



Original article

# Assessment of risk management and control measures against coronavirus disease

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## ABSTRACT

This article presents the COVID-19 situation and control measures taken by the Government of Pakistan. Two waves of pandemic are faced globally and similar in the study area. We have investigated the risk management decision in two phases. Primarily, strict lockdown was observed from March 2020 to July 2020 and smart lockdown was enforced from August 2020 to December 2020. It has been studied that during strict lockdown, COVID cases reduced gradually but reopening of institutes and smart lockdown strategy resulted gradual increase in confirmed cases and death rates. During first wave of COVID-19 in Pakistan, a total confirmed number of patients of COVID-19 were 263,496 till 18th of July 2020 with total deaths of 5,568 people and 204,276 recoveries, while total number of COVID-19 patients reached 555,511 till 9th of February 2021 with total deaths of 12,026 people. Province of Sindh was affected badly with total number of 251,434 COVID-19 cases followed by Punjab Province with total number of 161,347 COVID-19 till 9th of February 2020.

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## 1. Introduction

The current coronavirus disease, also recognized as COVID-19, is a contagious disease caused by a severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Mahmood et al., 2020a; Sanche et al., 2020). The first case of the disease was recorded in Wuhan, the capital city of Hubei province, China in December 2019, and has since proliferated globally (Li et al., 2020; Mahmood et al., 2020a). This coronavirus disease was declared a pandemic by the World Health Organization (WHO) on 30 January 2020. The transfer of the disease from animals to humans in the Wuhan seafood market was suggested to be the origin of its outbreak, resulting in the closure of the market on 1st January 2010 (Mahmood et al., 2020a). The municipal health commission of Wuhan informed the WHO of the outbreak of the coronavirus disease on 31st of December 2019 as an unidentified pneumonia. The

genome sequence of the virus (is almost 70 percent like the previously proliferated SARS virus (Severe acute respiratory syndrome coronavirus) (Gorbalenya et al., 2020a,b). Afterwards, five more sequences have been updated on the GISAID (global science initiative and primary source for genomic data) databank by various research institutes in China allowing further studies of the virus (GISAID database, 2020). As at 21st January 2020, the virus had affected most provinces in China, resulting in lockdown and restriction of movement across all provinces as a strategy to reduce further spread. About three months after the disease outbreak in China, there was a total global confirmed case of more than 170,000 with more than 6500 deaths (Sanche et al., 2020).

### 1.1. Shared symptoms of COVID-19 with other viruses

Coronavirus diseases have a long history since 1930, when the bronchitis virus was first observed in chickens (Cui et al., 2019). The spread of the viral bronchitis disease among domesticated chickens was controlled by isolating infected birds (Mahmood et al., 2020b; Hussain et al., 2005). Afterwards, many different viral diseases were detected in animals, such as the 1940 hepatitis virus that was in mouse (Cauchemez et al., 2013). The current coronavirus disease shares similar symptoms (fever, sore throat, body pain and shortness of breath) with a previous Middle East respira-

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tory syndrome coronavirus that was known to infect upper respiratory tract in humans (Cauchemez et al., 2013). In 1965, another virus named B814, which is the first coronavirus of human origin, was reported as causing common cold (Eckerle et al., 2010). Virus B814 shared similar characteristics with the chicken coronavirus IBV and was found responsible to infect respiratory tract. Studies have found great similarities between the strains of animal and human coronaviruses (Perlman et al., 2009). Later in 2002 the severe acute respiratory syndrome (SARS) virus was also found from Asia and shares similar with previous viruses of animal origin and causing respiratory tract infection (Wang et al., 2006). It was confirmed in 2017 that SARS virus was transferred to humans by horseshoe bats (Gorbalenya et al., 2020a,b), which were being used as intermediate animals in research. Global fatality rate of SARS virus was 9.6 percent and fatality rate were dependent on age group of infected persons (Ullah et al., 2019; Ge et al., 2013). The World Health Organization and many other research institutes from different countries found that the 2002 coronavirus shared matching sequences of COVID-19 (Naming the coronavirus disease, 2020). In this sequence a camel flu was found due to coronavirus transferred from bats to camels. Later, this virus was transferred from camels to humans and named MERS-CoV (Naming the coronavirus disease, 2020). Fatality caused by the MERS-CoV virus was 36% till the end of 2017. Transfers of corona virus from camels to humans were common in the Arabian countries and were controlled by isolating infected persons (Xiong et al., 2020).

Current pandemic coronavirus showed shared morphological (shape and size), genetic (RNA genome from 26 to 32 kb), clinical (fever, sore throat, muscle pain etc) and anatomical (envelope and spike proteins) characteristics with previously reported corona viruses both in humans and animals (Yu et al., 2020).

### 1.2. Pathological and anatomical characteristics of COVID-19 process

RNAs of corona virus are non-segmented and have spike like projections on the surface. Greatest known RNA genomes (30 kb) were identified in corona virus with exceptional reproduction strategies (Ogando et al., 2019). A complete set of mRNAs (Eckerle et al., 2010) enables unique replication strategy of corona virus having polyadenylated 3-ends and just a 5-end portion of the sequence is translated (Chen and Guo, 2016). Name of corona virus is originated from Latin, corona, means wealth. Image of the corona virus is observed under electron microscope and found that coronavirus is like sun or had many crowns on surface. So, its name is after the shape or image of the virus (Vynnycky et al., 2019).

Studies investigated the shapes of corona virus. Most observed and known were L and S types of corona virus; S type showed more shared morphological and anatomical characteristics with ancient corona virus (Sawicki et al., 2007) but recently in humans L types corona virus is observed; that might be due to intervention in humans (Cui et al., 2019). Diseases were controlled previously by isolating animals or infected persons because viruses were more observed in animals. The present corona virus is genetically like SARS corona virus as represented in Fig. 4. They both belong to Sarbecovirus subgenus and were mainly found in bats (Huang et al., 2020). A higher rate of genetic mutation was observed in corona virus. It is very interesting that genetic sequence of COVID-19 is highly similar to SARS Co-virus detected in 2013 (Marco et al., 2003). So, we can conclude that mutations of corona virus occurred in many years in immediate bat ancestors (Snijder et al., 2006). Functional receptors of corona virus are ACE2 both in SARS corona virus and SARS corona virus 2 (Vivanti et al., 2020). In, SARS coronavirus many mutations occurred, and spike proteins developed binding with ACE2 (Mahmood et al., 2015; Gorbalenya et al., 2020a,b). This newly mutated virus structure has ability to cause impact on cardiovascular functions by swelling in the inner lining

of lungs and heart. Attachment of S1 component of S protein of virus with the ACE2 enables the virus to attach with receptors in host surface cells. Then S protein from the virus cleavage in hist cell from S1 to S2 site and fusion between host and viral cells occurred then. Imbalance response by the types of corona virus enhances the cytokine storm (The molecular biology of coronaviruses, 2006); that could cause dysfunction of respiratory tract and could lead to damaging of the myocardial cells. Same response is being observed in COVID-19.

### 1.3. National Status of COVID-19

In Pakistan Sindh, the first case of the coronavirus disease was reported on 26th February 2020 from a student who returned from Iran that was already highly affected by the disease before any incidence was reported in Pakistan (Coronavirus in Pakistan, 2020). Afterwards, all provinces and districts in Pakistan have reported cases of the disease. Till mid of the 2020 in Asia, Pakistan has the third largest cases of coronavirus infection, but fatality rate (2.12%) has been lower than globally (4.1%) (Coronavirus in Pakistan, 2020).

This paper was aimed to analyze the risk management of COVID-19 in Pakistan along with its epidemiology, administrative strategies, and their impacts on confirmed cases along with recovery and death rates both during first and second wave of COVID-19.

## 2. Methodology

### 2.1. Study design

Study was designed to analyze risk management status of pandemic COVID-19 with reference to decisions taken by management to combat the risk. In Pakistan strict lockdown was observed from March 2020 to July 2020 and later was smart lockdown but educational institutes were remained closed till September 2020. By considering this situation and for appropriate analysis, recent study was divided in two main parts. From March 2020 to July 2020 (duration of strict lockdown) and second from August 2020 to December 2020 (Duration of smart lockdown).

### 2.2. Data collection

Daily data about daily Covid-19 patients, tests performed, recovered cases and daily deaths was collected from daily updates provided by Government of Pakistan and easily accessible to researchers. For second phase data was collected from WHO Pakistan COVID19 situational reports about new cases, recovered, and deaths with reference to global situation.

### 2.3. Data analysis intervals

Data was collected on daily basis for first part as Government of Pakistan observed strict lockdown. After that, for second part, data was collected after every 5 days, when smart lockdown was observed in the country and free mobility was allowed by using proper SOPs.

### 2.4. Statistical analysis

All data was subjected to Arc GIS followed by Mahmood and Malik, 2014 and IBM SPSS statistical analysis version 20 for creating situational maps for first part during strict lockdown. And for second part during smart lockdown data was subjected to IBM SPSS statistical analysis version 20 for descriptive analysis.

### 3. Results

#### 3.1. COVID-19 identification in Pakistan

Pakistan is following the center for disease control and prevention CDC recommendations (Nucleic acid or antigen on priority) to test for coronavirus.

##### 3.1.1. First response

Patients with clear signs of coronavirus are hospitalized as soon as they show symptoms. Proper health care units and quarantine centers are formed with complete personal protective equipment for health workers and patients to cope with the situation. Long term residences such as prisons, camps or shelters are equipped with necessary medical facilities in order to control proliferation of COVID-19 at first step (WHO, 2020).

##### 3.1.2. Second response

Public service messages and campaigns are originated to cause awareness among the public about common symptoms (fever, shortness of breath, cough, chills, body pain, loss of taste and smell, diarrhea, vomiting and sore throat) and prevention of the coronavirus disease (Zhu et al., 2020a,b). Government of Pakistan has also taken the initiative (economic and medical support) (Pakistan Statistical Yearbook, 2020) to motivate and encourage people to fight against the pandemic (WHO, 2020).

Persons with symptoms of corona virus are hospitalized and those recently contacted are quarantined to avoid disease transmission. Samples (oropharyngeal or nasopharyngeal washes and swabs, bronchoalveolar lavage, blood serum, sputum and tracheal aspirates) for testing are taken from people with COVID-19 symptoms or those suspected to have the virus. Sometimes if, test is negative, then specimens are collected again to confirm the status of COVID-19 in the suspected persons. Complete information and guidance for COVID19 is provided on this link [www.covid.gov.pk](http://www.covid.gov.pk) by Government of Pakistan.

#### 3.2. Epidemiological status of coronavirus in Pakistan from March 2020 to July 2020

In order to increase awareness on the spread of the coronavirus disease, the government of Pakistan initiated a system (National Disaster Management Authority Pakistan) that updates daily data on the infection rate, tests conducted, recovery cases and deaths due to the disease.

##### 3.2.1. Day by day COVID-19 tests, confirmed cases, deaths and recoveries

In Pakistan, as at 18th of July 2020, the total confirmed cases of COVID-19 affected patients was 263,496, with total deaths and recoveries at 5,568 and 204,276, respectively, with 1,721,660 tests performed (Fig. 1). At the start of COVID-19 transmission in the country, the number of tests were higher than confirmed cases (Fig. 1). On 11 March 2020, a total of 471 tests were performed with only 20 confirmed cases, 2 recoveries and no death reported. However, as at 18th of July 2020, the ratio of confirmed cases against number of tests had increased. The first death due to coronavirus disease was registered on 18th of March 2020 and a daily increase in death rate had since been recorded. Increase in daily recovery rate has also been recorded and is higher than observed for death rate (Fig. 1).

##### 3.2.2. Status of COVID-19 in all provinces of Pakistan along with capital city of Pakistan

Among the provinces in Pakistan, Province of Sindh has the highest total confirmed and recovery cases (113,007 and 92,037) followed by Province of Punjab (89,793 and 15), as of 18th of July 2020. Also, till date (22,278), number of active cases has always been higher in Province of Punjab (Fig. 2).

##### 3.2.3. COVID-19 hotspot cities of Pakistan during first wave

As at 18th of July 2020, 20 cities (Karachi, Quetta, Lahore, Peshawar, Islamabad, Rawalpindi, Multan, Faisalabad, Gujranwala, Hyderabad, Sukkur, Swat, Ghotki, Sialkot, Larkana, Gujrat, Dera Ghazi Khan, Mardan, Khairpur and Malakand) in Pakistan were highlighted as hotspots of transmission for the coronavirus disease (Fig. 3).

#### 3.3. Epidemiological status of coronavirus in Pakistan from August 2020 to December 2020

Smart lockdown was observed in Pakistan from August 2020 to December 2020.

##### 3.3.1. Weekly COVID-19 confirmed cases, recoveries and deaths

Fig. 4 showed the number of confirmed cases, recoveries and deaths from August 2020 to December 2020 on weekly basis. Number of confirmed cases (319), recoveries (403) and deaths (1) are gradually decreased after observing strict lockdown till 29th of August 2020 but continuous increase in new confirmed cases and death rate is observed during smart lockdown since September 2020 to December 2020 as presented in Fig. 4.

##### 3.3.2. COVID-19 status of Pakistan till 31st December 2020

Total confirmed cases (482178), active (34773), Recoveries (437229) and deaths (10176) in Pakistan till 31st of December 2020 is presented in Fig. 5.

##### 3.3.3. Status of COVID-19 in all provinces of Pakistan

Among the provinces in Pakistan, Province of Sindh has the highest total confirmed and recovery cases (230,718 and 210127) followed by Province of Punjab (147292 and 131825), till 31st December 2020 (Fig. 6).

## 4. Discussion

### 4.1. Administration and management

Government of Pakistan has taken and implemented key steps for both medical and management (Lockdown, Smart lockdown) purposes (UNESCO, 2020). From the medial point of view, Pakistan is following the international standards to provide needed facilities in medical and quarantine centers to properly handle the pandemic (Coronavirus disease, 2020). High flow nasal canola and non-invasive ventilations are reserved for the patients with some symptoms of acute respiratory distress syndrome (ARDS). Room pressures are maintained negative to stop transfer of disease through vapors (WHO, 2020). Early use of inotropes and vasopressors are in practice to avoid worse condition. Previous studies regarding SARS are also in consideration in order to significantly reduce mortality rate. Also, various steps are taken to avoid possible damage of organs, especially in diabetic and delayed tested patients (corona virus in Pakistan 2020).

Currently, no definite therapy or treatment has been approved for corona virus. However, few medicines and treatments (Chloroquine, convalescent plasma, intra-venous immunoglobulin, favipiravir and tocilizumab) that have been recommended by Centre

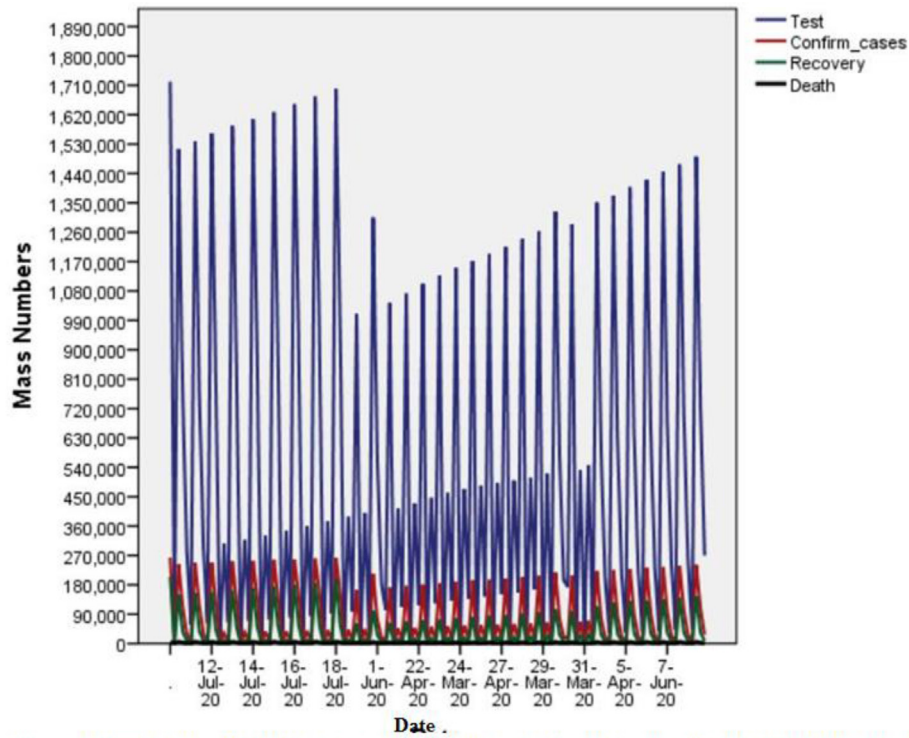


Fig. 1. Day by day COVID-19 tests, confirmed cases, deaths and recoveries in Pakistan till 18th of July 2020.

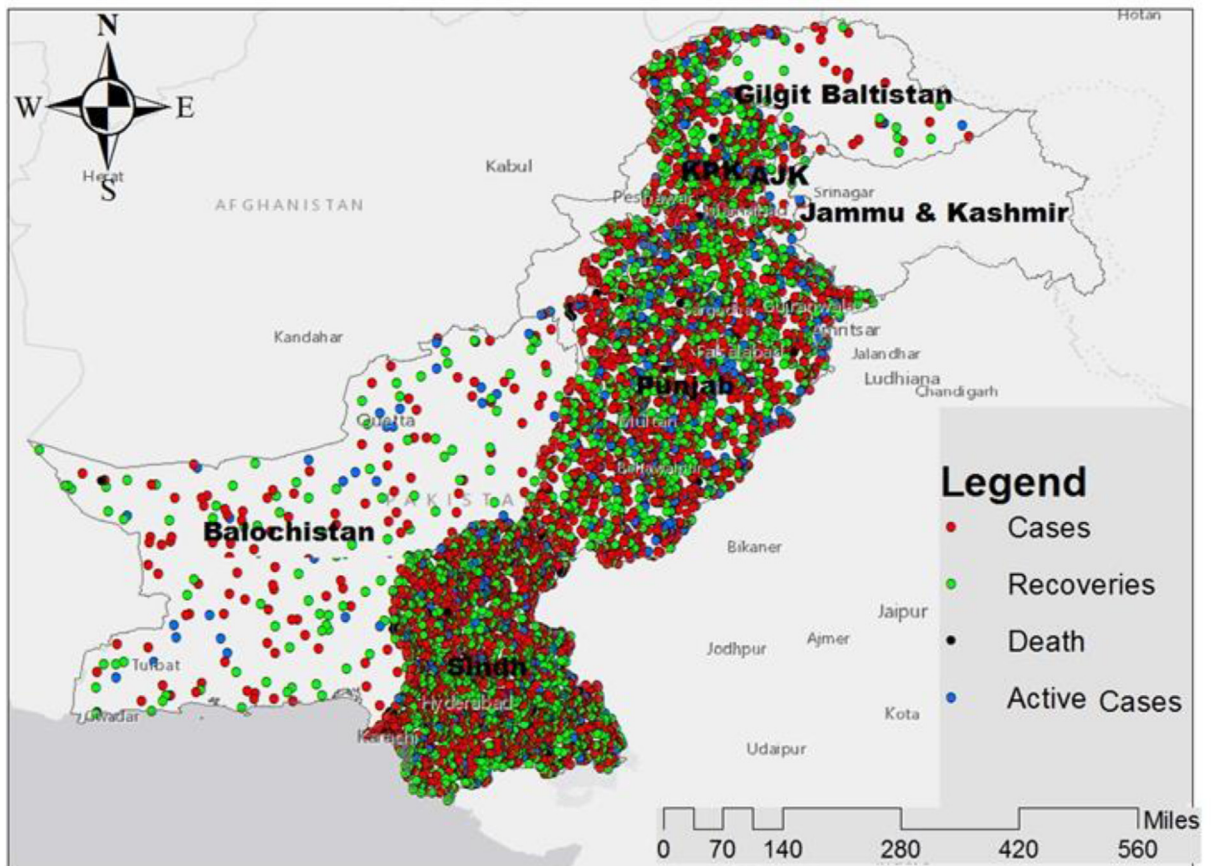


Fig. 2. Status of COVID-19 in all Provinces of Pakistan along with Captial City of Pakistan till 18th of July 2020.

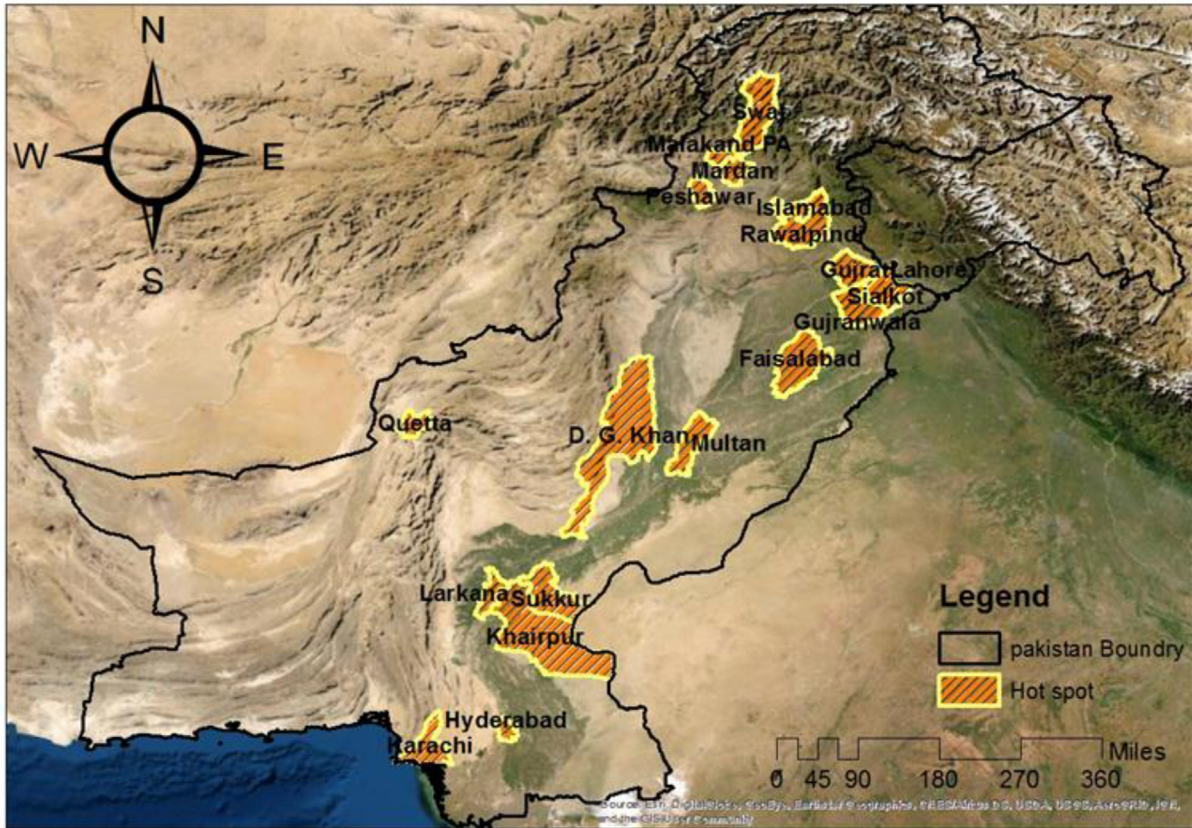


Fig. 3. COVID-19 hotspot cities of Pakistan till 18th of July 2020 (First wave).

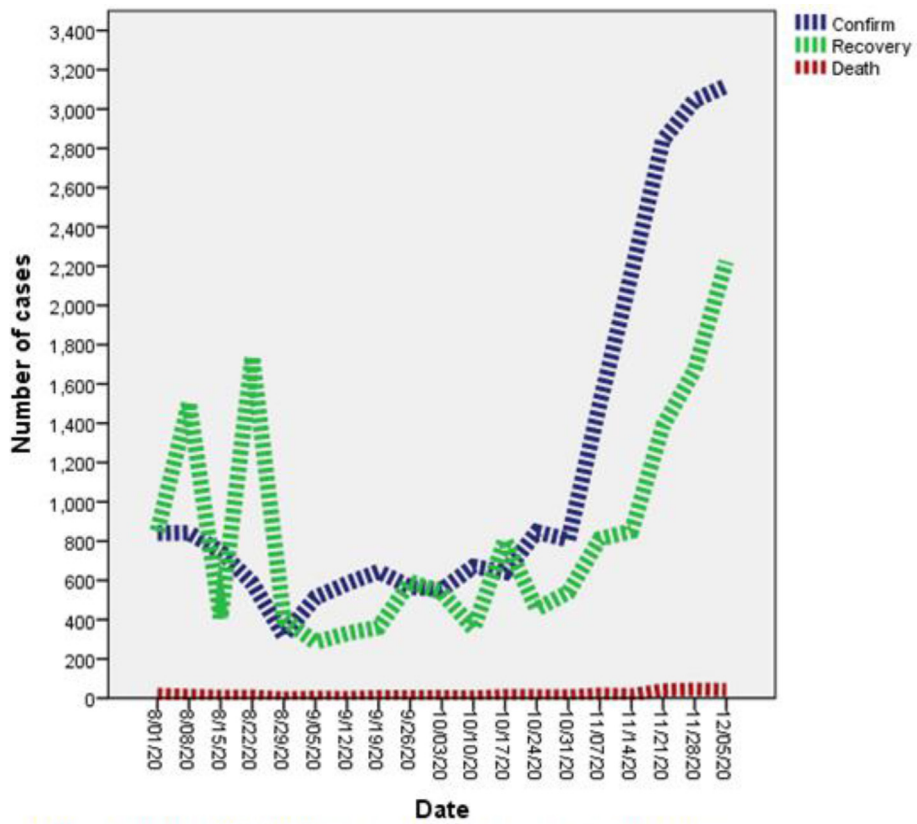


Fig. 4. Weekly COVID-19 confirmed cases, recoveries and deaths.

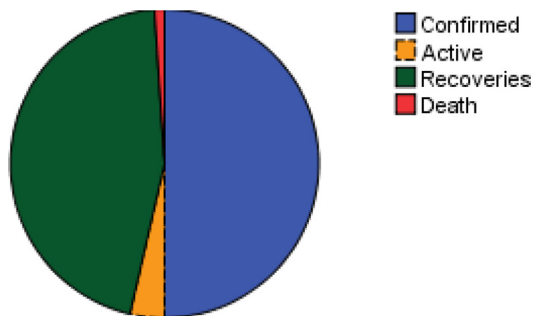


Fig. 5. COVID-19 Status of Pakistan till 31st December 2020.

for disease control and prevention (CDC) are being used in Pakistan to cure general symptoms of the coronavirus disease. Which resulted in gradual decrease in corona virus cases while observing strict lockdown during first wave as resented in Fig. 1? All precautionary measures are taken to prevent the spread of the virus but relaxation in lockdown and chances of close contact of people cause increase in COVID-19 cases in Pakistan as given in Fig. 4.

#### 4.2. Transference and contagion

Transfer of disease can be calculated by reproductive number and this term is represented as R0 (Yu et al., 2020). Normally R0 is dependent on number of new cases caused by an infected person. R0 of SARS coronavirus –2 is reported from 1.5 to3.5 while R0 of measles and influenza is reported 12e18 and 2e3 respectively. Literature showed that infectious rate of measles was highest than corona virus; R0 for SARS-2003 was estimated as 2.75 (Yu et al., 2020). But an individual’s mobility causes significant impact

on R0 of virus (Yu et al., 2020). That an infected person could transfer disease rapidly or slowly is the main factor in calculating R0. Patient with ability to transfer disease rapidly is the point of focus in epidemiology; same in case of current COVID-19 transmission (Cui et al., 2019). According to the WHO, the primary factor in transfer of the coronavirus disease is through droplets released from infected person when coughing, sneezing or talking. Same trend is observed in Pakistan (Fig. 1 and Fig. 4). Depending on the type of surface, the coronavirus could remain viable for a long time. For example, in the air, on smooth surface, in aerosols, on stainless steel, on plastic, and on cardboard the virus could remain alive for up to 1.1 h, 5.6 h, 6.8 h and 72 h, respectively (Corona virus in Pakistan 2020). Thus, the transmission of the corona virus is easier, infectious and rapid. Researchers investigated that pandemic corona virus disease infects gastrointestinal glandular epithelial cells by staining of RNA and intracellular nucleocapsid protein of the virus, So the cases of corona virus were higher in the cities are more important for business point view and had higher chances of communication (Fig. 2 and Fig. 3). Studies also reported that COVID-19 infected patients showed positive results when the feces were tested, even after negative test was obtained from testing the respiratory tract (Xiao et al., 2020), suggesting the possibility of transferring the virus through contact with feces (Xiao et al., 2020). COVID-19 is not transferable or not transferable through the placenta from positive mother to baby is a transition matter (Vivanti et al., 2020). But there are chances to transfer corona virus from mother to baby during birth. High level precautions could save the baby from infection due to corona virus. Normal incubation duration for COVID-19 is estimated at 5.1 days but all persons who got infected with corona virus will observe symptoms within two days and average 14 days are recommended for observation and quarantine for COVID-19 positive persons. Studies

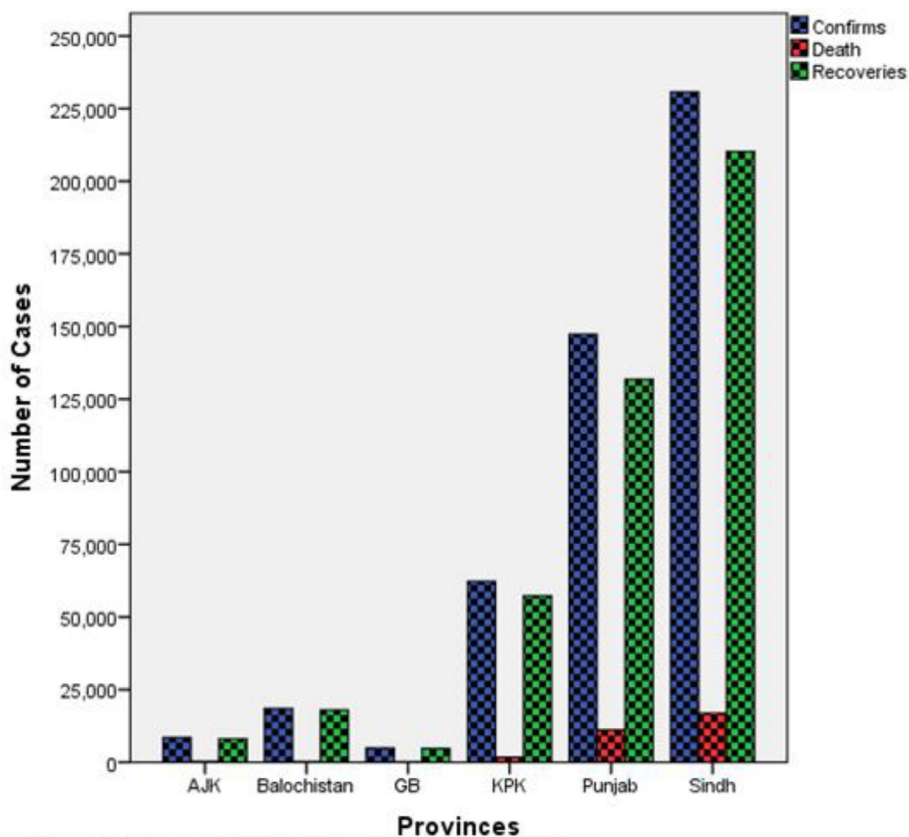


Fig. 6. Status of COVID-19 in all Provinces of Pakistan.

suggested that 14 days are enough to observe if, an individual is infected or not with the COVID-19.

#### 4.3. Clinical expression

Current study investigated that Government of Pakistan used multiple options to cause awareness among common public about clinical expressions in affected persons as mentioned earlier. Important information shared on website [www.covid.gov.pk](http://www.covid.gov.pk) also matched with literature that patients of corona virus respond differently to the disease depending on their age, immunity and health conditions. The most common symptoms are fever, dyspnea, cough, fatigue, myalgia, pneumonia and imbalance leukocytes count. Patients could face improper organ functions like shock or respiratory stress, cardiac or kidney injury or even death in severe cases. Approximate time to cause pneumonia is 5 days on average. Older patients (>50 years) have a higher chance of acute injuries due to COVID-19. Infected person with severe symptoms could have more laboratory complexities (Wang et al., 2020). Mortality rate is higher in infected persons who have higher troponin T levels because it can cause myocardial injuries (Guan et al., 2020).

#### 4.4. Medical care and cure

Currently, vaccine procedures and experiments are being conducted globally. Precautionary measures, such as wearing of masks, social distancing, use of sanitizers and sprays, are being taken to avoid the spread of the coronavirus disease; also, consumption of nutrition food is advocated in order to build immunity (Corona virus in Pakistan 2020). Elderly infected persons are prone to the disease due to poor immunity (Cromley et al., 2018). Further studies are being conducted to conclude easy target and health concerns regarding COVID-19.

### 5. Conclusion

Pandemic COVID-19 made it clear to every person that where they stand regarding their economic and health conditions. Many human rights organizations (Governmental and non-governmental) acted actively to raise awareness about human rights and to take care of each other. Current study concluded that strict and smart lockdown during first and second wave of COVID-19 in Pakistan added positively in combating the situation (Corona virus in Pakistan 2020). More economic and health facilities are required with every passing day globally and in Pakistan. Government of Pakistan has taken many steps to share data and information about COVID-19 with low- and high-income public equally. Website ([www.covid.gov.pk](http://www.covid.gov.pk)) is designed and updated on daily basis by pointing out the hospitals and centers specified for corona virus (Critical preparedness 2020). Furthermore; Government of Pakistan is considering the impacts of disease on economy and formulating policies to control problems (both social and health) seemed to be faced in future.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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