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Elucidating Severity of Waves of COVID-19 in Pakistan

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Abstract

Background: COVID-19 has radically changed the globe. This virus has a powerful impact on almost every country in the world. The most significant hurdle arises for the overall capacity of a disease control when the number of cases peaks during each wave of the pandemic. There are various waves that have occurred in the preceding period, each of them is characterized by a distinct variant of the virus. For a developing country like Pakistan COVID-19 ruins every sector of the country. There is a proper need for care and protection from this virus as guided by the World Health Organization (WHO). The spread rate is different in every country based on various factors. Two or more factors are required to trigger a high infection rate.

Methods: The data sourced from the National Command and Operations Center (NCOC) was focused on analyzing the data from the four waves of COVID-19 in Pakistan encompassing reported cases, death and testing capacity. Utilizing the SPSS software, a comprehensive examination of these factors was performed.

Results: The data of four waves has been analyzed including reported cases, no. of death, and testing capacity of the country. The data analysis reveals there is a strong correlation between these factors. By the interpretation of the data, it reveals upcoming waves are more dangerous than earlier due to new mutations.

Conclusion: The virus is evolving to become more contagious and infectious in each consecutive wave. Vaccination should be considered compulsory for everyone to win the battle against the virus. Data analysis revealed a correlation between the number of cases and passage of time, showing that the new waves will emerge earlier and have a significant impact on the country.

Introduction

The COVID-19 is a pandemic disease in the world starting in 2019 in Wuhan. It is caused by a virus that has ribose nucleic acid and protein. Protein envelopes secure the genome of the virus from degradation. The common symptoms that appear in infection are flu, fever, dry cough, short breathing but rare symptoms are diarrhea, vomiting, chest pain, nausea, sneezing, nasal congestion, sputum production, and rash on the skin. The mode of transmission is aerosols as shown in figure 1. The coughing or sneezing of patients spreads aerosols in the environment, the aerosols enter into a host cell and replicate the number of viruses. The spike protein attacks the ACE-2 receptor to enter the cells [1,2]. The virus affects the cells of the lungs which ultimately cause pneumonia. Healthy adults recover more quickly than immunocompromised individuals. The spread of disease varies from person to person. Protection against a virus is necessary to avoid the drastic consequences as shown in figure 2. The mask-wearing and social distancing assist individuals to protect themselves against the virus.

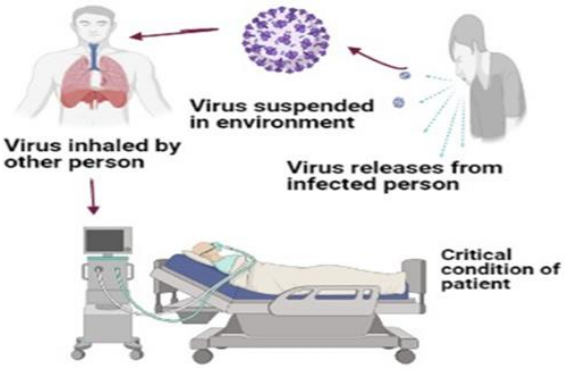

Figure 1: Transmission of the virus. The aerosols contain particles of viruses. Aerosols is generating from infected person and is infecting healthy as well as immune-compromised patients. The immune-compromised patient is in critical condition due to severity of infection.

Pakistan is a developing country. COVID-19 infection causes drastic events in the country. The different waves had passed in the past, and each had a separate strain of the virus. The first case was reported on 26th February 2020 in Pakistan [3]. The first wave started off in April 2020, it was a huge outbreak of the disease in the country, and it went down in September 2020. The first wave went to its peak in June 2020 [8]. The second wave was initiated as the number of cases increased again after the 10th of November 2020. The third wave appeared in Pakistan in March 2021. The third wave contains the UK strain that was beta strain, as it was contagious than other strains. This strain had badly affected Europe and spread ate was very high [4]. The fourth wave started affecting country in May 2020 and had the delta strain [5]. It was more dangerous than the previous strain. Smart lockdown had been imposed in the country, but these efforts are not fruitful [6]. This paper mainly focused to overcome the spread rate in Pakistan by analyzing factors affecting spread of infection and examination of correlation of the different factors.

Figure 2: Safety measures are very important to save the humanity. a) When the infected person interacts without any safety measure, they spread the virus in the community. The healthy person of the community become the infected individuals as show in red color. b) As the infected person is now following the safety measures such as wearing mask. So, this person is not transmitting the virus to healthy person, and they remain healthy as show in yellow color.

Methods

The data of the first four waves was targeted and data ranges from 1st April 2020 to 25th August 2021. The data was taken from the website of NCOC. The analysis of the data was done by the use of SPSS software.

Results

Three important factors were turned up after the analysis. The first factor is the testing capacity, it is important to consider the actual number of reported cases by the country. If fewer tests are performed, we are unable to detect the actual number of cases. The fig. 3 shows that the testing capacity of the country. In the fourth wave duration the maximum tests were performed as shown in figure in 3 (d) and the highest mean value is 48558.85. Testing capacity was improved with the passage of the time. The next part of the data deals with confirmed cases that was reported during the pandemic. The confirmed cases are pivotal to understand, so that the infectious person can be traced within the community. The highest number of positive cases was reported in the third wave and the mean value is 3713.47 cases. It is shown in figure 4.

The death rate is critical to understand because it is the percent of people that lost their precious lives from this virus. The mutated virus strain is dangerous as it

increases the death rate of the community [10]. As time passes, there is a significant increase in the mutation as well as in death rate of the citizens. The highest death rate is observed during third wave of COVID-19 in Pakistan.

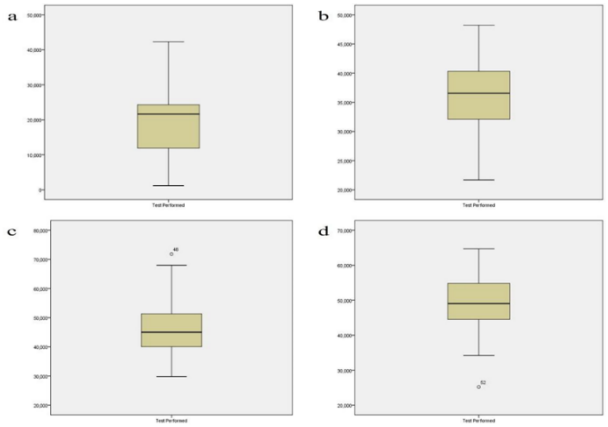

Figure 3: Test performed during wave a, b, c, and d by box and whisker plot. The testing capacity is maximum in the 4th wave of COVID-19.

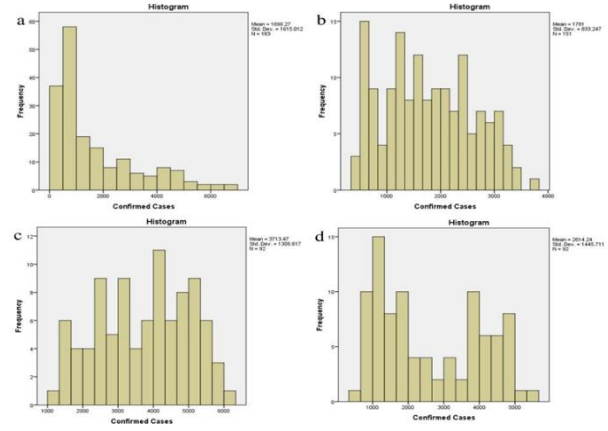

Figure 4: Confirmed cases of waves a, b, c, and d. The confirmed number of cases shows the high intensity of the disease. The highest cases confirmed during the third wave as shown in (c).

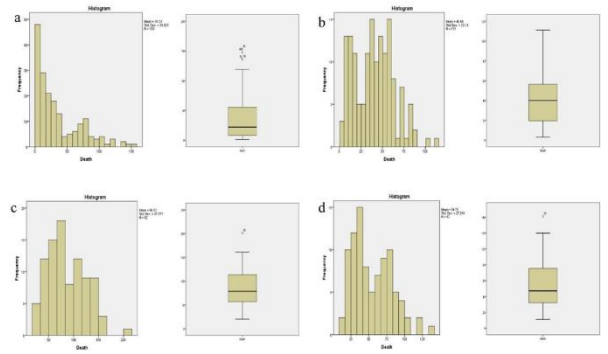

Figure 5: Number of deaths in waves a, b, c, and d. The death rate shows the severity of the infection. a part represents the histogram with mean value while b part shows the box whisker plot which shows the extreme value exist in the data.

The average death rate during 3rd wave is 86 deaths per day as shown in Fig 5 (a and b). The extreme values of death rate were noted during the first wave period. By the data analysis, there is a correlation between the number of cases and time. As time passes the new wave has more impact than the previous ones. The second wave is more dangerous than the first. The third one is more than the second; likewise, the fourth wave has a high impact of spreading infection.

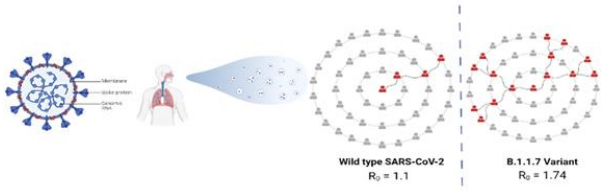

Figure 6: Mutated variant B.1.17 has a higher spread rate than the wild type of viruses as there was a mutation in spike protein. This mutation in B.1.17 strain creates strong binding capacity as compared to wild type; hence the number of cases increases in the community.

Discussion

There are many factors affecting the rate of spread of the infection and some of them are discussed here [10]. The government and citizens are responsible for controlling the rate of the infection. The government imposes a lockdown to control the spread rate. The smart lockdown was imposed in May 2020 in Pakistan [11]. A similar study reported in India that lockdown decreases the case of infection [14]. This case shows the lockdown is effective [13]. Social interaction plays a crucial role in the spread rate. Social interaction is of two types one is interaction within different countries and second is interaction of people among same country. A study reported that Sudan has more interaction during trading of basic commodities, hence there is huge number of cases. A similar case was reported in Pakistan at the funeral ceremony of, Khadim Hussain Rizvi died where two hundred thousand people gathered [12]. This increases the rate of infection [13].

The spread rate of the country is independent of the temperature as reported in Brazil [14]. The low temperature is also independent in several cases [15]. The mutation rate is very high in this virus naturally. The RNA-based genome viruses are less efficient so there are high chances of mutation. The RNA-dependent RNA polymerase incorporates more error in the genome. This causes high mutation in the genome of the virus. The mutation in the genome arises various number of strains, some can be more dangerous as they are resistant to previous treatment [7]. Delta strain in the world is more infectious as compared to beta strain. The new strain of coronavirus that is the beta strain spread in the UK rapidly [16]. This strain was also

observed in different parts of the world. This strain is highly contagious and spreads swiftly in the world [9]. The UK has started the lockdown in the country to overcome the rate of spread from this strain. The virus has mutations in the amino acid sequence that are necessary for the spike protein of the virus. This is 56% more contagious than the previous strain and can be more dangerous as shown in fig 6. There is the highest number of deaths recorded in the country, that is one hundred and eleven deaths. Pakistan restricted travel from the UK to protect us from viruses. This shows the more mutated virus can be more lethal for humans. The death rate in Pakistan is lower than in other countries because the Asian countries have already experienced SARS-CoV-2 viruses. People living in this region have already immunity against this virus.

Pakistan has a limited diagnostic test for the country. The biggest reason for the lower number of cases in-country is less testing of people. India is conducting 18831 test people per million while in the US 202106 test is conducted per million. Pakistan is conducting 9878 tests per million which is very low as compared to other countries [11].

Test reporting is a way that helps to know about the cases in the country. The vaccination rate is important to be considered these days. The most effective way of prevention is vaccination. The report gives results show that in the US, Asia, Europe, Africa, South America, and the World will reach 139 million, 109 million, 127 million, 8 million, 38 million, and 441 million people will be fully vaccinated on 1 June 2021, respectively [17]. By 21st February 2023 there are 132,485,851 people fully vaccinated in Pakistan. 139,735,015 people are partially vaccinated. The total number of vaccines administrated in Pakistan is 303,864,046. 50,114,329 encounter the booster doses. The data is taken from the NCOC website [8]. In Israel, after having a booster dose of vaccination, author reported decrease of immunity from 90% to 40%, this could be due to delta variant [22]. The vaccinated people become asymptomatic especially who are above 60 years old. The vaccinated people have a smaller number of infections than unvaccinated people [23]. The vaccination also decreases the severity of disease as reported in Israel [24]. The similar study was reported in China that fully vaccinated people have less chance of getting infection as the antibody is created. In China the use of the herbal medicines is helpful in treating the patients that are Lianhua Qingwen and Arbidol Hydrochloride. This study reports 98% recovery, so the treatment of affected individuals is required with care of vaccination [25].

The strategy for controlling the positive cases is education about the infection and transmission of disease in the general population. The proper use of masks and sanitizer with PPE can protect the transmission of disease from paramedical staff [2,25]. The major spread is due to a lack of tracing of patients and more social interaction of the patient with community[18]. The isolation of the patient and tracking the patient's interaction is one of the keys that control the spread rate in months [2,19]. The patients that do not develop symptoms are more dangerous as it is stated earlier that females are more asymptomatic than males [20]. Social distancing is one of the key elements to cut off the transmission route of virus [21]. The vaccination of COVID-19 is necessary to control this disease. The booster doses of vaccines are also available in Pakistan. The people who are vaccinated by Sinovac or Sinopharm can take the booster dose of Pfizer to overcome the infection.

All factors play an important role in the spread of disease and there is need to overcome this spread by following the safety measures. Safety measures like vaccination and social distancing can prevent from this disease. The analysis of data shows the correlation between the factor of time and number of cases. Based on the above data the new waves appear early and have a drastic effect on the country. Concerning the current situation, the country has faced a huge loss faced. The mutation rate is high so the virus would be dangerous in the next waves. Vaccination should be promoted to overcome these cases. Vaccination can prevent the severity of the disease as the immunity was already generated against virus.

Author Contributions

Muhammad Zubair Yousaf conceptualized and supervised the study, Rabia Zia & Zilwa Mumtaz, both collected data, performed experiments, did data analysis and reviewing manuscript, Zubia Rashid helped in computational analysis and Ashaq Ali was involved in proofreading the manuscript.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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