

The first two months epidemiological study of COVID-19, related public health preparedness, and response to the ongoing epidemic in Pakistan

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Abstract

As an underdeveloped country, the coronavirus disease 2019 (COVID-19) epidemic has posed a major risk to the health and economy of Pakistan. The SIR (susceptible–infected–recovered) model of epidemiologic analysis predicts that there should have been more cases since late March 2020 in Pakistan. We therefore sought to investigate COVID-19's prevalence and epidemiologic trends in Pakistan. Research for COVID-19 is still in its early stages, so data were collected from official websites and research journals, then analyzed for the disease's prevalence, epidemiology, mortality and recoveries. The results indicated that a rapid increase had indeed occurred in the number of COVID-19 infections in Pakistan, with the first case reported on 25 February, 2020. From 25 February 25 to April, 2020, COVID-19 infected 11,155 people in Pakistan, with 237 deaths (2.12%) and 2527 recoveries (19.96%). We found a statistically significant positive correlation between the prevalence of COVID-19 and the mortality ratio ($r = 0.983$, $r^2 = 0.966$; $p \leq 0.05$). We concluded that proper management must be undertaken to improve the quarantine system, and the World Health Organization guidelines must be closely followed to cope with COVID-19. There is no vaccine for COVID-19, so antiviral drugs (interferon alfa, ribavirin) may be useful to prevent COVID-19; however, severe control measures implemented in China have significantly mitigated the spread of COVID-19. Suspected and confirmed cases must be treated in separate rooms. Staying home and social distancing are the safe way to proceed.

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Introduction

Infections caused by viruses are the most rapidly increasing infections worldwide, and they cause serious health concerns [1]. In late December 2019, a novel human coronavirus outbreak started in Wuhan, Hubei province, People's Republic of China,

that subsequently spread to dozens of other countries, becoming a global pandemic. Wuhan is a big city located in Hubei province, where serious pneumonia cases of unknown cause emerged [2]. Severe acute respiratory syndrome (SARS) coronavirus 2 (CoV-2) is a novel type of zoonotic virus that causes respiratory illness [3]. Initially, coronavirus disease 2019 (COVID-19) infection manifests nonspecifically, with signs and symptoms of headache, cough, shortness of breath, fever and diarrhoea [4]. Consensus has it that the coronavirus infection traveled to humans from a bat consumed by an inhabitant of Wuhan [5]. The genome sequencing of COVID-19 had an about 88% similarity with bat-SL-CoV-ZC45 [6] and was 96.2% identical to bat CoV-RaTG13 [7]. However, another study suggested transmission to humans via snakes, turtles or pangolins [8].

In February 2020, the World Health Organization (WHO) designated this disease coronavirus disease 2019 [9]. WHO declared an international emergency [2] because coronavirus is the major type of virus that primarily targets humans [10]. As a result of the rising number of suspected and confirmed cases of COVID-19 in Wuhan, China has created a severe worldwide health risk [11]. Pakistan borders are connected to China and Iran, both of the countries are seriously under the COVID-19 pandemic [12]. COVID-19 has been found to have a higher rate of transmission than SARS [10]. Pakistan's ministry of health confirmed the first COVID-19 case on 26 February 2020 in Karachi, Sindh province [12]. China has faced a peak period of COVID-19 and is now moving slowly towards normal because certain positive steps were taken. But dozens of countries remain under attack by this serious novel viral infection. COVID-19 is a very serious issue for public health, especially for the immunodeficient population. Most seriously infected people are already hospitalized and quarantined, but it is important that healthy individuals follow the WHO's guidelines so we can tackle the grave issue of COVID-19.

As a result of the disease's high prevalence and continuing circulation, we decided to query electronic research databases to collect current basic knowledge regarding COVID-19 and its epidemiology, prevalence and prevention measures. To help us learn how to prevent further spread of COVID-19, we designed an e-searching-based study, in which some measures were adjusted to control for the further dispersal of COVID-19.

Patients and methods

The current study was conducted in the School of Life Sciences, Lanzhou University, China. We conducted a database search of the following in Pakistan: prevalence, epidemiology, number of confirmed cases, number dead and recovery rate. The specific data was a search by keywords (terms used were: coronavirus, current

outbreak, Wuhan outbreak, COVID-19, severe acute respiratory syndrome, SARS) in different electronic databases like Science Direct, PubMed, Google Scholar, BioMed Central and the Lancet. Data of COVID-19 infection in Pakistan were collected from 25 February 2020 to 24 April 2020. These data consisted of the total number of cases, new emerging cases per day, total number of deaths and total recovered individuals in Pakistan.

Case collection

Up-to-date cases of COVID-19 were collected by searching for data available at official websites. The following were the most important websites we consulted: <https://www.nih.org.pk/>, <http://www.covid.gov.pk/> and <https://www.who.int/>.

Ethical statement

In the current study, data were collected from official websites and research documented databases for COVID-19 infection in Pakistan, so ethical approval was not required for these publicly available deidentified data sets.

Comparison of Pakistan with other countries

We compared the prevalence, mortality and number of recoveries in Pakistan with COVID-19 infections in some other countries that reported their first case on the same day as, or a day close to, Pakistan.

Statistical analysis

The collected data were analysed. Results were expressed as numbers and percentages. To find correlation, a linear regression test was applied. $p < 0.05$ was considered statistically significant. All statistical analysis was performed by SPSS Statistics 23 software (IBM, Armonk, NY, USA).

Results

Our data were compiled from publicly available information. The current outbreak is spreading day by day—a fact reflected by our model's fitting a curve to existing data—but we cannot predict the peak. Therefore, we assessed more current data, till 24 April 2020. **Table 1** lists the total number of cases, new cases per day, number of dead and number of recoveries for each date (25 February to 24 April 2020). More than 190 countries have been affected by the COVID-19 outbreak [1].

Confirmed cases till 24 April 2020

The number of cases varied daily. **Table 1** lists the daily emerging cases regarding COVID-19 in Pakistan till 24 April 2020, showing that the number jumps daily. The first confirmed case was documented on 25 February 2020 in Pakistan, but

now, as of 24 April 2020, the confirmed cases in Pakistan number 11 155, which is far fewer than some other countries have reported (Fig. 1). The toll death rate in Pakistan on 25 March, 2020 was 0.70% but has increased to 2.26% in late April, 2020. The toll death rate is still less than some other countries, like the United States (5.63%), Spain (10.20%), Italy (13.50%) and Germany (3.73%). The overall data were analysed and found to be statistically significant ($p < 0.05$, $\chi^2 = 21.428571$).

Correlation of total infected cases and death ratio reported with COVID-19

The COVID-19 correlation analysis assessing the total number of cases and the number of deaths in Pakistan showed significant correlation ($r = 0.985$, $r^2 = 0.970$); the overall data were statistically significant ($p < 0.05$). Moreover, the total number of confirmed cases was correlated to the total number of deaths ($r = 0.717$).

Cases per day

Initially, the number of COVID-19–positive cases was small in Pakistan, but the number of confirmed cases has been gradually rising day by day. In the pandemic’s first month, there were only 991 confirmed cases, with seven deaths and 19 recoveries. A rapid increase in confirmed cases started at the end of March 2020, as was predicted by the SIR (susceptible–infected–recovered) model of epidemiologic analysis. Statistically, the number of total cases and the number of new cases per day are correlated to each other ($r = 0.855$, $r^2 = 0.495$). Both cases are statistically significant ($p \leq 0.05$; Fig. 2).

Correlation coefficient of deaths and number of recoveries

Comparatively, the death toll (2.12%) is far smaller than the number of recovered cases (19.96%), according to Pakistan’s official ministry website. Statistically, there is a correlation ($r = 0.990$, $r^2 = 0.981$) between deaths and the number of recovered cases. The numbers of deaths and recovered cases were statistically significant ($p \leq 0.05$; Fig. 3).

Preventative measures and treatment

SARS-CoV-2 is novel, so there is neither a vaccine nor a specific drug for its treatment. The only way to reduce the chances of COVID-19 infection is to follow some simple measures. We mentioned earlier that Pakistan received 78% of its new cases from Iran [13], so the borders between Pakistan and Iran must soon close. Till now, Pakistan has had a lack of testing facilities, so visitors to the country had to be quarantined. In major cities, Pakistan has put a partial lockdown in place. Indeed, a focus must be placed on the complete lockdown of main cities.

TABLE I. COVID-19 cases in Pakistan from February 25 to April 24, 2020

Total cases	New cases	Recovered	Death	Date
2	0	0	0	25 February
4	2	0	0	29 February-2 March
6	2	0	0	3 March
16	10	0	0	4-10 March
19	3	0	0	10-12 March
20	1	0	0	13 March
21	1	0	0	14 March
28	7	1	0	15 March
52	24	1	0	16 March
187	135	3	0	17-18 March
241	54	3	2	19 March
461	220	3	2	20 March
495	34	5	3	21 March
730	235	5	3	22 March
875	145	6	6	23 March
991	116	19	7	24 March
1057	66	21	8	25 March
1197	211	25	9	26 March
1408	140	27	11	27 March
1526	118	30	13	28 March
1625	99	34	18	29 March
1865	240	60	25	30 March
2039	174	84	26	31 March
2289	250	109	31	1 April
2450	161	109	34	2 April
2708	258	113	39	3 April
2880	172	133	44	4 April
3287	407	220	49	5 April
3864	557	292	53	6 April
4074	210	330	57	7 April
4317	243	445	63	8 April
4598	281	600	66	9 April
4778	180	635	71	10 April
5011	233	635	77	11 April
5038	27	704	86	12 April
5374	336	987	89	13 April
5716	342	1055	100	14 April
5985	269	1254	117	15 April
6528	243	1374	128	16 April
7025	797	1441	136	17 April
7479	454	1868	159	18 April
7993	514	1970	176	19 April
8420	427	2066	192	20 April
9216	796	2156	209	21 April
9771	555	2337	224	22 April
10,513	742	2527	237	23 April
11,155	642	2755	253	24 April

Linear Regression: $P < 0.05$ Chi Square: 21.428571.
 Data collected from official websites (<https://www.nih.org/pki/>, <http://www.covid.gov.pk/>, <https://www.who.int/>). COVID-19, coronavirus disease 2019.

Discussion

Today the world is facing the problem of the current pandemic. This journey started from a single place in China. Now COVID-19 has infected many populations across the globe. In the current study, we investigated the current situation of COVID-19 infections and its disastrous results in Pakistan. We also compiled data regarding the epidemiology, mortality and recovery rate of COVID-19 in Pakistan. To date, there were >11 000 confirmed cases in Pakistan, with >250 deaths and >2800 recovered individuals in the first 2 months after the emergence of the first reported case on 25 February 2020. The COVID-19 infection has not yet reached its peak; it is spreading day by day, and globally it has infected 1.9 million, with more

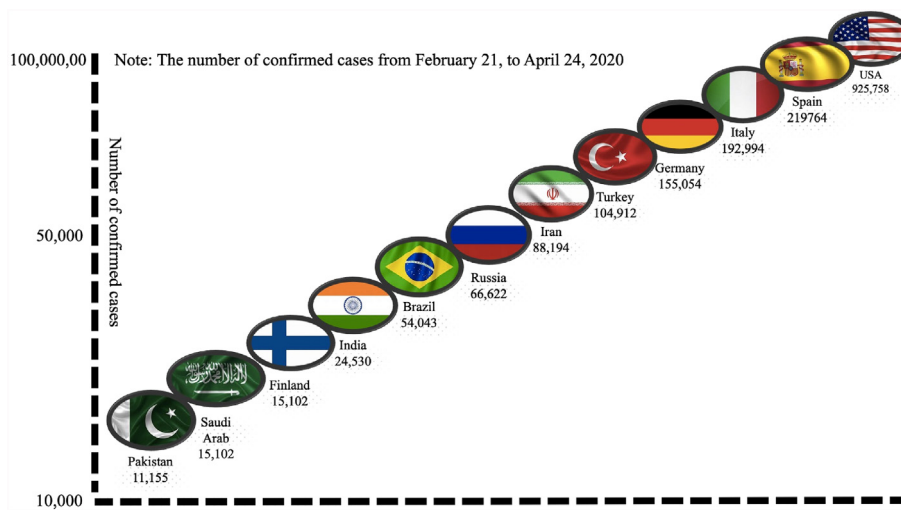


FIG. 1. Confirmed cases of COVID-19 in different countries including Pakistan from 21 February to 24 April, 2020.

than 120 000 dead [14]. The current mean growth factor for death is 7.86% globally and 2.26% in Pakistan.

Consensus has it that COVID-19 jumped to a human from a bat when it was consumed as food [15], so it is a zoonotic disease [16], with human-to-human transmission also possible via droplets [1]. This is why it has a global reach despite having begun in a single place [17]. In the United States, the first case was reported on 19 January 2020 [18]. After that, on 24 January 2020, France reported its first case. Pakistan received the report of its first case much later than other countries, on 24 February 2020 [19], but even then, Pakistan had a smaller number of confirmed cases and fewer deaths because after the declaration of the COVID-19 pandemic, the government of Pakistan took several positive steps to cope with the outbreak [20]. However, we cannot exclude the notion that the low rates of infection in Pakistan could be due to some environmental factors or perhaps innate immunity. In addition, because of its later start in the country, the public of Pakistan immediately received high doses of medicine; this may perhaps have helped enhance their immune systems, and may have affected morbidity and mortality.

To our knowledge, ours is the first study to study the prevalence and epidemiology of COVID-19 in Pakistan, thereby contributing to the knowledge base that will permit research regarding the control of COVID-19 to move beyond its initial stages. Right now, at this stage of the pandemic, the mantra needs to be ‘stay home, stay safe.’ China faced its peak stage of COVID-19, and today China is moving back to normal because of strict quarantine measures and good compliance with public health directives. Countries with no cases of COVID-19 or with smaller numbers of cases should practice isolation, testing and social distancing [21]. A recent study regarding the control

of COVID-19 focused on certain steps taken by government of China; according to Tian et al. [22], the Chinese government initially banned travel to and from Wuhan. The country’s educational ministry postponed the spring session, and finally, on 30 January 2020, 14 000 transport terminals were changed into health checkpoints. The cases decreased by 10% as a result of strict social distancing [23]. We emphasize that research gaps must be urgently addressed regarding COVID-19 and its treatment.

Conclusion

The results of our study of current cases mirrors that of the situation of the outbreak as a whole, which is spreading worldwide day by day. Massive efforts have been undertaken, including quarantine, travel restrictions, and closure of

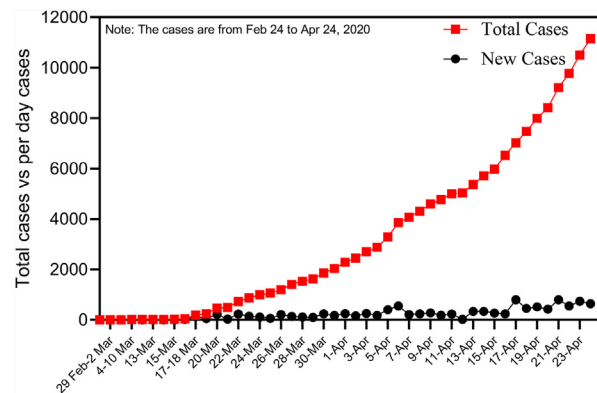


FIG. 2. Correlation coefficient between number of confirmed cases and number of new cases per day, 25 February to 24 April 2020.

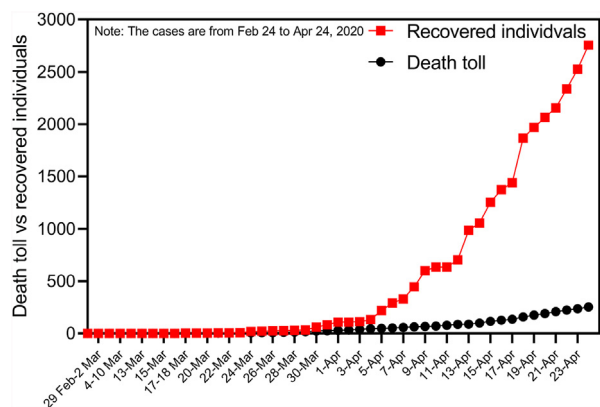


FIG. 3. Correlation between number of deaths and number of recovered individuals per day, 25 February to 25 April 2020.

restaurants and shopping malls. The SIR model of epidemiologic analysis predicted more cases since 26 March 2020 in Pakistan. There was indeed a rapid increase in the number of confirmed cases of COVID-19 in late March. We concluded that the rapidly increasing number of COVID-19 infections is due to unsatisfactory quarantine as well as mismanagement, especially along the border with Iran. Special quarantine sites must be established, and the WHO guidelines must be followed to cope with COVID-19. Finally, we suggest that COVID-19–infected countries follow China’s strategies for winning the battle against COVID-19.

Conflict of Interest

None declared.

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