

TREND OF SECOND WAVE COVID-19 PANDEMIC IN BANGLADESH

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Abstract: Objectives: The aim of this study is to analyze the trend of spreading out coronavirus (COVID-19) for the second wave attack in Bangladesh during this winter season. In this study, we included all reported new confirmed and death cases from March 30 to December 14, 2020. Our intension is to explore the trend of dispersion in infected and death cases after January, 2021. In this paper, we have conducted statistical analysis of Covid-19 in Bangladesh to deliver with reliable and perfect forecasts of the outbreak. We used MS excel and SPSS software for regression analysis and found the slope of the trendline of the data and R-squared value for both infected and death cases. The new confirmed cases gradually increase with date (from March, 30 to June) and reach towards the peak for first wave attack. We get the slope of the trendline for infected case which is increasing first as $\beta = 47.562, R^2 = 0.8799$ and decreasing later as $\beta = -20.709, R^2 = 0.6816$ (from July to September) for first wave. After then again, the slope is increasing. Death cases are also following the same trend pattern. This analysis may help to take significant role for securing public health for Bangladeshi people. In this situation, Bangladesh needs to take emergency management system to protect the attack of the virus which we going to face for second wave. As well as people should concern about the guidelines provided by IEDCR and WHO up to get vaccine.

Keywords: COVID-19, trend to outbreak, second wave, pandemic, Bangladesh.

I. INTRODUCTION

The novel coronavirus is rapidly spreading out through the world wide and have become a serious issue for public health. The ongoing coronavirus (Covid-19) pandemic, at first originated in Wuhan City, Hubei Province, China, around the end of the December 2019 which has subsequently spread in Bangladesh in early March 2020. Mutation rate of this virus is very fast and take various pattern in different countries. Temperature and humidity have an impact on the transmission rate of this virus. Wang et al. have presented the impact of temperature and relative

humidity on the transmission of COVID-19 across communities considering human mobility status [1]. They proposed that increase in 1°C temperature is associated with a reduction in the R value of COVID-19 as 0.026 (95% CI [-0.0395,-0.0125]) in China and as 0.020 (95% CI [-0.0311, -0.0096]) in the U.S. As a result, in winter-based country where the temperature is between -5°C to 15°C, like USA, Italy, France, Netherlands, Germany, Spain, have huge infected and death rate while the infected rate is apparently slower in Asian tropical countries [3]. Bangladesh is a tropical country. In Bangladesh, first COVID-19 positive patient (7 person) [2] identified in March 8, 2020 and one person died in March 19, 2020. After then this virus spread out exponentially from March to June, 2020 [2]. According to the WHO (World Health Organization), in Bangladesh, from Jan 3 to December 13, 2020 there have been 489,178 confirmed cases of COVID-19 with 7,020 deaths. Among the confirmed cases 85% people back in normal life after recovery, 12.8% people are still in isolation and 1.4% people died [2]. The position of Bangladesh in death rate due to Covid-19 is 33rd among the countries during January 01 - November 30, 2020 [2].

Bangladesh, the most densely populated (163 million) country as well as low-middle-income economy country where the people are still struggling to make shield against the spread of the coronavirus disease. In spite of being densely populated country, tropical weather (characterized by high temperature, humidity) might have an impact to prevent the devastating situation caused by pandemic [3]. The Institute of Epidemiology Disease Control and Research (IEDCR) under the Ministry of Health and Family Welfare, Bangladesh is taken charge to control and increase awareness among the people about this infectious disease, such as Covid-19 outbreak in Bangladesh. Anwar et al. (2020) asserted how Bangladeshi people could fight against Covid-19 and enabled to minimize the impact of the pandemic [4]. Still now, the researchers are trying to find out the more effective prevention policy and the reproductive rate for second wave attack of the corona virus in Bangladesh. In this write-up, we briefly represent the second wave attack situation of Covid-19 in

Bangladesh and highlight some statistical report in which the researcher can predict the extremity of this wave.

Various studies (Pai et al. 2020; Haque and Rahman, 2020; Sheta et al. 2020; Xu and Yang, 2020; Mohiuddin, 2020; He et al. 2020) have described the forecasting on basic reproduction number, peak point etc. Among them, Pai et al. (2020) used SEIR model during countrywide lockdown in India to predict the active Covid-19 cases and the peak period of the infected cases [5]. Haque and Rahman, 2020 have tried to highlight the association between temperature, humidity with COVID-19 outbreaks in Bangladesh [3]. Sheta et al. (2020) highlighted the basic reproduction number of the novel coronavirus and presented a comparison of daily reproductive number among different countries [6]. Xu and Yang, 2020 analyzed the public health emergency status taken in China to prevent the spread of new coronavirus pneumonia (COVID-19), and to introduce forward suggestions for system construction and improvement [7]. Mohiuddin, 2020 represents the role of IEDCR to identify the new coronavirus positive cases and also represent daily income of urban, slum and rural poor people due to present countrywide shutdown in Bangladesh [8]. A deterministic mathematical modelling of the corona virus diseases has been conducted to investigate the outbreak situation and going to peaks of the 2019-nCoV among the South Asian countries [11]. They have derived a model based daily reproduction number of currently infected cases. He et al. (2020) have studied the reproductive number which accelerate the transmission of infectious disease and shown schematic relation between different time periods and disease transmutability from human to human [12]. Based on basic reproduction number, Kuniya et al. (2020) analyzed the epidemic peak for Covid-19 using the real-time data in Japan [13]. To predict of daily new infected cases on the Diamond Princess Cruise ship, Zhang et al. (2020) estimated the reproductive number (R_0) of the novel virus in the early stage of outbreak [14].

However, still Bangladeshi people face huge challenges to prevent the second wave attack. Bangladesh government announced around US \$12.11 billion stimulus to protect Covid-19 in health sector. All famous scientist from developed country is in race to bring the vaccine and mitigate its dispersion of this virus. Bangladeshi scientists are trying to find out the reproductive rate because this is the indication of the dispersion of the virus. This research will analyze the data and predict the trend of spread out of

the virus, further to discuss the movement of infections during this winter in Bangladesh.

II. METHODOLOGY

i) Data Source

The nationwide data on clinically diagnosed cases are collected from the COVID-19 Bangladesh situation reports [9] and taken help from the daily reports of the IEDCR, Dhaka, Bangladesh [10]. We have collected data through March 30 to December 14, 2020 and rearrange the whole data set into three intervals (March 30 to June 30, July 01 to September 30, October 01 to December 14, 2020). In IEDCR, 35 laboratories perform rt-PCR based COVID-19 testing and identify first infected case in March 8 as well as first death in March 19 in all of Bangladesh using rt-PCR based testing [3]. Observing the daily new confirmed case, we can analyze the tendency of the virus to spread out. That is why we consider daily data value.

ii) Statistical Analyses

In this paper, we fit linear regression model in who have infected and died by this virus. We have shown the data value against the time variations through March 30 to December 14, 2020 in Figure-1, and Figure-2. It is seen that the empirical relationship between day and case as:

$$Case = \beta * Day + C \quad (1)$$

Here, β is the slope of the trendline and C is the arbitrary constant. Both, the daily new infected and death case can be express in the form of Eq. (1). We also present R^2 value which is the determination coefficient of the regression law. Descriptive statistics included slope for trendline of COVID-19 for daily confirmed cases and deaths in three different intervals to analyze the spread of new coronavirus pneumonia. We already know how the COVID-19 virus is spread out and there are many parameters which accelerate the spread of the virus. In this article, we consider day to day new infected death number. That is why, we represent the Eq. (1) with time to understand simply the trend of the virus. We use MS-excel-2019 to provide statistical analysis. This article may explore public health emergency management framework for Bangladesh's people and create a scope to develop and control the second wave attack.

III. RESULTS

(i) Trend of new infected cases for coronavirus

In Figure 1(a), the presented data shows that the new confirmed cases gradually increase with date and reach towards the peak for first wave attack. If we follow the trendline in this segment, we get the positive value of the slope as $\beta = 47.562$, $R^2 = 0.8799$ of trendline which indicates the infected case is going to be peak. Here, R^2 interpret how well the model fits the data.

$$y = 47.562x - 2e^6 \dots \dots \dots (2)$$

where, y and x represent new confirm cases and day, respectively.

The increased cases in this figure refer to the newly increasing confirmed cases compared with the previous day. In Figure 1(b), we presented the same case from July 1 to September 30, 2020. In this time interval, we observe that the infected case is going to be decreased. After July 1, the number of new cases has dropped significantly and emergency management interventions have gradually come into play. In this section, the slope of this interval is negative as $\beta = -20.709$, $R^2 = 0.6816$.

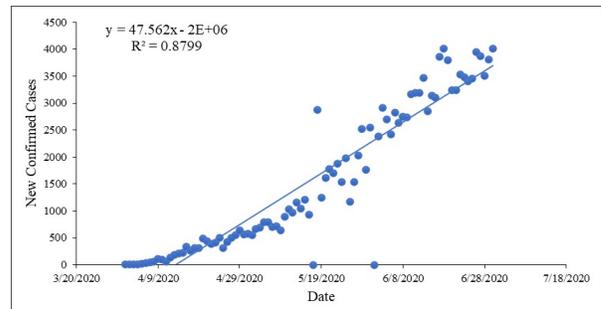
$$y = -20.709x + 914797 \dots \dots \dots (3)$$

Analyzing these two figures, we can say that the first attack wave has expanded through March 30 to September whereas June 30 indicated the peak point of this wave. After ending the first wave, suddenly infected cases are going to increase through October to last of this year which is presented in Figure-1(c). In this figure, we observed that slope of the trendline is positive as $\beta = 11.85$, $R^2 = 0.4933$ and the infected cases are increasing day by day.

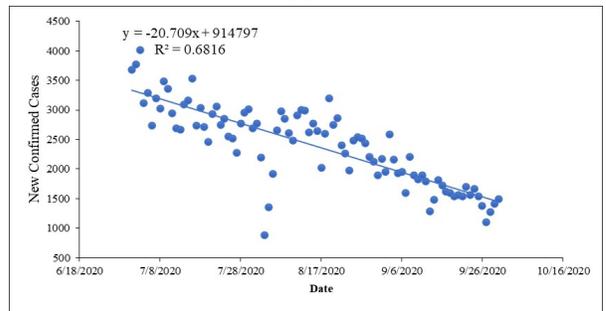
$$y = 11.853x - 521496 \dots \dots \dots (4)$$

According to this relation between time and spread pattern of this pandemic, we are passing on the second wave. So, analyzing the attack wave pattern, we can offer prediction about the newly infection rate that the infection rate may be reduced after January, 2021.

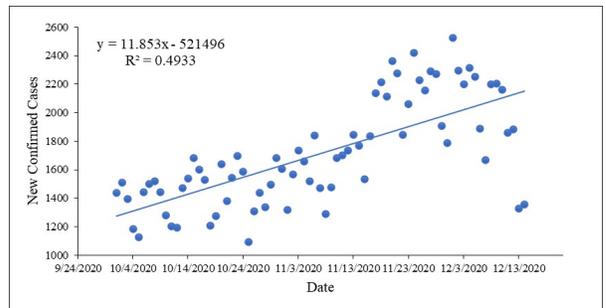
Observing the above three graph pattern from Figure 1: (a)-(c), we can predict the new infected case in early 2021, approximately, which will follow the Eq. (3).



(a)



(b)



(c)

Figure 1: New confirmed case with its trends in spread between (a) March, 30 to June 30, (b) July 01 to September 30, (c) October 01 to December 14, 2020.

(ii) Trend of deaths case for coronavirus

In Figure 2(a), the presented data shows that the number of deaths increases gradually and reach in peak for first wave attack. If we follow the trendline in this segment, we get the positive value of the slope

as $\beta = 0.5315$, $R^2 = 0.7915$ of trendline which indicates the death case is going to be peak.

$$y = 0.5315x - 23350 \quad \dots \dots \dots (5)$$

These statistics indicate that the newly death cases are increasing compared to the previous day. In Figure 1(b), we presented the same case from July 1 to September 30, 2020. In this figure, we observe that the death rate is going to downstream. In this section, the slope of this interval is negative as $\beta = -0.1313$, $R^2 = 0.1775$.

$$y = -0.1313x + 5820.8 \quad \dots \dots \dots (6)$$

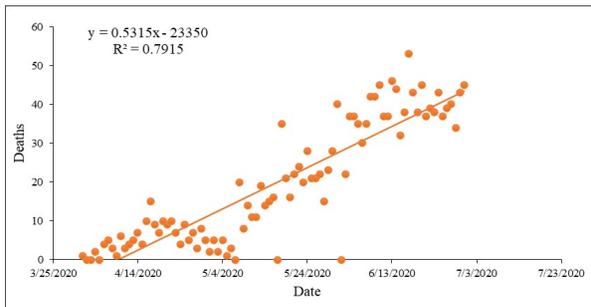
Analyzing these two figures, we see the similarity about trend pattern between infection rate and death rate. After ending the first wave in September, 2020 death rate again are growing high which is presented in Figure-1(c). From this figure, we observed that slope of the trendline is positive as $\beta = 0.1423$, $R^2 = 0.1675$ and the death cases are increasing day by day.

$$y = 0.1423x - 6255.9 \quad \dots \dots \dots (7)$$

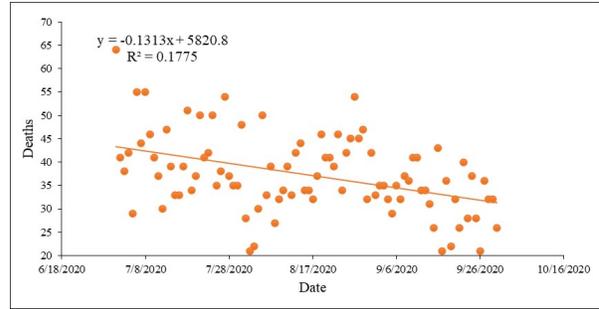
According to this relation between time and spread pattern and analyzing the previous data, we can give prediction about the death rate which may be reduced after January, 2021 though there have another complicity.

Observing the first wave attack and trend to reach the peak point, we can assure that we are going towards the peak of the second wave attack which may be visualized in last week of December or in first week of January, 2021. After that, the new infected rate and death rate may be diminished gradually.

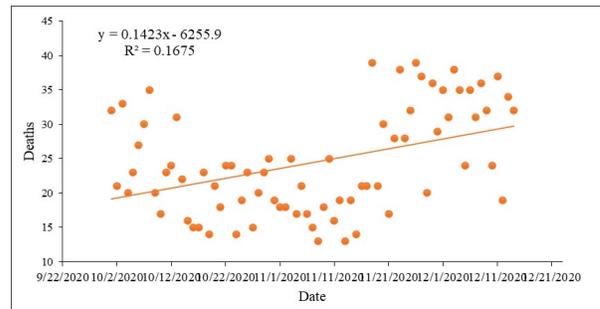
Observing the above three graph pattern from Figure 2: (a)-(c), we can predict the new deaths case in early 2021, approximately, which will follow the Eq. (6).



(a)



(b)



(c)

Figure 2: Trends of death cases between (a) March, 30 to June 30, (b) July 01 to September 30, (c) October 01 to December 14, 2020.

IV. DISCUSSION

A multi-sectoral and joint step was taken to prevent the first wave outbreak of acute infectious diseases from the attack of the pandemic in Bangladesh. There are several aged persons who are infected in Bangladesh. According to the WHO report, 26.6% cases were confirmed in people between 31 and 40 years old, 19.6% - in the age group of 21 to 30, 19.2% - 41 to 50 years and 15.9% in the age group between 51 and 60 years old among the total infected case up to November 30, 2020 [9]. The person of 61 to 70 years old age, reported as highest death possibilities which was around 31.7%. 29.6% was reported in the age group of above 71 years old while 22.3% in the age group between 51 and 60 years. According to the IEDCR report, male represented 72% and 77% of the of total infected and deaths cases due to COVID-19, respectively in Bangladesh. The infected rate and death rate were observed 2.57 and 3.35 times higher in male than female, respectively. Rahman et al. (2020) analyze the transmission dynamics of the COVID-19 outbreak considering space and time in Bangladesh using 154-day real-time epidemiological data series [15]. The suscceted-exposed-infectious-

recovered-dead (SEIRD) model is proposed to explain spread dynamics of the virus on the basis of kinematic parameters, fitted on the data in Bangladesh up to May 15 [16]. Mukaddes et al. estimated the basic reproduction number, R_0 as 2.85 (95% CI:2.66-3.04) and mentioned that virus transmission trends outbreak of COVID-19 in Bangladesh [16]. In Bangladesh, there are several busiest and densely populated cities and infected and deaths rate in those cities is highest among the others. Like Dhaka division is most populated division and both rates in this division is highest among all other division. According to the WHO statistical report, the infected reports between division was as 68.1% of reported cases in Dhaka division, 12.2% in Chattogram, 5.1% in Khulna, 4.9% in Rajshahi, 3.1% in Sylhet, 3.0% in Rangpur, 2.1% in Barishal and the lowest 1.5% in Mymensingh division up to November 30, 2020. While, the reported death was as 53.6% in Dhaka division, 19.1% in Chattogram, 7.5% in Khulna, 6.0% in Rajshahi, 4.5% in Sylhet, 4.1% in Rangpur, 3.3% in Barishal and the lowest 2.0% from Mymensingh division. To know the trend of the pandemic in Bangladesh, we conduct a statistical analysis. We divided the time period (March 30 to December 14, 2020) into three interval which is suitable to express the first attack wave and beginning stage of the second attack wave. We fit trendlines and express the tendency to spread pattern of the virus. We show the R^2 value which express how well the model fits the data and measures the strength of the relationship between your model and the dependent variable on a convenient (0 – 100%) scale. Analyzing the Figure 1 and 2, we can predict that in early January, 2021 c will follow the Eq. (3) and (6) and find approximately near the actual infected and death number under the same condition of other current parameters which accelerate the spread of the virus. Because, from the Figure 1: (a) and (b), we observe that virus spread tendency increases during first interval and after reaching the peak, the spread tendency decreases (second interval), considered as first wave attack. In the beginning of third interval, the new infected and death cases again start increasing. Observing the first wave pattern, it's our prediction that the new infected and death cases will decrease and follow the Eq. (3) and (6) after the third interval. In this situation, Bangladesh needs to continue out higher research to predict the virus trend and its reproductive rate for this second wave. As well as concern about the public health emergencies, and achieve networked and accurate management up to get vaccine.

1. CONCLUSION

Through analyzing and studying the reported cases from March to end of this year about COVID-19, we are passing on second wave attack of this infectious disease. The trendlines in the new infected and new death cases express the tendency of the COVID-19 spread among the human being. The presented trend equations (3) and (6) will help to predict the new infected and new death cases in future under the same condition of other current parameters. Based on this situation, we should boost up our immune system by taking proper nutrition as well as maintaining social distance, increasing personal awareness to prevent the attack of deadly coronavirus until to get Corona vaccine. Further technical and strong public health infrastructure should be taken to save human lives in Bangladesh.

Conflicts of Interest: The authors declare they have no conflicts of interest.

Authors' Contribution: All authors contributed in this study conceptualization, data curation, formal analysis and writing (original draft, review & editing) the manuscript.

Ethical Statement: Because this study uses the public data, therefore, there is no need for informed consent.

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