J. Health Biol Sci. 2020;8(1):1-8 doi: 10.12662/2317-3206jhbs.v8i1.3285.p1-8.2020

ORIGINAL ARTICLE

Prevalence and Severity of COVID-19 Disease in Bangladesh: A Trend Analysis

Prevalência e gravidade da COVID-19 em Bangladesh: Uma análise de tendências

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Abstract

Objective: To investigate the prevalence and changes of events of COVID-19 disease by trending in Bangladesh. **Methods**: In this study, the daily time series data for nine weeks was used. The daily cases, case fatality rate (CFR), recovery-death-ratio (RDR) and percent changes (PC) associated with COVID-19 disease were used for prevalence and trending. **Result**: It is found that 68% males and 32% females patients were infected, among them 21 to 30 (26%) was the most and below 10 (3%) was the least infected age group until May 09. The approximate number of days for the infection, recovery and deaths to be doubled are 10, 5 and 18 respectively in Bangladesh as of May 09, 2020. The CFR of Bangladesh is found 1.55% which is less than the CFRs of the world (6.89%), Europe (9.17%), America (5.61%), Africa (3.26%) and South-East Asia (3.52%) as of May 09, 2020. The daily RDR exhibited a downward trend from April 04, 2020 to April 25, 2020 then showed an upward trend until May 09, 2020. **Conclusion**: The downward trending of the CFR indicates the death rate is low compared to diagnosis. The upward trend of the RDR indicates the recovery caused by COVID-19 is fast compared to deaths over time in Bangladesh. The downward trending of the PC indicates the cases percent of COVID-19 disease is reducing relative to three days prior cases.

Keywords: Novel coronavirus. COVID-19. Outbreak. Pandemic.

Resumo

Objetivo: investigar a prevalência e as alterações da COVID-19 em Bangladesh. **Métodos:** foram utilizados os dados diários das séries temporais por nove semanas. Os casos diários, taxa de fatalidade de casos (CFR), razão de recuperação-morte (RDR) e alterações percentuais (CP) associadas à COVID-19 foram utilizados para calcudo da prevalência e tendências da doença. **Resultados**: verificou-se que 68% dos pacientes do sexo masculino e 32% do sexo feminino estavam infectados, entre eles, 21 a 30 (26%) era a faixa etária mais abaixo e 10 (3%) era a menos infectada até nove de maio. O número aproximado de dias para duplicação da infecção, recuperação e mortes foi de 10, 5 e 18, respectivamente, em Bangladesh, a partir de nove de maio de 2020. O CFR de Bangladesh, até nove de maio, foi de 1,55%, inferior aos CFRs do mundo (6,89%), Europa (9,17%), América (5,61%), África (3,26%) e Sudeste da Ásia (3,52%). O RDR diário exibiu uma tendência de queda de quatro de abril de 2020 a 25 de abril de 2020 e, em seguida, mostrou uma tendência de alta até nove de maio de 2020. **Conclusão**: a tendência descendente do CFR indica que a taxa de mortalidade é baixa em comparação com o diagnóstico. A tendência ascendente do RDR indica que a recuperação causada pelo COVID-19 é rápida, em comparação com as mortes, ao longo do tempo, em Bangladesh. A tendência de queda do PC indica que a porcentagem de casos de COVID-19 está diminuindo em relação aos três dias anteriores.

Palavras-chave: Novo coronavírus. COVID-19. Surto. Pandemia.

INTRODUCTION

The outbreak of the ongoing novel coronavirus disease (2019-nCoV or COVID-19) was first reported as viral pneumonia in Wuhan, Hubei province, China on December 31, 2019[1-3] and quickly affected most of the countries until now across the world. The name of the new disease was officially given by WHO is “COVID-19” on February 11, 2020 considering the global scale of the problem[4]. The coronavirus infected pneumonia (COVID-19) caused by a novel coronavirus was found highly infectious disease and has caused serious illness and death in China and other countries[3, 5]. After first reported in Wuhan, China, thousands of people were infected by novel coronavirus over the next few weeks and it transmitted from human to human more rapidly, spreading to different countries. The outbreak of novel coronavirus has attracted the global attention and on January 30, 2020, the World Health Organization (WHO) declared COVID-19 as the sixth Public Health Emergency of International Concern (PHEIC)[4-9] following H1N1 (2009), polio (2014), Ebola in West Africa (2014), Zika (2016), and Ebola in the Democratic Republic of Congo (2019)[9]. The outbreak of novel coronavirus (2019-nCoV) then represented a pandemic threat and declared by the World Health Organization on March 11, 2020[7, 10]. It is now a global health concern due to its widespread distribution across the world.

The coronaviruses are not new viruses, they were first described in 1966 by Tyrell and Bynoe[11] and cultivated from the patients with common colds. Coronaviruses are enveloped, positive single-stranded large Ribonucleic acid (RNA) group of viruses which infect many animal species including human, causing different types of respiratory and gastrointestinal illnesses[11,12].

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Received: 2020 May 12; Revised: 2020 Jun 15; Accepted: 2020 Jun 20

One of the newly identified RNA viruses which are found in many mammal species including human being is the novel coronavirus[13]. The new virus is analogous to severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MARS-CoV) but it is quite different from these[14]. At the beginning state, it was thought that this virus would not be as severe as SARS and MARS but with the time frame of fast human-to-human transmission, it has been evident that this virus is more spreadable than SARS and MARS[15-17]. Although COVID-19 is highly transmissible, the case fatality rate (CFR) appears to be lower than that of SARS (9.5%) and MARS (34.4%)[18]. The novel coronavirus is mainly spread between people when they are in close contact through droplets of infected persons produced during coughing, talking, or sneezing[7]. The most common clinical symptoms of COVID-19 diseases caused by novel coronaviruses are fever, cough, shortness of breath and occasionally watery diarrhea in addition to other non-specific symptomatology including dyspnea, headache, muscle soreness and fatigue[3,6,8]. Because of fast-spreading, the outbreak of the novel coronavirus disease (COVID-19) has affected more than 210 countries and territories around the world and 2 international conveyances[19]. Globally, 38,55,788 diagnosed cases of COVID-19 have been reported by the World Health Organization (WHO) as of May 09, 2020, including 2,65,862 deaths and the most severely affected countries include the U.S.A, Italy, Spain and France[19].

The global COVID-19 disease caused by the novel coronavirus has also created an impact on a highly densely populated country like Bangladesh. The first case of COVID-19 disease was reported in Bangladesh on March 8, 2020 by the Institute of Epidemiology Disease Control and Research (IEDRC) of Bangladesh[20,21]. Within a very short period the disease has spread out across the country and observed the first death due to COVID-19 on March 18, 2020[22,23,24]. Bangladesh has recorded the highest number of diagnosed cases in a single day from novel coronavirus infection as 790 on May 06, 2020 up to May 09, 2020[22,23,25]. Since there are no drugs and vaccines of COVID-19 disease until now, social and physical distancing is the only way of reducing the transmission of this disease[26]. To reduce and minimize the outbreak of COVID-19 across the country, as well as to ensure the social and physical distancing of the citizens, the government of Bangladesh has taken several steps such as restricting the movement of people except for crying necessity and emergency health care, compulsory home quarantine, social distancing, local or international flight bans, the lockdown of some vulnerable areas, etc. To prevent human-to-human transmission of this virus, the government of Bangladesh has also announced to shut down all educational institutions on March 18, 2020 and government and private offices on March 26, 2020 which is still in progress. As of May 09, 2020, after testing 1,16,919 samples, the cumulative number of infected novel coronavirus cases in Bangladesh was 13,770 including 214 deaths and 2,414 recovered from COVID-19 disease reported by IEDCR, Bangladesh[22,23,27]. If the rapid growth of coronavirus outbreak will continue in Bangladesh in the next few weeks or months, it will be a serious threat to the economy of Bangladesh and will pose an additional burden on the health care system.

Research on COVID-19 and novel coronavirus is still in primary stages, many areas have not been examined. In response to the global outbreak, Sohrabi C et al. (2020)[8] summarized the current state of knowledge surrounding COVID-19 in their review papers. Wu JT et al. (2020)[28] estimated the clinical severity of COVID-19 from the transmission dynamics in Wuhan, China and estimated the overall symptomatic case fatality risk of COVID-19 was 1.4%. Using data-driven statistical method Yang S et al. (2020)[3] estimated the case fatality rate (CFR) in the early phase of the COVID-19 outbreak in mainland China and found 0.15% in the first week in mainland China excluding Hubei, 1.41% in Hubei province excluding the city of Wuhan, 5.25% in Wuhan. Porcheddu R et al. (2020)[29] compared to the CFR between Italy and China which were identical at 2.3% in the month of February and the deaths were similar in both countries with fatalities mostly in the elderly with known comorbidities. Based on the published evidence, Sun P et al. (2020)[4] systematically discussed the characteristics of COVID-19 intending to prevent and control of this epidemic. The knowledge and perceptions of COVID-19 in Bangladesh were investigated by Mannan DK et al. (2020)[7]. This study aimed to investigate the prevalence of COVID-19 disease in Bangladesh. It also intended to reveal the daily changes of events and their trending to the daily cases, daily case fatality rates (CFRs), recovery-death-ratio (RDR) and percent change (PC) of diagnosed, recovered and death cases associated with COVID-19 disease.

METHODOLOGY

The daily time series data for this study is taken from the Institute of Epidemiology Disease Control and Research (IEDRC) of Bangladesh following daily press briefing. The first COVID-19 patients initiated in Bangladesh on March 08 and data have been taken for nine weeks which is from March 08 to May 09, 2020. The data about daily infected (diagnosed) cases, daily recovered or cured cases and daily deaths due to COVID-19 was taken. A diagnosed case of COVID-19 is which showed a positive result in a respiratory specimen of nucleic acid. A recovered case is identified which showed negative results in two consecutive tests. A death case is recognized which was first identified as COVID-19 patient before dying. Total reverse transcription-polymerase chain reaction (RT-PCR) clinically diagnosed cases due to COVID-19 was found 13770, totally recovered, and deaths were 2414 and 214 as of May 09, 2020[27].

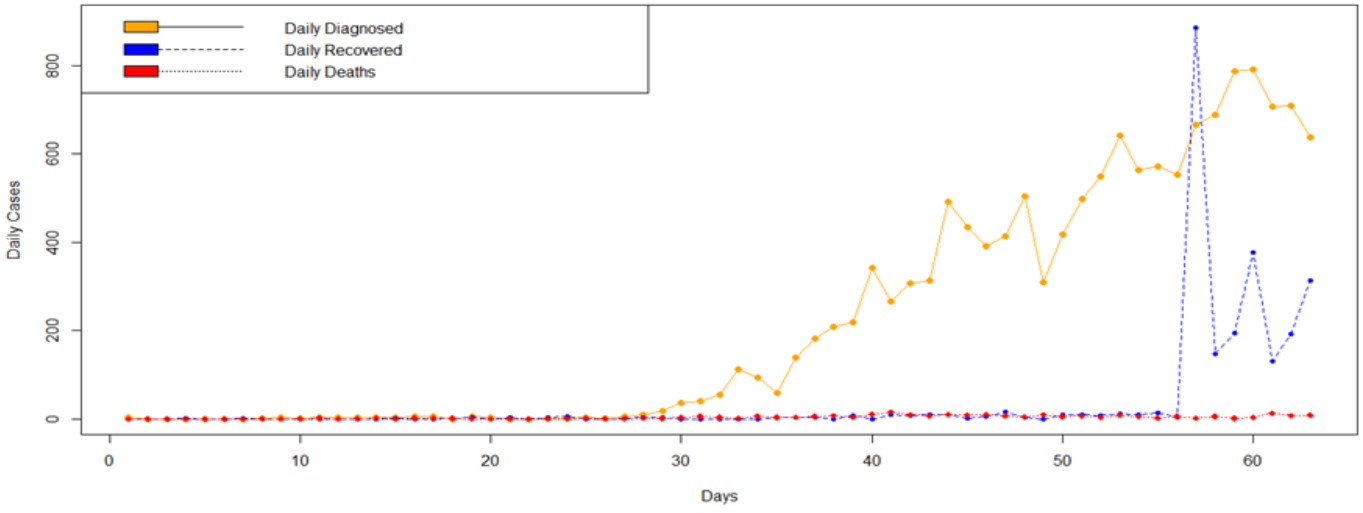
The case fatality rate (CFR) is the most commonly discussed measure of the risk of dying. But this is not the same as the risk of death for an infected person. The CFR is defined by dividing the number of deaths from a specified disease over a defined period by the number of individuals diagnosed with the disease during that time and the resulting ratio is then expressed as percentage multiplying by 100[30]. Recovery-to-death ratio (RDR) is the ratio of the cumulative number of patients recovered or cured of a disease divided by the cumulative number of

deaths over time by that disease. The RDR tells the proportion of patients recovering compared to dying. An upward trend may indicate more recovery than death. The n-day percent change (PC) conveys how much does an event have changed (%) compared to what it was n-days ago. A downward trending suggests a slow growth of the event over time. Statistical analysis was done using R 3.5.1 version of statistical software. Daily cases were directly converted to cumulative cases using Microsoft excel version 13 software.

RESULTS

Total RT-PCR tests until May 09, 2020 was 116916, so the infected cases per 100 test were 11.8 in Bangladesh. About 68% males and 32% females were infected until May 09, 2020. The most infected age group was 21 to 30 (26%) and the least infected age group was below 10 (3%) until May 09. Around 73% of deaths were males and 27% were females due to COVID-19 in Bangladesh until May 09, 2020. Figure 1 reveals the trend of the COVID-19 situation in Bangladesh. At the beginning of the outbreak, there was a likeness of diagnosed and recovered cases. At the very beginning of the first detection of death in Bangladesh, the diagnosed, recovered and death cases were more or less alike. The diagnosed cases display a downward trend in the last week, the recovered cases display an upward trend in the last week and the death cases show almost a constant trend (Figure 1).

Figure 1. Comparison graph of daily diagnosed, recovered and death cases due to COVID-19 in Bangladesh as of May 09, 2020



The cumulative deaths were less than the cumulative recovered until April 13, 2020 but on April 14, 2020 cumulative deaths started to be greater compared to cumulative recovery and it was continuing as of April 30, 2020. As of May 09, 2020, the approximate number of days the infection, recovery and deaths to be doubled are 10, 5 and 18 respectively (Table 1).

Table 1. Cumulative diagnosed, recovered, deaths of COVID-19 cases and CFR (%), RDR and 3-days PC (%) in Bangladesh as of May 09, 2020

Date	Cumulative diagnosed	Cumulative recovered	Cumulative deaths	CFR (%)	RDR	PC (diagnosed)	PC (recovered)	PC (deaths)
08-03-20	3	0	0	-	-	-	-	-
09-03-20	3	0	0	-	-	-	-	-
10-03-20	3	0	0	-	-	-	-	-
11-03-20	3	2	0	-	-	0	-	-
12-03-20	3	2	0	-	-	0	-	-
13-03-20	3	2	0	-	-	0	-	-
14-03-20	3	3	0	-	-	0	50	-
15-03-20	5	3	0	-	-	66.67	50	-
16-03-20	8	3	0	-	-	166.67	50	-
17-03-20	10	3	0	-	-	233.33	0	-
18-03-20	14	3	1	7.14	3	180	0	-

Date	Cumulative diagnosed	Cumulative recovered	Cumulative deaths	CFR (%)	RDR	PC (diagnosed)	PC (recovered)	PC (deaths)
19-03-20	17	3	1	5.88	3	112.5	0	-
20-03-20	20	3	1	5	3	100	0	-
21-03-20	24	3	2	8.33	1.5	71.43	0	100
22-03-20	27	5	2	7.41	2.5	58.82	66.67	100
23-03-20	33	5	3	9.09	1.67	65	66.67	200
24-03-20	39	5	4	10.25	1.25	62.5	66.67	100
25-03-20	30	7	5	16.67	1.4	11.11	40	150
26-03-20	44	11	5	11.36	2.2	33.33	120	66.67
27-03-20	48	11	5	10.42	2.2	23.07	120	25
28-03-20	48	15	5	10.42	3	60	114.28	0
29-03-20	48	15	5	10.42	3	9.09	36.36	0
30-03-20	49	19	5	10.21	3.8	2.08	72.7	0
31-03-20	51	25	5	9.81	5	6.25	66.667	0
01-04-20	54	25	6	11.11	4.16	12.5	66.67	20
02-04-20	56	25	6	10.71	4.16	14.28	31.58	20
03-04-20	61	26	6	9.84	4.33	19.61	4	20
04-04-20	70	30	8	11.43	3.75	29.63	20	33.33
05-04-20	88	33	9	10.22	3.67	57.14	32	50
06-04-20	123	33	12	9.75	2.75	101.64	26.92	100
07-04-20	164	33	17	10.36	1.94	134.29	10	112.5
08-04-20	218	33	20	9.17	1.65	147.73	0	122.22
09-04-20	330	33	21	6.36	1.57	168.29	0	66.67
10-04-20	424	33	27	6.36	1.22	158.53	0	17.65
11-04-20	482	36	30	6.22	1.2	121.11	9.09	50
12-04-20	621	39	34	5.47	1.14	88.18	18.18	70
13-04-20	803	42	39	4.85	1.07	89.39	27.27	95
14-04-20	1012	42	46	4.54	0.91	109.96	16.67	53.33
15-04-20	1231	49	50	4.06	0.98	98.23	25.64	47.06
16-04-20	1572	49	60	3.82	0.82	95.76	16.67	53.85
17-04-20	1838	58	75	4.08	0.77	81.62	38.09	63.04
18-04-20	2144	66	84	3.91	0.79	74.16	34.69	68
19-04-20	2456	75	91	3.71	0.82	56.23	53.06	51.67
20-04-20	2948	85	101	3.42	0.84	60.39	46.55	34.67
21-04-20	3382	87	110	3.25	0.79	57.74	31.82	30.95
22-04-20	3772	92	120	3.18	0.76	53.58	22.67	31.87
23-04-20	4186	108	127	3.03	0.85	41.99	27.06	25.74
24-04-20	4689	112	131	2.79	0.85	38.65	28.74	19.09
25-04-20	4998	112	140	2.81	0.8	32.51	21.74	16.67
26-04-20	5416	122	145	2.67	0.84	29.38	12.96	14.17
27-04-20	5913	131	152	2.57	0.86	26.11	16.96	16.03
28-04-20	6462	139	155	2.39	0.89	29.29	24.11	10.72
29-04-20	7103	150	163	2.29	0.92	31.15	22.95	12.41

Date	Cumulative diagnosed	Cumulative recovered	Cumulative deaths	CFR (%)	RDR	PC (diagnosed)	PC (recovered)	PC (deaths)
30-04-20	7667	160	168	2.19	0.95	29.66	22.14	10.53
01-05-20	8238	174	170	2.06	1.02	27.48	25.17	9.67
02-05-20	8790	177	175	1.99	1.01	23.75	18	7.36
03-05-20	9455	1063	177	1.87	6.01	23.32	564.37	5.35
04-05-20	10143	1210	182	1.79	6.64	23.12	595.40	7.05
05-05-20	10929	1403	183	1.67	7.66	24.33	692.65	4.57
06-05-20	11719	1780	186	1.58	9.56	23.94	67.45	5.08
07-05-20	12425	1910	199	1.61	9.59	22.49	57.85	9.34
08-05-20	13134	2101	206	1.56	10.19	20.17	49.75	12.56
09-05-20	13770	2414	214	1.55	11.28	17.50	35.62	15.05

The active cases are defined by subtracting recovered and death cases from diagnosed cases. So, the active cases are those who are under treatment and it was 11142 in Bangladesh as of May 09. It is seen that 81% cases are active, 17.5% are recovered and 1.5% are deaths in Bangladesh as of May 09, 2020.

Table 2. Age distribution in percent infected due to novel coronavirus in Bangladesh as of May 09, 2020.

Age group	Percent infected
≤10	3%
11-20	8%
21-30	26%
31-40	24%
41-50	18%
51-60	13%
Above 60	8%

In the first week, only 3 cases were found diagnosed in Bangladesh and all of them were recovered within the week. In the second week, no cases were recovered although 21 cases were diagnosed and deaths were found from that week. The death cases increased over time and it was unexpectedly increased in the fifth, sixth and seventh weeks with the increase of diagnosed cases. The recovered cases were greater compared to death cases except for the fifth, sixth and seventh weeks and radically increased in the last week (Figure 2).

Since the first death due to COVID-19 in Bangladesh was found on March 18, the CFR estimated on that day is 7.143%. That is approximately 7.143% of the patients died due to COVID-19 out of cumulative diagnosed patients until that day. The trend of CFR was decreasing until March 20 and then again started to increase. The CFR reached its highest on March 25 and then fluctuated slightly until April 07 and started decreasing from April 08, 2020 and showed a downward trend. As of May 09, 2020, the CFR of Bangladesh is found 1.55% which indicates the percent of the patients dying due to COVID-19 among the diagnosed patients is much less from initial states of COVID-19 in Bangladesh. The downward trending of daily CFR indicates the percent of dying is decreasing over time compared to diagnosed cases due to COVID-19 disease (Figure 3). The CFRs estimated for the world, Europe, America, Africa and South-East Asia are 6.89%,9.17%,5.61%, 3.26% and 3.52% respectively as of May 09, 2020[19]. The CFR of Bangladesh is low compared to the global, European, American, African and South-East Asian region as of May 09, 2020 which indicates the death rate is lower than diagnosed in Bangladesh.

Figure 2. Weekly recovered and death cases due to COVID-19 in Bangladesh as of May 09, 2020.

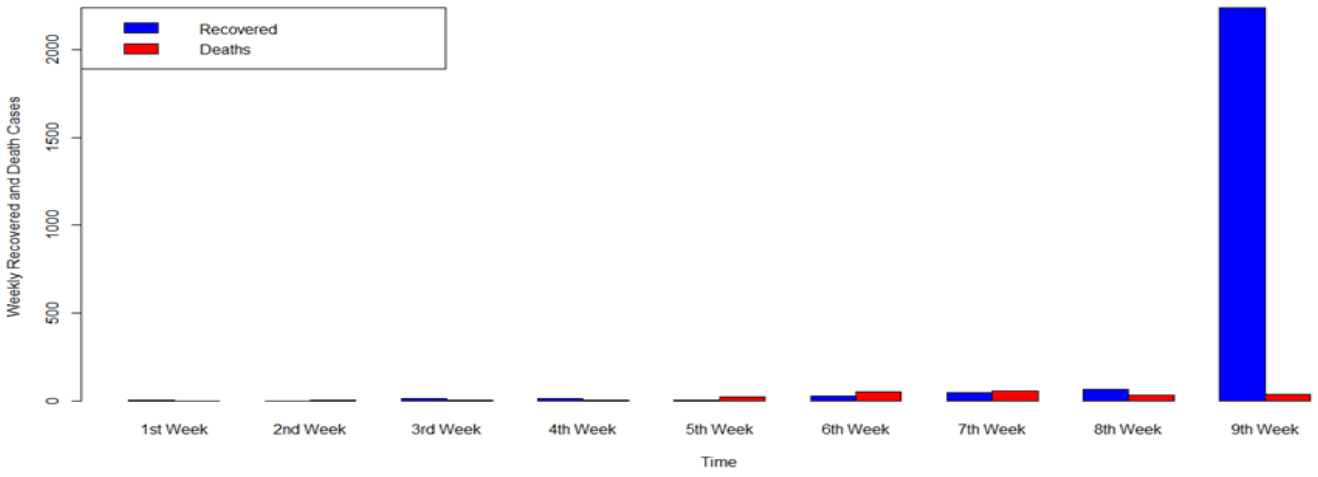
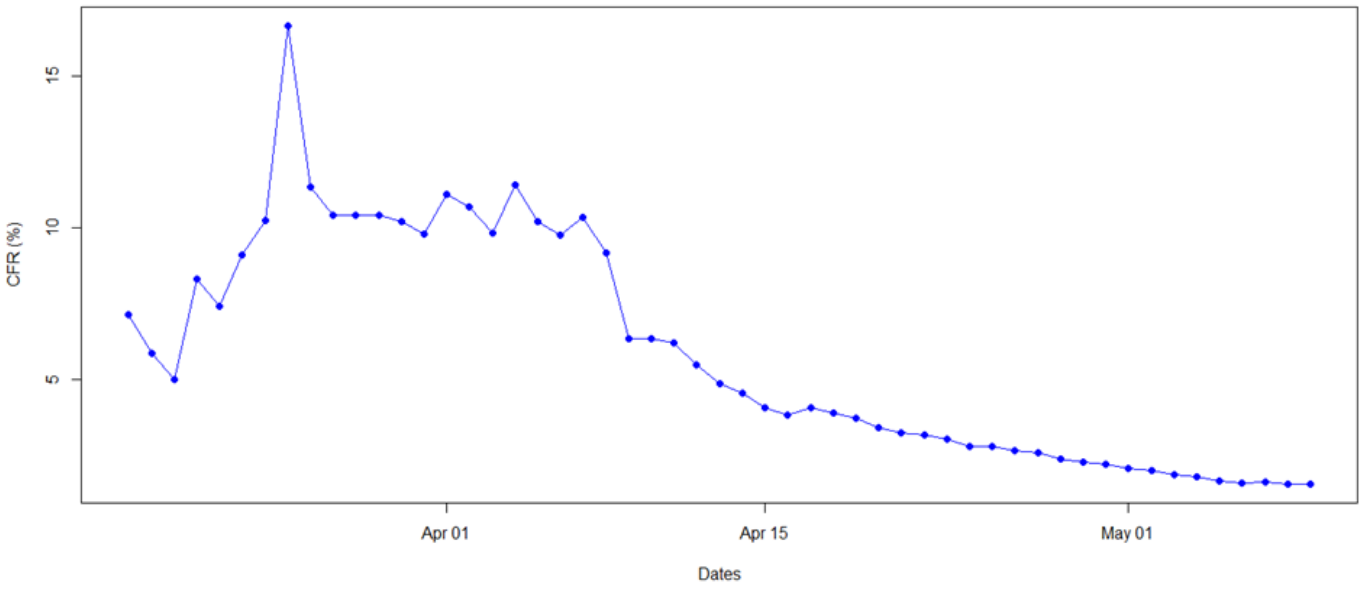
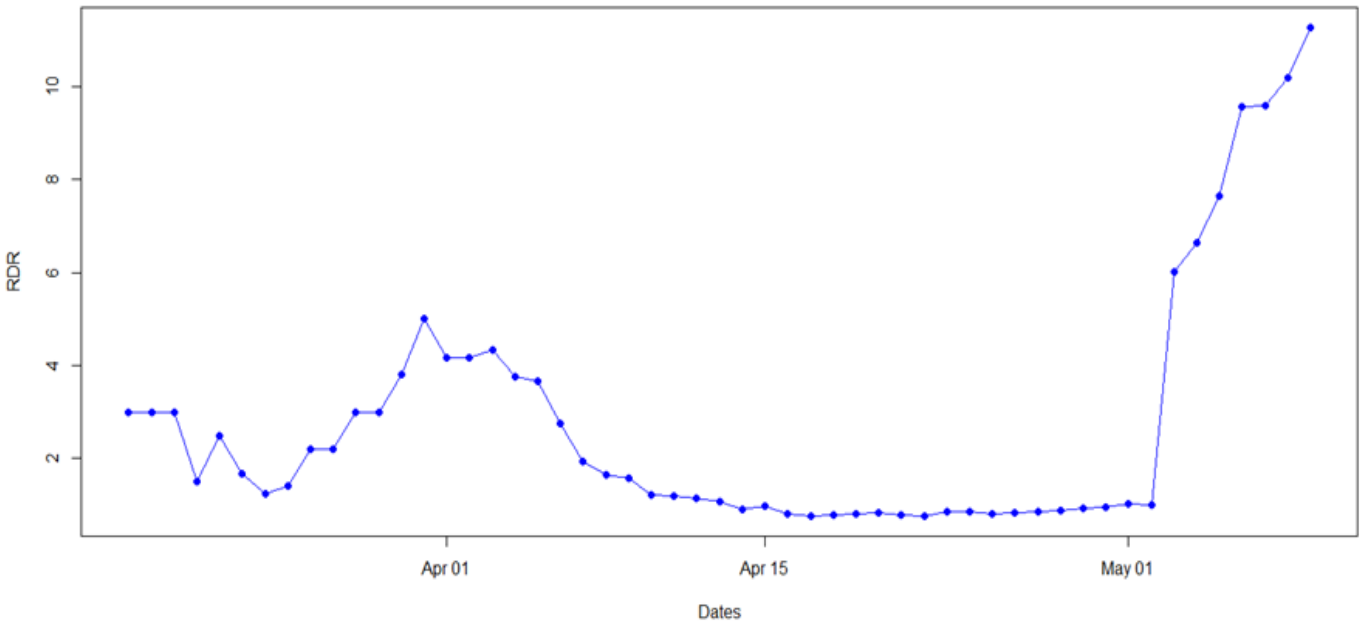


Figure 3. The daily case fatality rate (%) of Bangladesh till May 09, 2020.



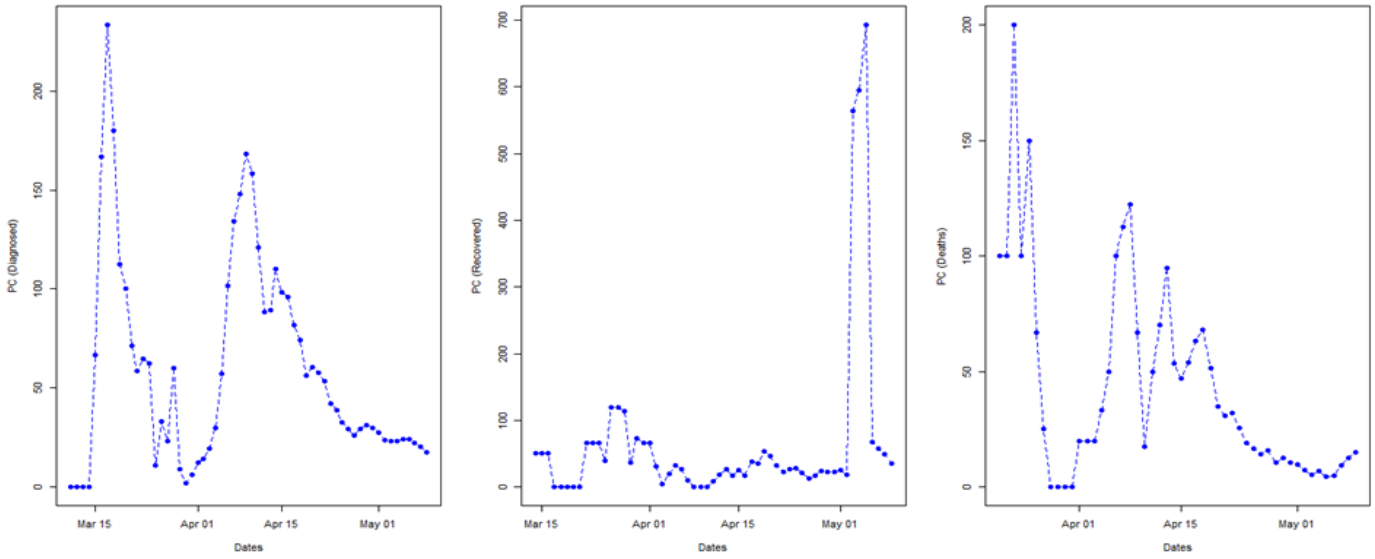
As of CFR, also the RDR was found in Bangladesh from March 18 and it was 3. So, the recovery cases from COVID-19 was three times more compared to deaths. The RDR fluctuated until April 03 and reached its peak that was 5 on March 31. From April 14, 2020 the RDR was below one that cumulative deaths started to be greater compared to cumulative recovery and the trend was continuing until April 25, 2020. From April 26, 2020 the daily RDR showed an upward trend which suddenly increased from May 03, 2020 that indicates the recovery is rapidly increasing compared to deaths in Bangladesh (Figure 4).

Figure 4. The daily recovery to death ratio (RDR) of Bangladesh till May 09, 2020



The 3-days percent change represents how much percent change of an event compared to what it was three days prior. So, the 3-days PC (diagnosed), PC (recovered) and PC (deaths) were found from March 11, March 14 and March 21, 2020 respectively. The PC of diagnosis fluctuated over time and it had a decreasing trend from April 15, 2020 which indicates a slow growth of diagnosed cases in Bangladesh. The PC of recovery vacillated over time and reached its maximum on May 05 which was 692.65% compared to 3-days before. The PC of deaths fluctuated over time and it had an approximate downward trend from April 19. The downward trend indicates a slow growth of deaths due to COVID-19 in Bangladesh (Figure 5).

Figure 5. The daily percent change of diagnosed, recovery and death cases of Bangladesh till May 09, 2020



DISCUSSION

The novel coronavirus (COVID-19 disease) was first detected in Wuhan, Hubei province, China on December 31, 2019. Then it started out-breaking in different countries across the world and 3 cases were diagnosed in Bangladesh on March 08, 2020 by IEDCR through RT-PCR testing. After three days of diagnosis, two cases were recovered since they showed negative results in two consecutive tests. The first death occurred in Bangladesh due to novel coronavirus infection on March 18, 2020. The highest number of deaths in a day so far is 15 that was reported on April 17, 2020 and the highest number of infection in a day so far is 790 which was reported on May 06, 2020. Sex wise infection prevalence was 68% males and 32% females until May 09, 2020 in Bangladesh by the novel coronavirus. The age group 21-30 (26%) is the most vulnerable for infection and almost 73% of deaths were males and the rest of the 27% females due to COVID-19. There was a similarity among diagnosed, recovered and death cases due to novel coronavirus until March 28, 2020. The diagnosed cases fluctuated over time, the recovered cases showed an upward trend and the death cases remain almost constant until May 09, 2020. The CFR of COVID-19 is not constant and varies by geographical locations, ages, sex or over time. The RDR reveals how much proportion recovered compared to deaths. The trend of the daily CFR fluctuated over time until April 07, 2020 and showed a downward trend from April 08, 2020 to May 09, 2020 in Bangladesh. This downward trending directs the deaths are decreasing over time compered to diagnosed cases due to COVID-19 disease in Bangladesh. The trend of daily RDR varies over time until April 03, 2020 and then showed a downward trend from 04 April to 25 April, then showed an upward trend from 26 April to 09 May. The upward trend designates the recovery is fast compared to deaths over time in Bangladesh caused by COVID-19. The PC discloses the percent change of diagnosis or recovery or deaths of a particular day compared to a pre-specified day. The daily 3-days PC of diagnosis, recovery and deaths due to novel coronavirus alternated over time and diagnosed and deaths displayed a downward trending in the last week. The downward trending indicates the cases percent of COVID-19 disease are lessening compared to three days prior cases.

The COVID-19 disease is new and devastating globally. So, the healthcare authorities of Bangladesh have to ensure spreading true knowledge about novel coronavirus towards the citizens of the country via different media. Since there has not been invented a vaccine of novel coronavirus, social and physical distancing is the only way to fight against COVID-19 disease. The healthcare authorities of Bangladesh have to ensure the social and physical distancing among the citizens in the ongoing lockdown. The study has some limitations as it does not identify associated demographic risk factors behind COVID-19 disease. Further research will be needed to see the impact of the inter-connectivity of different regions, the health history of citizens, and so on.

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Como citar este artigo/How to cite this article:

Muyeed A, Siddiqi NA, Tawabunnahar M. Prevalence and Severity of COVID-19 Disease in Bangladesh: A Trend Analysis . J Health Biol Sci. 2020 J; 8(1):1-8.