272   21-40 years is the most preponderant age group in Bangladesh

273   (https://www.cia.gov/library/publications/the-world-factbook/fields/341.html),   young   and

274   middle-aged people mostly fall under the working class and are needed to go are mostly

275   obligated to leave home for work, and hence having higher odds of getting infected.[13] Females,

276   especially in rural Bangladesh are mostly confined to household work, which might be a cause

277   for less infection among these groups.

278   Among the study subjects, 38.33% had comorbidities. Diabetes was found to be the most

279   prominent comorbidity (19.40%) within the study sample and this fact was reflected in similar

280   studies conducted in China and UK.[11, 14] Other noteworthy comorbidities were respiratory

281   (8.40%) and cardiovascular diseases (7.70%) and the results obtained from our study aligned to

282   the trends in other countries in terms of high prevalence.[9, 10, 14]

283   As for the symptoms associated with COVID-19, fever (72.4%) and cough (55.9%) were the

284   most prominent and shared among cases (Table-2). Other clinical manifestations with significant

285   association (P<0.01) were breathing difficulty (25.90%) and chills (12.50%). Diarrhea and GI

286   symptoms were also widely observed in 19.80% cases of COVID-19 in the study sample akin to

287   results obtained from previous studies conducted on the MERS/SARS-CoV pandemics.[15]

288   Of the 1,021 COVID-19 positive cases in our sample, 10.9% were asymptomatic which is in

289   accordance with the findings in South Korea and China.[9, 16] Interesting enough, our observation

290   identified an upward trend for the increase in asymptomatic COVID-19 cases following April

291   2020 (Figure 1). Although no systematic assessment has been done on this aspect, our

292   observation complies with the records and pronouncements of the health professionals and

293   hospital registries in Bangladesh. For getting a better insight on the upward trend of

294   asymptomatic COVID-19 cases further studies and scrutinization are required including a larger

295   sample and dataset.

296   The current study observed different parameters obtained from biochemical assays conducted

297   within the sample and categorized the results as low, normal and high compared to a reference

298   value (Figure 2A). Almost half of the cases had a high level of D-dimer (46.12%) establishing

299   COVID-19 related coagulopathy which is likely a manifestation of profound inflammatory

300   response.[17] For the other parameters, rise in ferritin, CRP, ESR and glucose levels were found in

301   37.92%, 36.08%, 27.37% and 36.48% of the COVID-19 cases respectively. These findings were

302   found to comply with results obtained from similar studies in China conducted on a sample size

303   of 99 and 138 patients respectively.[18, 19]

304   Our study revealed that 28.75% cases of patients had raised troponin level and it is assumed that

305   this is owing to myocarditis, microangiopathy, myocardial infarction, cytokine storm etc.[17, 20-23]

306   Elevated liver enzyme, SGPT was also found in 36.83% cases in this study which is also in

307   accordance with in many other papers confirmed by review.[24] Although, possible mechanism is

308   yet to be confirmed, majority of these cases reported use of multiple drugs like antibiotics,

309   antivirals, hydroxychloroquine and steroids, which could have contributed to the liver cell

310   damage. Additionally, ischemia and immune mediated injury might be responsible for elevated

311   liver enzyme in Covid-19 positive cases.[24] These observations suggest that patients diagnosed

312   with COVID-19 should also undergo follow up diagnosis procedures to check for chronic

313   damages of the heart and liver.

314   Total cell count reports for COVID-19 positive individuals indicated that neutrophil count was

315   elevated in 46.44% of the cases. On the contrary, reduced lymphocyte and platelet counts have

316   been observed among 50% and 10% COVID-19 positive patients. This is in accordance with

317   several other case series around the globe.[17, 25-28] As our sample included individuals recovered

318   from COVID-19, it is clear that these fluctuating parameters for the blood cell counts did not

319   become lethal to the patient. However, whether they were related to any severe symptom

320   previous to recovery requires further investigation. Our study did not investigate the level of

321   cytokines or other inflammatory mediators in the patients. Further studies in this regard will be

322   helpful in understanding the severity and fatality among COVID-19 patients with respect to

323   immune response mediators.

324   Human-to-human transmission of SARS-CoV-2 has been established as the major mode of

325   spread and several reports provided evidence of transmission of COVID-19 by direct and

326   indirect contact in hospital, family and community settings where interventions were not applied

327   and basic health norms and distancing were not maintained.[29-32] In our study, majority of the

328   cases (62%) reported indirect contact with confirmed cases, whereas, 48.5% admitted to go out

14

329   of their homes frequently prior to being infected and diagnosed (Table-S1, supplementary). It

330   further shows that 50% of the respondents had close contact with confirmed cases and 40.6% had

331   COVID-19 positive family members. So, it can be easily concluded from this data that

332   community transmission is very common in Bangladesh and hence social distancing and other

333   preventive measures should be fully implemented to prevent further deterioration.

334   Our study has revealed that antibiotics were heavily suggested as a part of the treatment protocol

335   for the COVID-19 patients (Figure 2B). It has been found that Azithromycin was the most

336   prescribed antibiotic (74%); among them 55.71% were prescribed to take it as a sole drug.

337   Doxycycline and Ivermectin were taken by 14.7% and 11.2% cases respectively; among them

338   8.18% and 6.14% patients got them exclusively. Supportive drugs like montelukast were also

339   taken by a very small number of patients (3%). In Bangladesh, the guideline for COVID-19

340   management allows compassionate use of various antiviral and anti-bacterial drugs along with

341   antimalarial drugs (https://dghs.gov.bd/index.php/en/). However, we recommend that the

342   excessive use of Azithromycin and other antibiotics may aggravate the crisis related to the rise of

343   antibiotic resistance in Bangladesh.

344   Whether BCG vaccination may play a significant role in preventing the SARS-CoV-2 infection

345   has remained an area of debate and requires further analysis and assessment. According to the

346   latest WHO brief,[33] BCG does not give protection against SARS-CoV-2 infection. In our study,

347   we have found that 835 (82%) cases have a BCG vaccination mark (Table-1). Therefore,

348   supporting the WHO brief, we infer that BCG vaccination may not play any role in preventing

349   SARS-CoV-2 infection despite some early speculations about it. However, as the subjects are all

350   alive despite SARS-CoV-2 infection, it will be insightful to further investigate whether BCG

351   vaccination may help reduce the severity and hence mortality by modulating the innate immune

352   system.[34]

353   Our study has also shed light on the relationship between the ABO blood groups and

354   susceptibility to SARS-CoV-2 infection. A number of previous reports suggested individuals

355   having an A (+ve) blood group have the highest risk of being infected while O (+ve) individuals

356   have a comparatively lower risk rate.[35-37]. Our study has showed that the majority of the cases

357   belong to B+ve blood group (35.4%), preceded by O (+ve) 28.2% and A (+ve) 20.3% (Table-1).

358   This ratio is comparable with the population distribution of ABO blood groups (B+ve ~34%,

359   O+ve ~30% and A+ve ~26%) in Bangladesh.[38]   So, we assume that the variation in the

360   geographical prevalence of different blood groups might be the reason behind the findings of

361   certain ABO blood groups being more common in certain countries without having any real

362   contribution to COVID-19 susceptibility.

363   An important part of our study was to assess and scrutinize the sample for post-COVID

364   complications- both physical and mental (Table-3 and Table-S2, supplementary file). Our study

365   found that people with comorbidities have reported post-COVID complications such as mobility

366   problems, pain and discomfort, anxiety and depression and indication of memory loss with a

367   greater significance (Table-4). We also found that the vulnerability of recovered individuals

368   towards post COVID complications was due to being comorbid and being exposed to drugs for a

369   prolonged period (Table-4). Although retrieved from a basic questionnaire, the results obtained

370   from this study are statistically significant. Our findings are consistent with data obtained from

371   similar studies in other countries.[39, 40]

372   Since this study was an onset in regards to epidemiological analysis of COVID-19 patients in

373   Bangladesh, it was prone to some limitations. Firstly, the study sample only included inpatients

16

374   from 6 selected hospitals providing aid to COVID-19 cases in Bangladesh which narrows down

375   the sample size and diversification in results. Secondly, since the data were collected over the

376   telephone there may be possibilities of information bias, interviewer bias as well as recall bias.

377   Finally, commenting on an individual's health status and complications post COVID-19

378   depending on a four-week recovery period is prompt. Nevertheless, this study aimed to observe

379   the early post- COVID-19 health complications.

380   To date this is the most comprehensive study conducted in Bangladesh that assessed COVID-19

381   patients for both pre-recovery and post-recovery complications. Our data have reconfirmed some

382   significant global observations in regards to the epidemiological and clinical aspects of the

383   disease, but above all, the study has helped in addressing concerns that raised eyebrows

384   including the role of ABO blood group and BCG vaccination in COVID-19 susceptibility and

385   progression. We anticipate that the outcomes of this study will work as a baseline for future

386   studies in the same context.

387

388

389

390

391

392

393

394

Conclusion:

To sum up, this study identified the early health complications post recovery in COVID-19 patients which yet has aspects that require further assessment and examining for more in-depth insights. This study found that individuals with comorbidities had a hard time coping with the clinical implications imposed while they were with COVID-19. The fact that there is a significant advancement of the number of asymptomatic COVID-19 cases calls for further investigations. The results obtained from this study could contribute to devising effective strategies for the provision of comprehensive health care to COVID-19 patients with comorbidity.

Table1 Demographics and baseline characteristics of patients diagnosed with COVID-19

	All patients (N=1021)	Asymptomatic (N=111)	Symptomatic (N=910)	P value*
	N (%)	N (%)	N (%)	
Age (years)				
0-9	18 (1.8)	8 (7.2)	10 (1.1)	0.000
10-19	50 (4.9)	8 (7.2)	42 (4.6)	
20-29	248 (24.4)	32 (28.8)	216 (23.8)	
30-39	309 (30.4)	32 (28.8)	277 (30.5)	
40-49	171 (16.8)	11 (9.9)	160 (17.6)	
50-59	126 (12.4)	15 (13.5)	111 (12.2)	
60 and above	96 (9.4)	5 (4.5)	91 (10)	
Gender				
Male	764 (75)	72 (64.9)	692 (76.1)	0.010
Female	256 (25)	39 (35.1)	217 (23.9)	
BMI				
<18.5	20 (2.1)	4 (4)	16 (1.9)	0.475
18.5 – 22.9	258 (27.4)	29 (29.3)	229 (27.2)	
23.0 – 26.9	434 (46.1)	43 (43.4)	391 (46.4)	
27.0 $^+$	230 (24.4)	23 (23.2)	207 (24.6)	
Blood group				
A+	207 (20.9)	27 (25)	180 (20.4)	0.009
A-	12 (1.2)	1 (0.9)	11 (1.2)	
AB+	92 (9.3)	4 (3.7)	88 (10)	
AB-	10 (1)	4 (3.7)	6 (0.7)	
B+	360 (36.3)	34 (31.5)	326 (36.9)	
B-	15 (1.5)	2 (1.9)	13 (1.5)	
O+	287 (29)	33 (30.6)	254 (28.7)	
O-	9 (0.9)	3 (2.8)	6 (0.7)	
Vaccinated	903 (90.4)	96 (88.9)	807 (90.6)	0.575
Having BCG mark	835 (84.7)	93 (89.4)	742 (84.1)	0.156
Comorbidities				
Diabetes	197 (19.3)	14 (12.6)	183 (20.1)	0.058
Cancer	10 (1)	2 (1.8)	8 (0.9)	0.298
Cardiovascular disease	78 (7.7)	7 (6.3)	71 (7.8)	0.573
Respiratory disease	86 (8.4)	5 (4.5)	81 (9)	0.146
Liver disease	20 (2)	0 (0)	20 (2.2)	0.154
Kidney disease	27 (2.7)	3 (2.7)	24 (2.6)	1.000
Other chronic disease	80 (7.8)	11 (10)	69 (7.6)	0.391

We used Fisher's exact test for categorical variables in analyzing P values. P<0.05 was considered statistically significant.
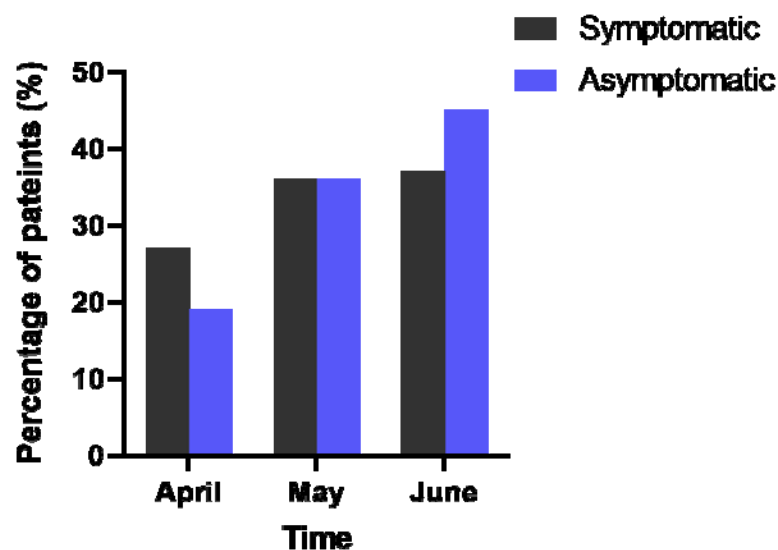
19

416

417

418

419   **Figure 1-** Frequency of symptomatic and asymptomatic COVID-19 patients at various time points.

420

421

422

423

424

425

426

427

428

429

430

431

432

433

434

| Table 2 Signs and symptoms of COVID patients	
All patients (N=1021)	*N (%)*
Sign	
Body temperature	
<99^0 F	89 (9.6)
99^0 F – 101^0 F	368 (39.5)
>101^0 F	474 (51)
Oxygen saturation rate	
<90%	80 (19.3)
90%-92.9%	33 (8)
93%-95.9%	130 (31.3)
>96%	172 (41.5)
Blood pressure	
<120; <80 mmHg	89 (9.5)
120-140; 80-89 mmHg	796 (85.2)
141-159; 90-99 mmHg	5 (0.5)
>159; >99 mmHg	44 (4.7)
Symptom	
Fever	738 (72.4)
Chills	127 (12.5)
Body ache	407 (40)
Cough	570 (55.9)
Sore throat	242 (23.7)
Breathing difficulty	264 (25.9)
Loss of taste	415 (40.7)
Loss of smell	376 (36.9)
Chest pain	178 (17.5)
Running nose	190 (18.6)
Diarrhea	202 (19.8)
Tiredness	127 (12.5)
Vomiting	116 (11.4)
Blurred vision	40(4)

435

436

437

438

439

440
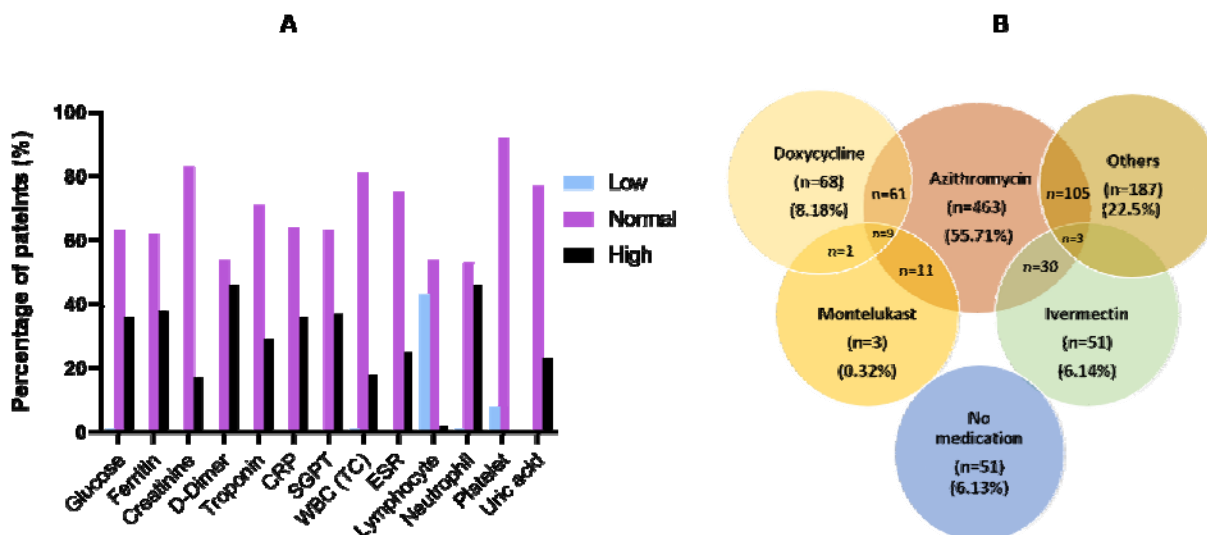
Figure 2. Biochemical parameters and medication history of COVID-19 patients. A) Various biochemical measurements during onset of COVID-19. Normal reference values are: D-dimer < 0.5 µg/mL, Ferritin -Male 18-370 ng/mL, Female 9- 120ng/mL; Serum Creatinine- Male 0.4-1.4 mg/dL, Female - 0.3mg -1.1mg/dL; CRF: < 5mg/L; Troponin: < 0.30 ng/mL; Uric acid: Male- 3.4 – 7 mg/dL, Female 2.4 – 6 mg/dL; ESR: Male < 22 mm/hr, Female < 29mm/hr; SGPT: Male: 15- 65 U/L, Female 15 -60 U/L; CBC : WBC: 4-11 x 109/L, Neutrophil: 40-75%; lymphocyte 20-45%, ESR: male 0-10 mm, Female 0-15 mm. B) Medication history of the patients during the tenure of COVID-19 persistence for cases.

22

460

461

462

463

Table 3 post-COVID complications of patients by comorbidity status

	All patients, (N=1,021)	With comorbidity, (N=358)	Without comorbidity, (N=662)	P value
Mobility problem	179 (17.7)	93 (26)	86 (13)	0.000
Problems performing usual activities	104 (10.7)	50 (14)	54 (8.2)	0.003
Pain and discomfort	319 (31.8)	143 (40)	176 (26.6)	0.000
Anxiety and depression	230 (23.1)	102 (28.5)	128 (19.3)	0.000
Sleep disturbances	312 (32)	148 (41.3)	164 (24.8)	0.000
Panic attack	121 (12.4)	43 (12)	78 (11.8)	0.712
Lack of concentration	243 (24.4)	102 (28.5)	141 (21.3)	0.005
Memory loss	195 (19.5)	88 (24.6)	107 (16.2)	0.001

464

465

466

467

468

469

470

471

472

473

474

475

476

477

478

Table 4 Adjusted odds ratios for predictors of post-COVID complications

	1	2	3	4	5	6	7
	Memory loss	Concentration inability	Anxiety & depression	Mobility problem	Activity problem	Sleep disturbance	Pain & discomfort
Diabetes	—	—	—	—	—	—	—
Cancer	—	—	0.10* (0.138)	—	—	—	—
Cardiovascular disease	—	—	—	—	—	—	—
Respiratory disease	1.70** (0.477)	1.62* (0.433)	—	—	—	2.41*** (0.652)	1.70** (0.445)
Kidney disease	—	—	—	—	—	—	—
Liver disease	—	—	9.76*** (6.643)	6.06*** (3.499)	5.07*** (2.957)	2.88* (1.701)	—
Other chronic disease	—	—	1.95** (0.546)	—	—	—	—
Prolonged medication use	1.85*** (0.436)	1.84*** (0.403)	1.65** (0.375)	—	—	2.16*** (0.470)	—
No. of observations	902	898	894	905	863	872	901

All models are controlled for age, gender, BMI, vaccination. *** P<0.01, ** P<0.05, * P<0.10,
Parentheses include standard errors. Coefficients are reported if they are statistically significant

479

480

481

482

483

484

485

486

487

488

References:

1.   Hoffmann M, Kleine-Weber H, Schroeder S, Krüger N, Herrler T, Erichsen S*, et al.* SARS-CoV-2 cell entry depends on ACE2 and TMPRSS2 and is blocked by a clinically proven protease inhibitor. *Cell.* 2020.

2.   Becerra‐Flores M, Cardozo T. SARS‐CoV‐2 viral spike G614 mutation exhibits higher case fatality rate. *International Journal of Clinical Practice.* 2020.

3.   Forster P, Forster L, Renfrew C, Forster M. Phylogenetic network analysis of SARS-CoV-2 genomes. *Proceedings of the National Academy of Sciences.* 2020; 117(17): 9241-3.

4.   Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y*, et al.* Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The lancet.* 2020; 395(10223): 497-506.

5.   DESA. World population prospects 2019: Highlights. *United Nations Department for Economic and Social Affairs.* 2019.

6.   Mondal RN, Sarker MAR, Das A, Ahsan MAK, Jahan SMS, Sultana A*, et al.* Socio-demographic, clinical, hospital admission and oxygen requirement characteristics of COVID-19 patients of Bangladesh. *medRxiv.* 2020.

7.   Huq AF, Rahman MF, Islam MA, Iqbal SA, Rahman A, Abdullah SAHM*, et al.* Real-life Management Strategy of COVID-19 Patients in Bangladesh with No Death: An Observational and Cohort Study. *Euroasian journal of hepato-gastroenterology.* 2020; 10(1): 31.

8.   Yasmin R, Parveen R, Al Azad N, Deb SR, Paul N, Haque MM*, et al.* Corona Virus Infection among Healthcare Workers in a COVID Dedicated Tertiary Care Hospital in Dhaka, Bangladesh. *Journal of Bangladesh College of Physicians and Surgeons.* 2020: 43-9.

9.   yeon Lee J, Hong SW, Hyun M, Park JS, Lee JH, Suh YS*, et al.* Epidemiological and clinical characteristics of coronavirus disease 2019 in Daegu, South Korea. *International Journal of Infectious Diseases.* 2020.

10.   Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW*, et al.* Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. *Jama.* 2020.

11.   Alkundi A, Mahmoud I, Musa A, Naveed S, Alshawaf M. Clinical characteristics and outcomes of COVID-19 hospitalized patients with diabetes in UK: A retrospective single centre study. *Diabetes Research and Clinical Practice.* 2020.

519   12.   Marco M, Valentina I, Laura G, Roberto G, Luigi U. Management of diabetic persons

520   with foot ulceration during COVID-19 health care emergency: effectiveness of a new triage

521   pathway. *Diabetes Research and Clinical Practice.* 2020.

522   13.   Plecher H. Median age of the population in Bangladesh 2015. Statista; 2020`URL|.

523   [|updated Last Update Date|; cited Accessed Year Access Date|]|; Edition:[Description].

524   14.   Wan S, Xiang Y, Fang W, Zheng Y, Li B, Hu Y*, et al.* Clinical features and treatment of

525   COVID□19 patients in northeast Chongqing. *Journal of medical virology.* 2020.

526   15.   Assiri A, Al-Tawfiq JA, Al-Rabeeah AA, Al-Rabiah FA, Al-Hajjar S, Al-Barrak A*, et al.*

527   Epidemiological, demographic, and clinical characteristics of 47 cases of Middle East respiratory

528   syndrome coronavirus disease from Saudi Arabia: a descriptive study. *The Lancet infectious*

529   *diseases.* 2013; 13(9): 752-61.

530   16.   Zhao D, Wang M, Wang M, Zhao Y, Zheng Z, Li X*, et al.* Asymptomatic infection by

531   SARS-CoV-2 in healthcare workers: A study in a large teaching hospital in Wuhan, China.

532   *International Journal of Infectious Diseases.* 2020.

533   17.   Terpos E, Ntanasis□Stathopoulos I, Elalamy I, Kastritis E, Sergentanis TN, Politou M*, et*

534   *al.* Hematological findings and complications of COVID□19. *American journal of hematology.*

535   2020.

536   18.   Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y*, et al.* Epidemiological and clinical

537   characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive

538   study. *The Lancet.* 2020; 395(10223): 507-13.

539   19.   Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J*, et al.* Clinical characteristics of 138

540   hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. *Jama.*

541   2020; 323(11): 1061-9.

542   20.   Clerkin KJ, Fried JA, Raikhelkar J, Sayer G, Griffin JM, Masoumi A*, et al.* COVID-19

543   and cardiovascular disease. *Circulation.* 2020; 141(20): 1648-55.

544   21.   Tersalvi G, Vicenzi M, Calabretta D, Biasco L, Pedrazzini G, Winterton D. Elevated

545   troponin in patients with Coronavirus Disease 2019 (COVID-19): possible mechanisms. *Journal*

546   *of Cardiac Failure.* 2020.

547   22.   Shi S, Qin M, Shen B, Cai Y, Liu T, Yang F*, et al.* Association of cardiac injury with

548   mortality in hospitalized patients with COVID-19 in Wuhan, China. *JAMA cardiology.* 2020.

549   23.   Guo T, Fan Y, Chen M, Wu X, Zhang L, He T, *et al.* Cardiovascular implications of fatal
550   outcomes of patients with coronavirus disease 2019 (COVID-19). *JAMA cardiology.* 2020.

551   24.   Kumar-M P, Mishra S, Jha DK, Shukla J, Choudhury A, Mohindra R, *et al.* Coronavirus
552   disease (COVID-19) and the liver: a comprehensive systematic review and meta-analysis.
553   *Hepatology international.* 2020: 1-12.

554   25.   Tan L, Wang Q, Zhang D, Ding J, Huang Q, Tang Y-Q, *et al.* Lymphopenia predicts
555   disease severity of COVID-19: a descriptive and predictive study. *Signal transduction and*
556   *targeted therapy.* 2020; 5(1): 1-3.

557   26.   Yang X, Yu Y, Xu J, Shu H, Liu H, Wu Y, *et al.* Clinical course and outcomes of
558   critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered,
559   retrospective, observational study. *The Lancet Respiratory Medicine.* 2020.

560   27.   Arentz M, Yim E, Klaff L, Lokhandwala S, Riedo FX, Chong M, *et al.* Characteristics
561   and outcomes of 21 critically ill patients with COVID-19 in Washington State. *Jama.* 2020;
562   323(16): 1612-4.

563   28.   Bhatraju PK, Ghassemieh BJ, Nichols M, Kim R, Jerome KR, Nalla AK, *et al.* Covid-19
564   in critically ill patients in the Seattle region—case series. *New England Journal of Medicine.*
565   2020; 382(21): 2012-22.

566   29.   Hu Z, Song C, Xu C, Jin G, Chen Y, Xu X, *et al.* Clinical characteristics of 24
567   asymptomatic infections with COVID-19 screened among close contacts in Nanjing, China.
568   *Science China Life Sciences.* 2020; 63(5): 706-11.

569   30.   Chan JF-W, Yuan S, Kok K-H, To KK-W, Chu H, Yang J, *et al.* A familial cluster of
570   pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission:
571   a study of a family cluster. *The Lancet.* 2020; 395(10223): 514-23.

572   31.   Guan W-j, Ni Z-y, Hu Y, Liang W-h, Ou C-q, He J-x, *et al.* Clinical characteristics of
573   coronavirus disease 2019 in China. *New England journal of medicine.* 2020; 382(18): 1708-20.

574   32.   Phan LT, Nguyen TV, Luong QC, Nguyen TV, Nguyen HT, Le HQ, *et al.* Importation
575   and human-to-human transmission of a novel coronavirus in Vietnam. *New England Journal of*
576   *Medicine.* 2020; 382(9): 872-4.

577   33.   WHO. Bacille Calmette-Guérin (BCG) vaccination and COVID-19: scientific brief, 12
578   April 2020: World Health Organization2020.

579   34.   O'Neill LA, Netea MG. BCG-induced trained immunity: can it offer protection against

580   COVID-19? *Nature Reviews Immunology.* 2020; 20(6): 335-7.

581   35.   Wu Y, Feng Z, Li P, Yu Q. Relationship between ABO blood group distribution and

582   clinical characteristics in patients with COVID-19. *Clinica Chimica Acta.* 2020; 509: 220-3.

583   36.   Göker H, Karakulak EA, Demiroğlu H, Ceylan ÇMA, Büyükaşik Y, Inkaya AÇ*, et al.*

584   The effects of blood group types on the risk of COVID-19 infection and its clinical outcome.

585   *Turkish journal of medical sciences.* 2020; 50(4): 679-83.

586   37.   Zhao J, Yang Y, Huang H-P, Li D, Gu D-F, Lu X-F*, et al.* Relationship between the ABO

587   Blood Group and the COVID-19 Susceptibility. *medRxiv.* 2020.

588   38.   Dipta TF, Iqbal MR, Hossain AZ, Rahman MT, Chowdhury S. Distribution of

589   phenotypic and genotypic ABO and Rhesus blood groups among Bangladeshi population.

590   *Ibrahim Medical College Journal.* 2011; 5(2): 59-62.

591   39.   Jiang DH, McCoy RG. Planning for the Post-COVID Syndrome: How Payers Can

592   Mitigate Long-Term Complications of the Pandemic. *Journal of general internal medicine.*

593   2020: 1-4.

594   40.   Carfì A, Bernabei R, Landi F. Persistent symptoms in patients after acute COVID-19.

595   *Jama.* 2020.

596

597

598

599