Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
1. Introduction

A novel coronavirus (nCoV-2) has been reported first from the city of Wuhan, situated in Southern part of China. This deadly virus is initially predicted for its human to human transmission. D. Paraskevis et al. has performed a detail comparison analysis of BatCoV RaTG13 with nCoV-2 virus sequences in January 2020 [1].

There is 96.3% pattern similarity obtained between novel coronavirus with Bat-SARS like corona virus. Because of the genetic pattern matching between these two virus sequences, a general hypothesis came into existence that the nCoV-2 originated from bats. After having approx. 40,000 active corona virus cases across the world, this comparison theory has got faded because of the dissimilarity of fatality rate. The World Health Organization (WHO) estimated the overall fatality rate for severe acute respiratory syndrome (SARS) patients at 14%–15%, significantly higher than nCoV-2. The agency estimated the rate for people older than 64 years to be more than 50% for SARS cases [2]. S.K. Lau et al. reported a research report on SARS coronavirus-like virus in Chinese horseshoe bats in 2005 [3].This deadliest coronavirus resource has been cultured deeply by W. Li, where in 2005 W. Li has described that bats are the natural reservoirs of SARS-like corona viruses [4]. In 2012, A.M. Zaki et al. emphasises on severe pneumonia can also be the first stage of novel coronavirus, that actually transmitted from human to human [5]. Recent literature survey report of novel corona virus from patients with Pneumonia in China in 2019 has been reported by N. Zhu et al. in 2020 [6]. There are many related literature surveys highlighted on pneumonia outbreak in humans and its
potential bat origin [7,8]. The WHO also reported that the virus has caused a casualty of over 16,600 people worldwide with more than 380,000 people confirmed as infected by it, of which more than 10,000 cases are serious as of March last week of the year 2020.

The four stages of the COVID-19 are defined in a methodical way. If the people traveled abroad and test positive, then it is considered as stage-1. In this case, the cases are imported from and affected foreign countries and the disease has not been spread in any local area. If the local transmission is happened and a few local people have been affected from the people who traveled abroad and bring the virus inside the country, then it is considered as a stage-2. In these cases, the source is always known and the numbers of affected people are minimal. In this stage, fast action for self-quarantine is possible. In the third stage, the community transmission is happened from an infected person who cannot be identified. Stage-4 is when the virus has rapidly spread and takes the shape of pandemic which cannot be controllable. China, Italy, etc., have already dealt with this situation.

Since the data on COVID-19 are changing on daily basis, therefore it is becoming very difficult to provide real-time statistics for the affected, recovered, and casualties. However, a few emerging characteristics for this novel coronavirus are highlighted based on some initial study reports. It is reported that the case-fatality-rate (CFR) for coronavirus was 2.3%, initially; however, the age group of 70—79 has an 8% CFR, and CFR is 14.6% for those more than 80 years old [9]. This means that the virus has a stronger impact on the aged population. In recent times, this novel virus has also gripped on animals reported by the Economic Times [10]. The report said that it was believed that the virus may get transmitted from the caretaker of a zoo in the United States of America to four tigers. However, the caretaker was found asymptotic at that time. The animals were tested as coronavirus positive, developed dry cough and loss of appetite.

Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness. WHO reported that the best way to prevent and slow down transmission is be well-informed about the COVID-19 virus, the disease it causes, and how it spreads. Protecting ourselves and others from this emerging infection by washing our hands or using an alcohol-based rub frequently and not touching facial regions of human body. This coronavirus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, therefore the WHO clearly stated every human being to practice respiratory etiquette, for example, by coughing into a flexed elbow.

Currently, there are no specific vaccines or treatments for COVID-19. However, there are many ongoing clinical trials evaluating potential treatments.
2. Literature survey of situation report by World Health Organization

The WHO [11] provides the official situation report on COVID-19 every day. It started giving the official reports since January 21, 2020 and as of now (Date: April 8, 2020) they have issued 78 Situation Report [12] on the COVID-19 for the whole world. The research focuses on 15 important countries throughout the world that contains the highest number of COVID cases as on April 8, 2020. Table 8.1 demonstrates the total number of confirmed cases, number of deceased, and the popularity density of the corresponding country of top 15 countries, India, and its subcontinental countries.

After collecting the data for Tables 8.1 and 8.2, Tables 8.3 and 8.4 have been designed to collect the data for eight periodic situation reports with interval 10 issued by WHO. It further compares all the report with the popularity density of the corresponding country as the COVID-19 is directly proportional to the distance maintained by people.

The above analysis in Table 8.3 and Fig. 8.1 illustrate the total number of corona confirmed cases in top 15 counties based on eight periodic situation reports issued by WHO. From this graph, it is clearly visible that China has taken the strict action against COVID-19 through which they could control the total number of new cases in last few months. But in the case of USA, it grows almost exponentially in last 20 days (in last two days).

| Sl no. | Country name               | Total confirmed cases | Total deaths | Popularity density (per km²) | 1st case is reported on |
|--------|-----------------------------|-----------------------|--------------|------------------------------|-------------------------|
| 1      | United States of America    | 333,811               | 9559         | 36                           | 24-01-2020              |
| 2      | Spain                       | 135,032               | 13,055       | 94                           | 03-02-2020              |
| 3      | Italy                       | 132,547               | 16,525       | 206                          | 31-01-2020              |
| 4      | Germany                     | 99,225                | 1607         | 240                          | 28-01-2020              |
| 5      | China                       | 83,071                | 3340         | 145                          | 17-11-2019              |
| 6      | France                      | 73,488                | 8896         | 117.37                       | 26-01-2020              |
| 7      | Iran                        | 60,500                | 3739         | 50.96                        | 20-02-2020              |
| 8      | The United Kingdom          | 51,612                | 5373         | 281                          | 01-02-2020              |
| 9      | Turkey                      | 30,217                | 649          | 110                          | 12-03-2020              |
| 10     | Switzerland                 | 21,574                | 715          | 219                          | 26-02-2020              |
| 11     | Belgium                     | 20,814                | 1632         | 383                          | 05-02-2020              |
| 12     | Netherlands                 | 18,803                | 1867         | 488                          | 28-02-2020              |
| 13     | Austria                     | 12,297                | 220          | 109                          | 26-02-2020              |
| 14     | Republic of Korea           | 10,331                | 192          | 503                          | 25-01-2020              |
| 15     | Australia                   | 5844                  | 42           | 3.1                          | 25-01-2020              |
Table 8.2  Corona situation report by World Health Organization of India and sub-continental countries as on April 8, 2020.

| Sl no. | Country name | Total confirmed cases | Total deaths | Popularity density (per km²) | 1st case is reported on |
|--------|--------------|-----------------------|--------------|------------------------------|-------------------------|
| 1      | India        | 4067                  | 109          | 462                          | 30-01-2020              |
| 2      | Bhutan       | 5                     | 0            | 18                           | 06-03-2020              |
| 3      | Bangladesh   | 123                   | 12           | 1115.62                      | 09-03-2020              |
| 4      | Sri Lanka    | 176                   | 5            | 341                          | 28-01-2020              |
| 5      | Pakistan     | 3864                  | 54           | 287                          | 27-02-2020              |
| 6      | Nepal        | 9                     | 0            | 201                          | 25-01-2020              |

Table 8.3  Corona situation report by World Health Organization of 15 countries as on April 8, 2020.

| Sl no. | Country name | 1st case is reported on | World Health Organization situation report no. | Date of issuance | Total confirmed cases | Total confirmed new cases | Total deaths | Total | Popularity density (per km²) |
|--------|--------------|-------------------------|-----------------------------------------------|------------------|-----------------------|--------------------------|--------------|-------|------------------------------|
| 1      | United States of America | 24-01-2020 | 78 | 07-04-2020 | 333,811 | 26,493 | 9559 | 36 |
|        |              |            | 68 | 28-03-2020 | 85,228 | 16,894 | 1243 |
|        |              |            | 58 | 18-03-2020 | 3536 | 1822 | 58 |
|        |              |            | 48 | 08-03-2020 | 213 | 0 | 11 |
|        |              |            | 38 | 27-02-2020 | 59 | 2 | 0 |
|        |              |            | 28 | 17-02-2020 | 15 | 2 | 0 |
|        |              |            | 18 | 07-02-2020 | 12 | 2 | 0 |
|        |              |            | 8 | 28-01-2020 | 5 | 0 | 0 |
| 2      | Spain        | 03-02-2020 | 78 | 07-04-2020 | 135,032 | 4273 | 13,055 | 94 |
|        |              |            | 68 | 28-03-2020 | 64,059 | 7871 | 4858 |
|        |              |            | 58 | 18-03-2020 | 11,178 | 1987 | 491 |
|        |              |            | 48 | 08-03-2020 | 430 | 56 | 5 |
|        |              |            | 38 | 27-02-2020 | 12 | 0 | 10 |
|        |              |            | 28 | 17-02-2020 | 2 | 0 | 2 |
|        |              |            | 18 | 07-02-2020 | 1 | 0 | 1 |
|        |              |            | 8 | 28-01-2020 | - | - | - |
Table 8.3  Corona situation report by World Health Organization of 15 countries as on April 8, 2020.—cont’d

| Sl no. | Country name | 1st case is reported on | World Health Organization situation report no. | Date of issuance | Total confirmed cases | Total confirmed new cases | Total deaths | Popularity density (per km²) |
|--------|--------------|--------------------------|-----------------------------------------------|------------------|----------------------|--------------------------|-------------|----------------------------|
| 3 Italy | 31-01-2020   | 78                       | 07-04-2020                                   | 132,547          | 3599                 | 16,525                   | 206         |                            |
|        |              | 68                       | 28-03-2020                                   | 86,498           | 5959                 | 9136                     |             |                            |
|        |              | 58                       | 18-03-2020                                   | 31,506           | 3526                 | 2503                     |             |                            |
|        |              | 48                       | 08-03-2020                                   | 5883             | 1247                 | 234                      |             |                            |
|        |              | 38                       | 27-02-2020                                   | 400              | 121                  | 12                       |             |                            |
|        |              | 28                       | 17-02-2020                                   | 3                | 0                    | 0                        |             |                            |
|        |              | 18                       | 07-02-2020                                   | 3                | 3                    | 0                        |             |                            |
|        |              | 8                        | 28-01-2020                                   | –                | –                    | –                        |             |                            |
| 4 Germany | 28-01-2020 | 78                       | 07-04-2020                                   | 99,225           | 3834                 | 1607                     | 240         |                            |
|        |              | 68                       | 28-03-2020                                   | 48,582           | 6294                 | 325                      |             |                            |
|        |              | 58                       | 18-03-2020                                   | 7156             | 1144                 | 13                       |             |                            |
|        |              | 48                       | 08-03-2020                                   | 795              | 156                  | 0                        |             |                            |
|        |              | 38                       | 27-02-2020                                   | 21               | 2                    | 1                        |             |                            |
|        |              | 28                       | 17-02-2020                                   | 16               | 2                    | 0                        |             |                            |
|        |              | 18                       | 07-02-2020                                   | 3                | 3                    | 0                        |             |                            |
|        |              | 8                        | 28-01-2020                                   | 1                | 0                    | 0                        |             |                            |
| 5 China | 17-11-2019   | 78                       | 07-04-2020                                   | 83,071           | 66                   | 3340                     | 145         |                            |
|        |              | 68                       | 28-03-2020                                   | 82,213           | 135                  | 3301                     |             |                            |
|        |              | 58                       | 18-03-2020                                   | 81,116           | 39                   | 3231                     |             |                            |
|        |              | 48                       | 08-03-2020                                   | 80,859           | 46                   | 3100                     |             |                            |
|        |              | 38                       | 27-02-2020                                   | 78,630           | 439                  | 2747                     |             |                            |
|        |              | 28                       | 17-02-2020                                   | 70,635           | 2051                 | 1772                     |             |                            |
|        |              | 18                       | 07-02-2020                                   | 31,211           | 3151                 | 637                      |             |                            |
|        |              | 8                        | 28-01-2020                                   | 4537             | –                    | –                        |             |                            |
| 6 France | 26-01-2020 | 78                       | 07-04-2020                                   | 73,488           | 3881                 | 8896                     | 117.37      |                            |
|        |              | 68                       | 28-03-2020                                   | 32,542           | 3756                 | 1991                     |             |                            |
|        |              | 58                       | 18-03-2020                                   | 7652             | 1079                 | 175                      |             |                            |
|        |              | 48                       | 08-03-2020                                   | 706              | 93                   | 10                       |             |                            |
|        |              | 38                       | 27-02-2020                                   | 18               | 7                    | 2                        |             |                            |
|        |              | 28                       | 17-02-2020                                   | 12               | 0                    | 1                        |             |                            |
|        |              | 18                       | 07-02-2020                                   | 6                | 0                    | 0                        |             |                            |
|        |              | 8                        | 28-01-2020                                   | 3                | 0                    | 0                        |             |                            |
| 7 Iran  | 20-02-2020   | 78                       | 07-04-2020                                   | 60,500           | 2274                 | 3739                     | 50.96       |                            |
|        |              | 68                       | 28-03-2020                                   | 32,332           | 2926                 | 2378                     |             |                            |
|        |              | 58                       | 18-03-2020                                   | 16,169           | 1178                 | 988                      |             |                            |
|        |              | 48                       | 08-03-2020                                   | 5823             | 1076                 | 145                      |             |                            |
|        |              | 38                       | 27-02-2020                                   | 141              | 28                   | 22                       |             |                            |
|        |              | 28                       | 17-02-2020                                   | –                | –                    | –                        |             |                            |
|        |              | 18                       | 07-02-2020                                   | –                | –                    | –                        |             |                            |
|        |              | 8                        | 28-01-2020                                   | –                | –                    | –                        |             |                            |
| Sl no. | Country name | 1st case reported on | World Health Organization report no. | Date of issuance | Total confirmed cases | Total confirmed new cases | Total deaths | Popularity density (per km²) |
|-------|--------------|----------------------|---------------------------------------|------------------|---------------------|--------------------------|-------------|-----------------------------|
| 8     | The United Kingdom | 01-02-2020 | 78 | 07-04-2020 | 51,612 | 3802 | 5373 | 281 |
|       |               | 68 | 28-03-2020 | 14,547 | 2885 | 759 |
|       |               | 58 | 18-03-2020 | 1954 | 407 | 55 |
|       |               | 48 | 08-03-2020 | 210 | 43 | 2 |
|       |               | 38 | 27-02-2020 | 13 | 2 | 1 |
|       |               | 28 | 17-02-2020 | 9 | 2 | 0 |
|       |               | 18 | 07-02-2020 | 3 | 1 | 0 |
|       |               | 8 | 28-01-2020 | — | — | — |
| 9     | Turkey | 12-03-2020 | 78 | 07-04-2020 | 30,217 | 3148 | 649 | 110 |
|       |         | 68 | 28-03-2020 | 5698 | 2069 | 92 |
|       |         | 58 | 18-03-2020 | 47 | 0 | 0 |
|       |         | 48 | 08-03-2020 | — | — | — |
|       |         | 38 | 27-02-2020 | — | — | — |
|       |         | 28 | 17-02-2020 | — | — | — |
|       |         | 18 | 07-02-2020 | — | — | — |
|       |         | 8 | 28-01-2020 | — | — | — |
| 10    | Switzerland | 26-02-2020 | 78 | 07-04-2020 | 21,574 | 509 | 715 | 219 |
|       |         | 68 | 28-03-2020 | 12,104 | 1390 | 197 |
|       |         | 58 | 18-03-2020 | 2650 | 450 | 14 |
|       |         | 48 | 08-03-2020 | 264 | 55 | 2 |
|       |         | 38 | 27-02-2020 | 1 | 0 | 0 |
|       |         | 28 | 17-02-2020 | — | — | — |
|       |         | 18 | 07-02-2020 | — | — | — |
|       |         | 8 | 28-01-2020 | — | — | — |
| 11    | Belgium | 05-02-2020 | 78 | 07-04-2020 | 20,814 | 1123 | 1632 | 383 |
|       |         | 68 | 28-03-2020 | 7284 | 1049 | 289 |
|       |         | 58 | 18-03-2020 | 1486 | 401 | 14 |
|       |         | 48 | 08-03-2020 | 169 | 60 | 0 |
|       |         | 38 | 27-02-2020 | 1 | 0 | 0 |
|       |         | 28 | 17-02-2020 | 1 | 0 | 0 |
|       |         | 18 | 07-02-2020 | 1 | 1 | 0 |
|       |         | 8 | 28-01-2020 | — | — | — |
| 12    | Netherlands | 28-02-2020 | 78 | 07-04-2020 | 18,803 | 952 | 1867 | 488 |
|       |         | 68 | 28-03-2020 | 8603 | 1172 | 546 |
|       |         | 58 | 18-03-2020 | 1705 | 292 | 43 |
|       |         | 48 | 08-03-2020 | 188 | 60 | 1 |
|       |         | 38 | 27-02-2020 | — | — | — |
|       |         | 28 | 17-02-2020 | — | — | — |
|       |         | 18 | 07-02-2020 | — | — | — |
|       |         | 8 | 28-01-2020 | — | — | — |
situation report) that depicts either strict action was not maintained within their country. The other countries viz. Spain, Italy, Germany, etc., they may have taken action but failed to restrict the number. In Table 8.4, the comparison analysis has been performed between India and its subcontinental countries.

The above analysis illustrates the total number of corona confirmed cases in India and its subcontinental counties based on eight periodic situation reports issued by the WHO. From this graph, it is clearly visible the Bhutan, Bangladesh, and Sri Lanka have

### Table 8.3 Corona situation report by World Health Organization of 15 countries as on April 8, 2020.—cont’d

| Sl no. | Country name     | 1st case is reported on | World Health Organization situation report no. | Date of issuance | Total confirmed cases | Total confirmed new cases | Total deaths | Popularity density (per km²) |
|--------|-----------------|-------------------------|-----------------------------------------------|------------------|-----------------------|---------------------------|--------------|-------------------------------|
| 13     | Austria         | 26-02-2020              | 78, 68, 58, 48, 38, 28, 18, 8                 | 07-04-2020       | 12,297                | 314                       | 220          | 109                           |
| 14     | Republic of Korea | 25-01-2020            | 78, 68, 58, 48, 38, 28, 18, 8                 | 07-04-2020       | 10,331                | 47                        | 192          | 503                           |
| 15     | Australia       | 25-01-2020              | 78, 68, 58, 48, 38, 28, 18, 8                 | 07-04-2020       | 5844                  | 100                       | 42           | 3.1                           |
## Table 8.4  Corona situation report by World Health Organization of India and sub-continental countries as on April 8, 2020.

| Sl no. | Country name | 1st case is reported on | World Health Organization situation report no. | Date of issuance | Total confirmed cases | Total confirmed new cases | Total deaths | Popularity density (per km²) |
|-------|--------------|--------------------------|-----------------------------------------------|------------------|-----------------------|--------------------------|-------------|---------------------------|
| 1     | India        | 30-01-2020               | 78                                            | 07-04-2020       | 4067                  | 0                        | 109         | 462                       |
|       |              |                          | 68                                            | 28-03-2020       | 724                   | 0                        | 17          |                           |
|       |              |                          | 58                                            | 18-03-2020       | 123                   | 23                       | 3           |                           |
|       |              |                          | 48                                            | 08-03-2020       | 34                    | 3                        | 0           |                           |
|       |              |                          | 38                                            | 27-02-2020       | 3                     | 0                        | 0           |                           |
|       |              |                          | 28                                            | 17-02-2020       | 3                     | 0                        | 0           |                           |
|       |              |                          | 18                                            | 07-02-2020       | 3                     | 0                        | 0           |                           |
|       |              |                          | 8                                             | 28-01-2020       | -                     | -                        | -           |                           |
| 2     | Bhutan       | 06-03-2020               | 78                                            | 07-04-2020       | 5                     | 0                        | 0           | 18                        |
|       |              |                          | 68                                            | 28-03-2020       | 3                     | 0                        | 0           |                           |
|       |              |                          | 58                                            | 18-03-2020       | 1                     | 0                        | 0           |                           |
|       |              |                          | 48                                            | 08-03-2020       | 1                     | 0                        | 0           |                           |
|       |              |                          | 38                                            | 27-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 28                                            | 17-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 18                                            | 07-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 8                                             | 28-01-2020       | -                     | -                        | -           |                           |
| 3     | Bangladesh   | 09-03-2020               | 78                                            | 07-04-2020       | 123                   | 35                       | 12          | 1115.62                   |
|       |              |                          | 68                                            | 28-03-2020       | 48                    | 0                        | 5           |                           |
|       |              |                          | 58                                            | 18-03-2020       | 8                     | 0                        | 0           |                           |
|       |              |                          | 48                                            | 08-03-2020       | -                     | -                        | -           |                           |
|       |              |                          | 38                                            | 27-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 28                                            | 17-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 18                                            | 07-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 8                                             | 28-01-2020       | -                     | -                        | -           |                           |
| 4     | Sri Lanka    | 28-01-2020               | 78                                            | 07-04-2020       | 176                   | 0                        | 5           | 341                       |
|       |              |                          | 68                                            | 28-03-2020       | 106                   | 0                        | 0           |                           |
|       |              |                          | 58                                            | 18-03-2020       | 29                    | 10                       | 0           |                           |
|       |              |                          | 48                                            | 08-03-2020       | 1                     | 0                        | 0           |                           |
|       |              |                          | 38                                            | 27-02-2020       | 1                     | 0                        | 0           |                           |
|       |              |                          | 28                                            | 17-02-2020       | 1                     | 0                        | 0           |                           |
|       |              |                          | 18                                            | 07-02-2020       | 1                     | 0                        | 0           |                           |
|       |              |                          | 8                                             | 28-01-2020       | 1                     | 0                        | 0           |                           |
| 5     | Pakistan     | 27-02-2020               | 78                                            | 07-04-2020       | 3864                  | 587                      | 54          | 287                       |
|       |              |                          | 68                                            | 28-03-2020       | 1235                  | 178                      | 9           |                           |
|       |              |                          | 58                                            | 18-03-2020       | 187                   | 134                      | 0           |                           |
|       |              |                          | 48                                            | 08-03-2020       | 5                     | 0                        | 0           |                           |
|       |              |                          | 38                                            | 27-02-2020       | 2                     | 0                        | 0           |                           |
|       |              |                          | 28                                            | 17-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 18                                            | 07-02-2020       | -                     | -                        | -           |                           |
|       |              |                          | 8                                             | 28-01-2020       | -                     | -                        | -           |                           |
taken the strict action against COVID-19 through which they could control the total number of new cases in last few months. But in the case of India and Pakistan, it grows almost exponentially in last 20 days (in last two situation report) that depicts either strict action was not maintained within their countries comparatively to other three countries. The other three countries may have taken proper action and succeeded to restrict the number. The next section analyzes the discipline and action taken by the mentioned countries through the proper mathematical model.

Table 8.4  Corona situation report by World Health Organization of India and subcontinental countries as on April 8, 2020.—cont’d

| Sl no. | Country name | 1st case is reported on | World Health Organization situation report no. | Date of issuance | Total confirmed cases | Total confirmed new cases | Total deaths | Popularity density (per km²) |
|--------|--------------|--------------------------|-----------------------------------------------|------------------|-----------------------|--------------------------|-------------|-----------------------------|
| 6      | Nepal        | 25-01-2020               | 78                                            | 07-04-2020       | 9                     | 0                        | 0           | 201                         |
| 68     |              |                          |                                               | 28-03-2020       | 3                     | 0                        | 0           |                             |
| 58     |              |                          |                                               | 18-03-2020       | 1                     | 0                        | 0           |                             |
| 48     |              |                          |                                               | 08-03-2020       | 1                     | 0                        | 0           |                             |
| 38     |              |                          |                                               | 27-02-2020       | 1                     | 0                        | 0           |                             |
| 28     |              |                          |                                               | 17-02-2020       | 1                     | 0                        | 0           |                             |
| 18     |              |                          |                                               | 07-02-2020       | 1                     | 0                        | 0           |                             |
| 8      |              |                          |                                               | 28-01-2020       | 1                     | 0                        | 0           |                             |

FIGURE 8.1  Comparison study on total number of confirmed cases in top 15 countries.
3. Supervised model for discipline analysis within a country against COVID-19

In our paper, the corona confirmed case in a country is denoted as $\alpha$ and the popularity density is denoted as $\beta$. So it can be said that $\alpha \sim \beta \equiv k \cdot \beta$, where $k$ is a constant that depends on the decision and action by the nation taken during COVID-19 outbreak. The range of $k$ is low if the corresponding country takes early or correct decision for the COVID outbreak during 2020. But the value of $k$ will be high if the corresponding nation considers it lightly at initial stages of the outbreak. Italy and Spain has taken these n-Cov2 issues casually at earlier stages, which has been a major cause of concern for the citizens of these countries.

Let us consider the total number of entries of each country is $n$. Then we get the following equation for each country where $SR$ denotes the Situation Report provided by the WHO.

$$k_{SR} = \frac{\alpha_{SR}}{\beta}$$

(8.1)

$$k_{mean} = \frac{\sum_{SR=1}^{n} k_{SR}}{n}$$

(8.2)

$$k_{range} = k_{n} - k_{1}$$

(8.3)

Here the $k_{mean}$ and $k_{range}$ values are playing a vital role to measure the maintained discipline within a nation. Based on the analogy, the $k$ value should be minimal if proper action is taken within the country and the country has already obtained the success to minimize the new COVID-19 positive cases; the higher value of $k$ depicts wrong decision or action have maintained within the respective nation to fight against COVID-19 outbreak. Table 8.5 illustrates the $k_{mean}$ and $k_{range}$ value of the top 15 countries, India, and its subcontinental countries.

From the above data, it can easily be analyzed that the range of top 15 countries varies within 9–1500 whereas the range of the range of India and subcontinental countries varies within 0.1–3.7. The bar chart analysis portraits clearer illustration of the above analysis in Figs. 8.3 and 8.4.

In few countries, like Bangladesh, Turkey, Netherlands, Bhutan, etc., the number of entries is less as in those countries COVID-19 entered three—four weeks back. COVID entered in Sri Lanka before India but it has not been spread rapidly. So it can be said that in Sri Lanka the $k_{range}$ and $k_{mean}$ are less than India, i.e., the discipline and strategy maintained in Sri Lanka is better than India to COVID-19.

On the other hand, USA and Spain have very less amount of popularity density ($\beta$) comparatively to China. But the strategy of China helps them to restrict COVID-19
Table 8.5 The $k_{mean}$ and $k_{range}$ measurement for the top 15, India, and its subcontinental countries.

| Sl. no | Country name     | Number of entries (n) | $k_{mean}$       | $k_{range}$       |
|--------|------------------|-----------------------|------------------|-------------------|
| 1      | USA              | 8                     | 1468.329861      | 9272.388889       |
| 2      | Spain            | 7                     | 320.2340426      | 1436.5            |
| 3      | Italy            | 7                     | 178.1137309      | 643.4174757       |
| 4      | Germany          | 8                     | 81.14479167      | 413.4333333       |
| 5      | China            | 8                     | 437.7025862      | 541.6137931       |
| 6      | France           | 8                     | 121.8624862      | 626.0969583       |
| 7      | Iran             | 5                     | 451.1970173      | 1184.438776       |
| 8      | UK               | 7                     | 34.74733096      | 183.6619217       |
| 9      | Turkey           | 3                     | 108.9757576      | 274.2727273       |
| 10     | Switzerland      | 5                     | 33.41826486      | 98.50684932       |
| 11     | Belgium          | 7                     | 11.09884372      | 54.34203655       |
| 12     | Netherland       | 4                     | 15.00973361      | 38.1454918        |
| 13     | Austria          | 5                     | 39.32477064      | 112.7981651       |
| 14     | Republic of Korea| 8                     | 9.215457256      | 20.53081511       |
| 15     | Australia        | 8                     | 404.0322581      | 1883.548387       |
| 16     | India            | 7                     | 1.532776747      | 8.796536797       |
| 17     | Bhutan           | 4                     | 0.138888889      | 0.222222222       |
| 18     | Bangladesh       | 3                     | 0.053482966      | 0.103081694       |
| 19     | Sri Lanka        | 8                     | 0.115835777      | 0.513196481       |
| 20     | Pakistan         | 5                     | 3.688501742      | 13.45644599       |
| 21     | Nepal            | 8                     | 0.012082445      | 0.039800995       |

FIGURE 8.2 Comparison study on total number of confirmed cases in India and subcontinental countries.

Chapter 8 • Statistical machine learning forecasting simulation • 157
FIGURE 8.3 Bar chart analysis of $k_{\text{mean}}$ value of top 15 countries ($k_{\text{mean}}$ is indirectly proportional to discipline maintenance performed by each nation).

FIGURE 8.4 Bar chart analysis of $k_{\text{mean}}$ value of India and subcontinental countries ($k_{\text{mean}}$ is indirectly proportional to discipline maintenance performed by each nation).
than USA and Spain. So, the \( k_{range} \) and \( k_{mean} \) values of China are much less than USA and Spain. In this way, by using Eqs. (8.1–8.3), the \( k_{range} \) and \( k_{mean} \) values can be calculated.

After obtaining the eight real-time data of the number of possible COVID-19 cases, the research measures the upcoming possible number of positive cases of COVID-19 in a country under the same circumstances and acquired strategies by measuring the \( k_{SR} \) values on 10 periodic intervals of the situation report provided by the WHO. The upcoming lower real-time data than the measured data will indicate the better strategies and disciplines would be maintained within the country.

The eight real-time data are already obtained based on which this research measures further 10 data through the machine learning process that helps to predict the upcoming difficulties because of COVID-19 outbreak for 21 given countries up to July 2020. Machine Learning Forecasting Strategy is used for measuring the upcoming \( k_{SR} \) data of each country through which a prediction for tentative total number of confirmed COVID-19 cases can be measured.

### 3.1 Statistical machine learning forecasting strategy

The correlation coefficient for the positive range by using Eq. (8.4) [13].

\[
 r = \frac{\frac{\sum xy - \frac{\sum x \sum y}{n}}{n}}{\sqrt{\left(\frac{\sum x^2 - \left(\frac{\sum x}{n}\right)^2}{n}\right) - \left(\frac{\sum y^2 - \left(\frac{\sum y}{n}\right)^2}{n}\right)}} \tag{8.4}
\]

Figs. 8.1 and 8.2 depicts the exponential data for the given countries on which Eq. (8.4) is not applicable. The research focuses on the exponential statistical correlation coefficient (Eq. 8.5) that helps to predict the upcoming \( k_{SR} \) values of the mentioned countries.

\[
 y = ab^x, a > 0 \tag{8.5}
\]

The research considers the situation report number as the \( x \) and \( k_{SR} \) as \( y \). Based on the exponential correlation regression, the upcoming tentative \( k_{SR} \) values are measured in Appendix I and Appendix II where Appendix I depicts all the predictive \( k_{SR} \) values for top 15 countries and Appendix II depicts all the predictive \( k_{SR} \) values for India and
subcontinental countries. The weighted moving average is calculated through Eq. (8.5) [14–17].

\[ F_{t+1} = W_1 D_t + W_2 D_{t-1} + \cdots + W_n D_{t-n+1} \]  

(8.6)

The Forecast error is

\[ E_t = D_t - F_t \]  

(8.7)

The upcoming real-time data may differ from the given measured data. The positive value of the forecast error will indicate that better action or decision would be taken by the corresponding countries per situation report. The overall discipline can be measured by using the average forecast error through Eq. (8.7).

\[ E = \frac{\sum_{t=1}^{n} E_t}{n} \]  

(8.8)

4. Limitations and future scope

The WHO has been collected the entire reports of all the countries, but in a very few reports, they have provided the active number of cases of different countries. Not only that, the proper medicine has not been identified by the scientists. The cost estimation could not be done in the proper way as no officials have been declared the coronavirus vaccine or medicines. It is still a limitation for the treatment of the virus. The active cases are declared by many unofficial resources which could not be considered in this research as the WHO is not providing it through their situation reports.

Many countries have decided for the lockdown inside the country to restrict the coronavirus in their respective areas. No official source has been found where the proper date of country wise lockdown period is provided. If the lockdown period is thoroughly analyzed, then the probable lockdown period of each country can be measured through which the discipline parameter can also be designed in more precisely.

After obtaining the forecasting report in Appendix I and Appendix II, the requirement of the medicine/vaccine can be measured through the tentative confirmed COVID cases for the people across the world. This calculation is very important now for each country to measure the total cost of the required medicines in due date. In this crucial time, the supply chain is playing a vital role to resist and recover the new COVID cases in the upcoming days. The given measurement may further help the mentioned countries for taking necessary decision on lockdown which may help their economist to calculate the economy of the country in the coming days.
References

[1] D. Paraskevis, E.G. Kostaki, G. Magiorkinis, G. Panayiotakopoulos, G. Sourvinos, S. Tsiodras, Full-genome Evolutionary Analysis of the Novel Corona Virus (2019-nCoV) Rejects the Hypothesis of Emergence as a Result of a Recent Recombination Event, Epub 2020 January 29, 2020, https://doi.org/10.1016/j.meegid.2020.104212.

[2] R. Ross, Estimates of SARS Death Rates Revised Upward, Center for Infectious Disease Research and Policy, May 07, 2003. Available at: https://www.cidrap.umn.edu/news-perspective/2003/05/estimates-sars-death-rates-revised-upward. (Accessed 10 April 2020).

[3] S.K. Lau, P.C. Woo, K.S. Li, Y. Huang, H.W. Tsoi, B.H. Wong, S.S. Wong, S.Y. Leung, K.H. Chan, K.Y. Yuen, Severe Acute Respiratory Syndrome Coronavirus-like Virus in Chinese Horseshoe Bats, Epub 2005 September 16, 2005. Available At, https://www.ncbi.nlm.nih.gov/pubmed/16169905. (Accessed 10 April 2020).

[4] W. Li, Z. Shi, M. Yu, W. Ren, C. Smith, J.H. Epstein, H. Wang, G. Cramer, Z. Hu, H. Zhang, J. Zhang, J. McEachern, H. Field, P. Daszak, B.T. Eaton, S. Zhang, L.F. Wang, Bats Are Natural Reservoirs of SARS-like Coronaviruses, Epub 2005 September 29, 2005. Available at: https://www.ncbi.nlm.nih.gov/pubmed/16195424. (Accessed 10 April 2020).

[5] A.M. Zaki, B.S. Van, T.M. Bestebroer, A.D. Osterhaus, R.A. Fouchier, Isolation of a Novel Coronavirus from a Man with Pneumonia in Saudi Arabia, Epub 2012 October 17, 2012, https://doi.org/10.1056/NEJMoa1211721.

[6] N. Zhu, D. Zhang, W. Wang, X. Li, B. Yang, J. Song, X. Zhao, B. Huang, W. Shi, R. Lu, P. Niu, F. Zhan, A novel coronavirus from patients with pneumonia in China, 2019, N. Engl. J. Med. (January 24, 2020), https://doi.org/10.1056/NEJMoa2001017.

[7] S. Perlman, Another decade, another coronavirus, N. Engl. J. Med. (February 20, 2020), https://doi.org/10.1056/NEJMe2001126.

[8] P. Zhou, X.L. Yang, X.G. Wang, B. Hu, L. Zhang, W. Zhang, H.R. Si, Y. Zhu, B. Li, C.L. Huang, H.D. Chen, J. Chen, Y. Luo, H. Guo, R.D. Jiang, M.Q. Liu, Y. Chen, X.R. Shen, X. Wang, X.S. Zheng, K. Zhao, Q.J. Chen, F. Deng, L.L. Liu, B. Yan, F.X. Zhan, Y.Y. Wang, G. Xiao, Z.L. Shi, Discovery of a Novel Coronavirus Associated with the Recent Pneumonia Outbreak in Humans and its Potential Bat Origin, 2020, https://doi.org/10.1038/s41586-020-2012-7. Available at: https://www.biorxiv.org/content/10.1101/2020.01.22.914952v2.full.pdf. (Accessed 10 April 2020).

[9] WHO China, Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19), WHO, Geneva, Switzerland, 2019. Available at: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf. (Accessed 10 April 2020).

[10] In a First, Bronx Zoo Tiger 'Nadia' Tests Positive for Covid-19, Develops Dry Cough, Loss of Appetite, The Economic Times. Dt, April 07, 2020.

[11] World Health Organization. Available at: https://www.who.int/. (Accessed 10 April 2020).

[12] Coronavirus disease (COVID-19) situation reports. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports. (Accessed 10 April 2020).

[13] M. Kaur, M. Dhalaria, P.K. Sharma, J.H. Park, Supervised machine-learning predictive analytics for national quality of life scoring, Appl. Sci. 9 (8) (2019). https://doi.org/10.3390/app9081613. Available at: https://www.mdpi.com/2076-3417/9/8/1613/htm. (Accessed 10 April 2020).

[14] Demand Forecasting, Production Engineering, National Chung Hsing University. Available at: http://www.me.nchu.edu.tw/lab/CIM/www/courses/Production%20Engineering/Chapter3.%20Demand%20Forecasting.pdf. (Accessed 10 April 2020).

[15] JD Edward’s World Forecasting Guide, Oracle Help Center. Available date: https://docs.oracle.com/cd/E26228_01/doc/093/e20706/ap_forcst_calc_ex.htm#WEAF/C278. (Accessed 10 April 2020).
Appendix I. Prediction data of top 15 countries

### Table I Prediction data for USA.

| Situation report sl. number | United States of America |
|-----------------------------|--------------------------|
|                             | $k_{SR}$ values | Tentative confirmed COVID cases |
| Real-time data              |               |                              |
| 8                           | 0.138888889    | 5                             |
| 18                          | 0.333333333    | 12                            |
| 28                          | 0.416666667    | 15                            |
| 38                          | 1.638888889    | 59                            |
| 48                          | 5.916666667    | 213                           |
| 58                          | 98.22222222    | 3536                          |
| 68                          | 2367.444444    | 85,228                        |
| 78                          | 9272.527778    | 333,811                       |
| 88                          | 21,250.85      | 765,031                       |
| Predicted data              |               |                              |
| 98                          | 112,171.9      | 4,038,188                     |
| 108                         | 592,095.51     | 21,315,438                    |
| 118                         | 3,125,355.81   | 112,512,809                   |
| 128                         | 16,497,083.15  | 593,894,993                   |
| 138                         | 87,079,285.96  | 3,134,854,295                 |
| 148                         | 459,645,015.9  | 16,547,220,572                |
| 158                         | 2,426,220,407  | 87,343,934,652                |
| 168                         | 12,806,720,967 | 4.61042E+11                   |
| 178                         | 67,599,836,136 | 2.43359E+12                   |
| 188                         | 3.57E+11       | 1.28456E+13                   |
### Table II  Prediction data for Spain.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|----------------|-------------------------------|
| **Real-time data**          |                |                               |
| 8                           | 0              | 0                             |
| 18                          | 0.0106383      | 1                             |
| 28                          | 0.0212766      | 2                             |
| 38                          | 0.1276596      | 12                            |
| 48                          | 4.5744681      | 430                           |
| 58                          | 118.91498      | 11,178                        |
| 68                          | 681.47872      | 64,059                        |
| 78                          | 1436.5106      | 135,032                       |
| 88                          | 3239.93        | 304,553                       |
| **Predicted data**          |                |                               |
| 98                          | 306,161.82     | 28,779,211                    |
| 108                         | 2,907,421.1    | 273,297,584                   |
| 118                         | 27,609,900     | 2,595,330,641                 |
| 128                         | 262,193,392    | 24,646,178,867                |
| 138                         | 2.49E+09       | 2.34049E+11                   |
| 148                         | 2.364E+10      | 2.22261E+12                   |
| 158                         | 2.25E+11       | 2.115E+13                     |
| 168                         | 2.13E+12       | 2.00437E+14                   |
| 178                         | 2.02E+13       | 1.90342E+15                   |
| 188                         | 1.92E+14       | 1.80755E+16                   |

### Table III  Prediction data for Italy.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|----------------|-------------------------------|
| **Real-time data**          |                |                               |
| 8                           | 0              | 0                             |
| 18                          | 0.014563107    | 3                             |
| 28                          | 0.014563107    | 3                             |
| 38                          | 1.941747573    | 400                           |
| 48                          | 28.55825243    | 5883                          |
| 58                          | 152.9417476    | 31,506                        |
| 68                          | 419.8932039    | 86,498                        |
| 78                          | 643.4320388    | 132,547                       |
| 88                          | 22,302.3       | 4,594,274                     |
| **Predicted data**          |                |                               |
| 98                          | 170,743.6      | 35,173,182                    |
| 108                         | 1,307,191      | 269,281,346                   |
| 118                         | 10,007,685.3   | 2,061,583,172                 |
| 128                         | 76,617,546.44  | 15,783,214,567                |
| 138                         | 586,574,043    | 1.20834E+11                   |
| 148                         | 4,490,735,137  | 9.25091E+11                   |
| 158                         | 3.44E+10       | 7.0864E+12                    |
| 168                         | 2.63E+11       | 5.42219E+13                   |
| 178                         | 2.02E+12       | 4.15115E+14                   |
| 188                         | 1.54E+14       | 3.17807E+16                   |
### Table IV  Prediction data for Germany.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|----------------|-------------------------------|
| Real-time data              |                |                               |
| 8                           | 0.004166667    | 1                             |
| 18                          | 0.0125         | 3                             |
| 28                          | 0.066666667    | 16                            |
| 38                          | 0.0875         | 21                            |
| 48                          | 3.3125         | 795                           |
| 58                          | 29.81666667    | 7156                          |
| 68                          | 202.425        | 48,582                        |
| 78                          | 413.4375       | 99,225                        |
| 88                          | 4907.1         | 1,177,704                     |
| Predicted data              |                |                               |
| 98                          | 32,676.97      | 7,842,473                     |
| 108                         | 217,599.7      | 52,223,928                    |
| 118                         | 1,449,021.2    | 347,765,088                   |
| 128                         | 9,649,198.3    | 2,315,807,592                 |
| 138                         | 64,255,115.6   | 15,421,227,744                |
| 148                         | 427,882,168    | 1.02692E+11                   |
| 158                         | 2.85E+09       | 6.84E+11                      |
| 168                         | 18,973,923,499 | 4.55374E+12                  |
| 178                         | 1.26E+11       | 3.0324E+13                    |
| 188                         | 8.41E+11       | 2.0193E+14                    |

### Table V  Prediction data for China.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|----------------|-------------------------------|
| Real-time data              |                |                               |
| 8                           | 31.28965517    | 4537                          |
| 18                          | 215.2482759    | 31,211                        |
| 28                          | 487.137931     | 70,635                        |
| 38                          | 542.2758621    | 78,630                        |
| 48                          | 557.6482759    | 80,859                        |
| 58                          | 559.4206897    | 81,116                        |
| 68                          | 566.9862069    | 82,213                        |
| 78                          | 572.9034483    | 83,071                        |
| 88                          | 763.92         | 110,768                       |
| Predicted data              |                |                               |
| 98                          | 858.6          | 124,497                       |
| 108                         | 965.02         | 139,928                       |
| 118                         | 1084.62        | 157,270                       |
| 128                         | 1219.04        | 176,761                       |
| 138                         | 1370.12        | 198,667                       |
| 148                         | 1539.94        | 223,291                       |
| 158                         | 1.73E+03       | 250,850                       |
| 168                         | 1945.31        | 282,070                       |
| 178                         | 2186.41        | 317,029                       |
| 188                         | 2457.38        | 356,320                       |
### Table VI  Prediction data for France.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|-------------------------------|
| **Real-time data**          |                 |                               |
| 8                           | 0.02556019      | 3                             |
| 18                          | 0.05112039      | 6                             |
| 28                          | 0.10224078      | 12                            |
| 38                          | 0.15336117      | 18                            |
| 48                          | 6.01516572      | 706                           |
| 58                          | 65.1955355      | 7652                          |
| 68                          | 277.259947      | 32,542                        |
| 78                          | 626.122519      | 73,488                        |
| 88                          | 6097.71         | 715,688                       |
| **Predicted data**          |                 |                               |
| 98                          | 36,499.12       | 4,283,902                     |
| 108                         | 218,472.8       | 25,642,153                    |
| 118                         | 1,307,713.2     | 153,486,298                   |
| 128                         | 7,827,582.4     | 918,723,346                   |
| 138                         | 46,853,581      | 5,499,204,805                 |
| 148                         | 280,451,606     | 32,916,604,996                |
| 158                         | 1.68E+09        | 1.97182E+11                   |
| 168                         | 1.0048E+10      | 1.17936E+12                   |
| 178                         | 6.0146E+10      | 7.05928E+12                   |
| 188                         | 3.60E+11        | 4.22547E+13                   |

### Table VII  Prediction data for Iran.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|-------------------------------|
| **Real-time data**          |                 |                               |
| 8                           | 0               | 0                             |
| 18                          | 0               | 0                             |
| 28                          | 0               | 0                             |
| 38                          | 2.766875981     | 141                           |
| 48                          | 114.2660911     | 5823                          |
| 58                          | 317.2880691     | 16,169                        |
| 68                          | 634.4583987     | 32,332                        |
| 78                          | 1187.205651     | 60,500                        |
| 88                          | 9517.56         | 485,015                       |
| **Predicted data**          |                 |                               |
| 98                          | 37,973.56       | 1,935,133                     |
| 108                         | 151,508.55      | 7,720,876                     |
| 118                         | 604,495.35      | 30,805,083                    |
| 128                         | 2,411,841.67    | 122,907,452                   |
| 138                         | 9,622,870.14    | 490,381,462                   |
| 148                         | 38,393,743.18   | 1,956,545,152                 |
| 158                         | 1.53E+08        | 7,806,308,410                 |
| 168                         | 611,184,196.7   | 31,145,946,664                |
| 178                         | 2,438,529,122   | 1.24267E+11                   |
| 188                         | 9.73E+09        | 4.95808E+11                   |
### Table VIII  Prediction data for United Kingdom.

| Situation report sl. number | United States of America |
|-----------------------------|---------------------------|
|                             | $k_{SR}$ values | Tentative confirmed COVID cases |
| Real-time data              |               |                                |
| 8                           | 0             | 0                              |
| 18                          | 0.010676157   | 3                              |
| 28                          | 0.03202847    | 9                              |
| 38                          | 0.046263345   | 13                             |
| 48                          | 0.747330961   | 210                            |
| 58                          | 6.953736655   | 1954                           |
| 68                          | 51.76868327   | 14,547                         |
| 78                          | 183.6725979   | 51,612                         |
| 88                          | 1065.88       | 299,512                        |
| Predicted data              |               |                                |
| 98                          | 6144.07       | 1,726,484                      |
| 108                         | 35,416.36     | 9,951,997                      |
| 118                         | 204,151       | 57,366,431                     |
| 128                         | 1,176,790.28  | 330,678,069                    |
| 138                         | 6,783,387.37  | 1,906,131,851                  |
| 148                         | 39,101,567.29 | 10,987,540,408                 |
| 158                         | 2.25E+08      | 63,225,000,000                 |
| 168                         | 1,299,239,630 | 3.65086E+11                    |
| 178                         | 7,489,223,750 | 2.10447E+12                    |
| 188                         | 4.32E+10      | 1.21308E+13                    |

### Table IX  Prediction data for Turkey.

| Situation report sl. number | Turkey |
|-----------------------------|--------|
|                             | $k_{SR}$ values | Tentative confirmed COVID cases |
| Real-time data              |               |                                |
| 8                           | 0             | 0                              |
| 18                          | 0             | 0                              |
| 28                          | 0             | 0                              |
| 38                          | 0             | 0                              |
| 48                          | 0             | 0                              |
| 58                          | 0.4272727     | 47                             |
| 68                          | 51.8          | 5698                           |
| 78                          | 274.7         | 30,217                         |
| 88                          | 11,734.14     | 1,290,755                      |
| Predicted data              |               |                                |
| 98                          | 297,528.19    | 32,728,101                     |
| 108                         | 7,544,055.65  | 829,846,122                    |
| 118                         | 191,285,319.5 | 21,041,385,145                 |
| 128                         | 4,850,186,046 | 5.3352E+11                     |
| 138                         | 1.23E+11      | 1.35278E+13                    |
| 148                         | 3.12E+12      | 3.43009E+14                    |
| 158                         | 7.91E+13      | 8.701E+15                     |
| 168                         | 2.00E+15      | 2.20525E+17                    |
| 178                         | 5.08E+16      | 5.59159E+18                    |
| 188                         | 1.29E+18      | 1.41779E+20                    |
### Table X  Prediction data for Switzerland.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|---------------------------------|
| Real-time data              |                 |                                 |
| 8                           | 0               | 0                               |
| 18                          | 0               | 0                               |
| 28                          | 0               | 0                               |
| 38                          | 0.004566        | 1                               |
| 48                          | 1.20547945      | 264                             |
| 58                          | 12.10045662     | 2650                            |
| 68                          | 55.26940639     | 12,104                          |
| 78                          | 98.51141553     | 21,574                          |
| 88                          | 4080.01         | 893,522                         |
| Predicted data              |                 |                                 |
| 98                          | 44,013.34       | 9,638,921                       |
| 108                         | 474,795.85      | 103,980,291                     |
| 118                         | 5,121,881.7     | 1,121,692,092                   |
| 128                         | 55,252,530.51   | 12,100,304,182                  |
| 138                         | 596,039,171.6   | 1.3053E+11                      |
| 148                         | 6,429,799,518   | 1.4081E+12                      |
| 158                         | 6.94E+10        | 1.51986E+13                     |
| 168                         | 7.48E+11        | 1.63865E+14                     |
| 178                         | 8.07E+12        | 1.7677E+15                      |
| 188                         | 8.71E+13        | 1.90692E+16                     |

### Table XI  Prediction data for Belgium.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|---------------------------------|
| Real-time data              |                 |                                 |
| 8                           | 0               | 0                               |
| 18                          | 0.002610966     | 1                               |
| 28                          | 0.002610966     | 1                               |
| 38                          | 0.002610966     | 1                               |
| 48                          | 0.441253264     | 169                             |
| 58                          | 3.879895561     | 1486                            |
| 68                          | 19.01827676     | 7284                            |
| 78                          | 54.34464752     | 20,814                          |
| 88                          | 581.16          | 222,584                         |
| Predicted data              |                 |                                 |
| 98                          | 4131.86         | 1,582,502                       |
| 108                         | 29,376.28       | 11,251,115                      |
| 118                         | 208,856.36      | 79,991,986                      |
| 128                         | 1,484,904.83    | 568,718,550                     |
| 138                         | 10,557,218.9    | 4,043,414,839                   |
| 148                         | 75,098,595.47   | 28,747,442,065                  |
| 158                         | 5.34E+08        | 2.04522E+11                     |
| 168                         | 3.79E+09        | 1.45312E+12                     |
| 178                         | 2.70E+10        | 1.03312E+13                     |
| 188                         | 1.92E+11        | 7.34517E+13                     |
### Table XII  Prediction data for Netherland.

| Situation report sl. number | United States of America |
|-----------------------------|--------------------------|
|                             | $k_{SR}$ values | Tentative confirmed COVID cases |
| Real-time data              |               |                                  |
| 8                           | 0             | 0                                 |
| 18                          | 0             | 0                                 |
| 28                          | 0             | 0                                 |
| 38                          | 0             | 0                                 |
| 48                          | 0.385245902   | 188                               |
| 58                          | 3.493852459   | 1705                              |
| 68                          | 17.62909836   | 8603                              |
| 78                          | 38.5307377    | 18,803                            |
| 88                          | 260.65        | 127,197                           |
| Predicted data              |               |                                  |
| 98                          | 1220.02       | 595,370                           |
| 108                         | 5710.58       | 2,786,763                         |
| 118                         | 26,729.66     | 13,044,074                        |
| 128                         | 125,114.34    | 61,055,798                        |
| 138                         | 585,625.63    | 285,785,307                       |
| 148                         | 2,741,153.89  | 1,337,683,098                     |
| 158                         | 1.28E+07      | 6,246,400,000                     |
| 168                         | 6.01E+07      | 29,307,577,724                    |
| 178                         | 2.81E+08      | 1.37181E+11                       |
| 188                         | 1.32E+09      | 6.42106E+11                       |

### Table XIII  Prediction data for Austria.

| Situation report sl. number | Austria |
|-----------------------------|---------|
|                             | $k_{SR}$ values | Tentative confirmed COVID cases |
| Real-time data              |               |                                  |
| 8                           | 0             | 0                                 |
| 18                          | 0             | 0                                 |
| 28                          | 0             | 0                                 |
| 38                          | 0.018348624   | 2                                 |
| 48                          | 0.95412844    | 104                               |
| 58                          | 12.22018349   | 1332                              |
| 68                          | 70.6146789    | 7697                              |
| 78                          | 112.8165138   | 12,297                            |
| 88                          | 3022.45       | 329,447                           |
| Predicted data              |               |                                  |
| 98                          | 26,609.81     | 2,900,469                         |
| 108                         | 234,274.16    | 25,535,883                        |
| 118                         | 2,062,562.15  | 224,819,274                       |
| 128                         | 18,158,906.54 | 1,979,320,813                     |
| 138                         | 159,871,976.1 | 17,426,045,395                    |
| 148                         | 147,521,355   | 16,079,827,695                    |
| 158                         | 1.24E+10      | 1.3516E+12                       |
| 168                         | 1.09E+11      | 1.18918E+13                       |
| 178                         | 9.61E+11      | 1.04696E+14                       |
| 188                         | 8.46E+12      | 9.21748E+14                       |
### Table XIV  Prediction data for Republic of Korea.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|---------------------------------|
| **Real-time data**          |                 |                                 |
| 8                           | 0.007952286     | 4                               |
| 18                          | 0.047713718     | 24                              |
| 28                          | 0.059642147     | 30                              |
| 38                          | 3.510934394     | 1766                            |
| 48                          | 14.18290258     | 7134                            |
| 58                          | 16.54075548     | 8320                            |
| 68                          | 18.84294235     | 9478                            |
| 78                          | 20.5387674      | 10,331                          |
| 88                          | 321.66          | 161,795                         |
| **Predicted data**          |                 |                                 |
| 98                          | 1098.41         | 552,500                         |
| 108                         | 3750.82         | 1,886,662                       |
| 118                         | 12,808.21       | 6,442,530                       |
| 128                         | 43,737.19       | 21,999,807                      |
| 138                         | 149,352.81      | 75,124,463                      |
| 148                         | 510,006.75      | 256,533,395                     |
| 158                         | 1.74E+06        | 875,220,000                     |
| 168                         | 5.95E+06        | 2,991,362,015                   |
| 178                         | 2.03E+07        | 10,214,838,520                  |
| 188                         | 6.93E+07        | 34,881,410,386                  |

### Table XV  Prediction data for Australia.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|---------------------------------|
| **Real-time data**          |                 |                                 |
| 8                           | 1.612903226     | 5                               |
| 18                          | 4.838709677     | 15                              |
| 28                          | 4.838709677     | 15                              |
| 38                          | 7.419354839     | 23                              |
| 48                          | 23.87096774     | 74                              |
| 58                          | 133.5483871     | 414                             |
| 68                          | 1172.580645     | 3635                            |
| 78                          | 1885.16129      | 5844                            |
| 88                          | 3843.94         | 11,916                          |
| **Predicted data**          |                 |                                 |
| 98                          | 10,961.08       | 33,979                          |
| 108                         | 31,255.79       | 96,893                          |
| 118                         | 89,126.66       | 276,293                         |
| 128                         | 254,146.85      | 787,855                         |
| 138                         | 724,706         | 2,246,589                       |
| 148                         | 2,066,516.98    | 6,406,203                       |
| 158                         | 5.89E+06        | 18,259,000                      |
| 168                         | 1.68E+07        | 52,090,067                      |
| 178                         | 4.79E+07        | 148,536,108                     |
| 188                         | 1.37E+08        | 423,554,366                     |
Appendix II. Prediction data of India and subcontinental countries

Table XVI  Prediction data for India.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|------------------|--------------------------------|
| Real-time data              |                  |                                |
| 8                           | 0                | 0                              |
| 18                          | 0.006493506      | 3                              |
| 28                          | 0.006493506      | 3                              |
| 38                          | 0.006493506      | 3                              |
| 48                          | 0.073593074      | 34                             |
| 58                          | 0.266233766      | 123                            |
| 68                          | 1.567099567      | 724                            |
| 78                          | 8.803030303      | 4067                           |
| 88                          | 17.17198801      | 7933                           |
| Predicted data              |                  |                                |
| 98                          | 62.83400908      | 29,029                         |
| 108                         | 229.92           | 106,223                        |
| 118                         | 841.29           | 388,676                        |
| 128                         | 3078.35          | 1,422,198                      |
| 138                         | 11,263.97        | 5,203,954                      |
| 148                         | 41,215.99        | 19,041,787                     |
| 158                         | 1.51E+05         | 69,675,791                     |
| 168                         | 5.52E+05         | 254,950,634                    |
| 178                         | 2.02E+06         | 933,240,000                    |
| 188                         | 7.39E+06         | 3,413,536,032                  |
Table XVII  Prediction data for Bhutan.

| Situation report sl. Number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|--------------------------------|
| Real-time data               |                 |                                |
| 8                           | 0               | 0                              |
| 18                          | 0               | 0                              |
| 28                          | 0               | 0                              |
| 38                          | 0               | 0                              |
| 48                          | 0.055555556     | 1                              |
| 58                          | 0.055555556     | 1                              |
| 68                          | 0.166666667     | 3                              |
| 78                          | 0.277777778     | 5                              |
| 88                          | 0.48            | 9                              |
| Predicted data              |                 |                                |
| 98                          | 0.87            | 16                             |
| 108                         | 1.57            | 28                             |
| 118                         | 2.85            | 51                             |
| 128                         | 5.15            | 93                             |
| 138                         | 9.32            | 168                            |
| 148                         | 16.85           | 303                            |
| 158                         | 3.05E+01        | 549                            |
| 168                         | 5.51E+01        | 993                            |
| 178                         | 9.97E+01        | 1795                           |
| 188                         | 1.80E+02        | 3248                           |

Table XVIII  Prediction data for Bangladesh.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|--------------------------------|
| Real-time data               |                 |                                |
| 8                           | 0               | 0                              |
| 18                          | 0               | 0                              |
| 28                          | 0               | 0                              |
| 38                          | 0               | 0                              |
| 48                          | 0               | 0                              |
| 58                          | 0.0071709       | 8                              |
| 68                          | 0.043025403     | 48                             |
| 78                          | 0.110252595     | 123                            |
| 88                          | 0.5             | 558                            |
| Predicted data              |                 |                                |
| 98                          | 1.95            | 2175                           |
| 108                         | 7.66            | 8546                           |
| 118                         | 30.03           | 33,502                         |
| 128                         | 117.76          | 131,375                        |
| 138                         | 461.76          | 515,149                        |
| 148                         | 1810.6          | 2,019,942                      |
| 158                         | 7.10E+03        | 7,920,400                      |
| 168                         | 2.78E+04        | 31,056,641                     |
| 178                         | 1.09E+05        | 121,602,580                    |
| 188                         | 4.28E+05        | 477,495,947                    |
Table XIX  Prediction data for Sri Lanka.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|--------------------------------|
| Real-time data              |                 |                                |
| 8                           | 0.002932551     | 1                              |
| 18                          | 0.002932551     | 1                              |
| 28                          | 0.002932551     | 1                              |
| 38                          | 0.002932551     | 1                              |
| 48                          | 0.002932551     | 1                              |
| 58                          | 0.085043988     | 29                             |
| 68                          | 0.31085044      | 106                            |
| 78                          | 0.516129032     | 176                            |
| 88                          | 0.64            | 218                            |
| Predicted data              |                 |                                |
| 98                          | 1.46            | 498                            |
| 108                         | 3.34            | 1139                           |
| 118                         | 7.64            | 2605                           |
| 128                         | 17.5            | 5968                           |
| 138                         | 40.09           | 13,671                         |
| 148                         | 91.82           | 31,311                         |
| 158                         | 2.10E+02        | 71,712                         |
| 168                         | 4.82E+02        | 164,249                        |
| 178                         | 1.10E+03        | 375,100                        |
| 188                         | 2.53E+03        | 861,639                        |

Table XX  Prediction data for Pakistan.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|--------------------------------|
| Real-time data              |                 |                                |
| 8                           | 0               | 0                              |
| 18                          | 0               | 0                              |
| 28                          | 0               | 0                              |
| 38                          | 0.006968641     | 2                              |
| 48                          | 0.017421603     | 5                              |
| 58                          | 0.651567944     | 187                            |
| 68                          | 4.303135889     | 1235                           |
| 78                          | 13.46341463     | 3864                           |
| 88                          | 166.59          | 47,811                         |
| Predicted data              |                 |                                |
| 98                          | 1312.54         | 376,699                        |
| 108                         | 10,341.48       | 2,968,005                      |
| 118                         | 81,480.55       | 23,384,918                     |
| 128                         | 641,985.3       | 184,249,781                    |
| 138                         | 5,058,202.41    | 1,451,704,092                  |
| 148                         | 39,853,578.64   | 11,437,977,070                 |
| 158                         | 3.14E+08        | 90,119,825,521                 |
| 168                         | 2.47E+09        | 7.10054E+11                    |
| 178                         | 1.95E+10        | 5.5965E+12                     |
| 188                         | 1.54E+11        | 4.40792E+13                    |
Table XXI  Prediction data for Nepal.

| Situation report sl. number | $k_{SR}$ values | Tentative confirmed COVID cases |
|-----------------------------|-----------------|-------------------------------|
| Real-time data              |                 |                               |
| 8                           | 0.004975124     | 1                             |
| 18                          | 0.004975124     | 1                             |
| 28                          | 0.004975124     | 1                             |
| 38                          | 0.004975124     | 1                             |
| 48                          | 0.004975124     | 1                             |
| 58                          | 0.004975124     | 1                             |
| 68                          | 0.014925373     | 3                             |
| 78                          | 0.044776119     | 9                             |
| 88                          | 0.02            | 4                             |
| Predicted data              |                 |                               |
| 98                          | 0.03            | 6                             |
| 108                         | 0.04            | 8                             |
| 118                         | 0.05            | 10                            |
| 128                         | 0.06            | 12                            |
| 138                         | 0.08            | 16                            |
| 148                         | 0.1             | 20                            |
| 158                         | 1.30E−01        | 26                            |
| 168                         | 1.70E−01        | 34                            |
| 178                         | 2.20E−01        | 44                            |
| 188                         | 2.80E−01        | 56                            |