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Impact Analysis of Temperature Data on the Increase in the Count of Infected Cases of COVID 19

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ABSTRACT

There was an outbreak of pneumonia in the month of December 2019 in Wuhan, China that spread with a rapid rate throughout the country and shook the world by spreading across the globe causing many deaths due. This disease is confirmed by means of molecular method as a novel coronavirus and was named as 2019 novel coronavirus (2019-nCoV) in its initial stage; however, on February 11, 2020, World Health Organization (WHO) renamed this disease COVID-19, which means corona virus disease. COVID-19 has impacted nearly the entire world, affecting more than 100 countries including India. The Coronavirus Study Group consisting of the International Committee on Taxonomy of Viruses renamed this virus, which was provisionally named 2019-nCoV, as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). This nomenclature is based on taxonomy, phylogeny, and established practice. As on March 2020, WHO has confirmed 692,575 number of cases of COVID-19 with 33,099 deaths, which are distributed across the globe: Western Pacific region with 103,775 confirmed cases with 3,649 deaths; European region with 392,757 number of confirmed cases with 23,962 deaths; South East Asia region with 4,084 confirmed cases with 158 deaths; Eastern Mediterranean region with 46,392 confirmed cases with 2,813 number of deaths; America region with 142,081 confirmed cases with 2,457 deaths; African region with 3,486 confirmed cases with 60 deaths. This paper focuses on these areas and regions and tries to find establish the relationship between numbers of deaths and number of cases with respect to the temperature. This paper takes the study of specific areas around the world and also the case study of India to study the effect of temperature on the rise of and death due to COVID-19 virus.

KEYWORDS

Coronavirus, COVID-19, Data Normalization, Effective Reproductive Number, Temperature

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1. BACKGROUND

Our paper study is based on the background that there is reporting in the early stage of COVID-19 that the virus spread and rise varies with temperature (Kim et al., 2016; Chen et al., 2019). We had taken temperature parameters of top 15 affected countries and tries to find our result with temperature parameters and in order to set up relationship between temperature and the rise and spread of this virus (Lancet 2020; Corman et al., 20230). We collected the data of top 15 affected countries along with India for month of January, February and March as (Tables 1-2 and Figure 1).

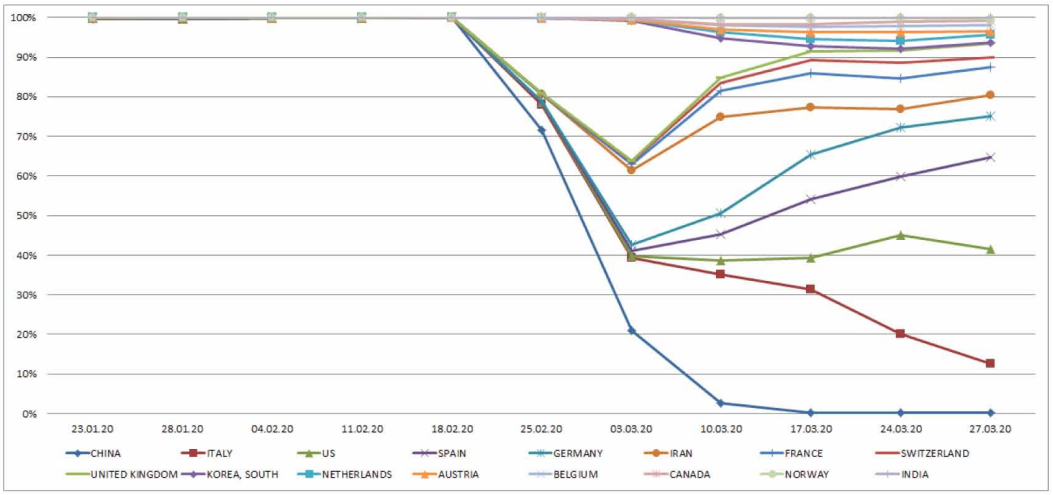
Table 1. Sample data with temperature and COVID 19 confirmed counts per week from January 23, 2020 to March 27, 2020

18.02.20	CC	74211	3	13	2	16	0	12	0	9	31	0	0	1	8	0	3
	T(°C)	10	16	14	13	8	13	11	10	10	2	8	11	9	5	8	25
11.02.20	CC	44386	3	12	2	16	0	11	0	8	28	0	0	1	7	0	3
	T(°C)	11	18	13	15	7	1	9	11	7	13	6	8	7	2	5	21
04.02.20	CC	23707	2	11	1	12	0	6	0	2	16	0	0	1	4	0	3
	T(°C)	1	18	18	20	7	11	9	13	9	3	7	10	6	2	1	20
28.01.20	CC	5509	0	5	0	4	0	4	0	0	4	0	0	0	2	0	0
	T(°C)	6	13	8	12	9	8	8	9	7	11	6	6	7	1	2	19
23.01.20	CC	643	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
	T(°C)	8	15	6	10	6	5	3	2	8	10	6	6	4	2	3	18
Country		**China**	**Italy**	**US**	**Spain**	**Germany**	**Iran**	**France**	**Switzerland**	**United Kingdom**	**Korea, South**	**Netherlands**	**Austria**	**Belgium**	**Canada**	**Norway**	**India**
S.N		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Table 2. Sample data with temperature and COVID 19 confirmed counts per week from January 23, 2020 to March 27, 2020

27.03.20	CC	81661	74386	65778	49515	37323	27017	25600	10897	9640	9137	6438	5588	4937	3251	3084	657
	T(°C)	13	17	12	10	18	15	13	12	13	16	13	17	13	9	9	26
24.03.20	CC	81591	69176	53740	39885	32986	24811	22622	9877	8164	9037	5580	5283	4269	2790	2863	536
	T(°C)	18	10	12	15	10	15	13	24	15	18	11	8	12	5	5	31
17.03.20	CC	81058	31506	6421	11748	9257	16169	7715	2700	1960	8320	1711	1332	1243	478	1463	142
	T(°C)	21	18	17	16	16	20	15	18	13	11	12	13	14	7	12	27
10.03.20	CC	80887	10149	959	1695	1457	8042	1794	491	384	7513	382	182	267	79	400	56
	T(°C)	11	17	21	22	9	17	15	7	15	10	11	12	12	11	4	25
03.03.20	CC	80261	2502	118	165	196	2336	204	56	51	5186	24	21	13	30	32	5
	T(°C)	7	13	17	14	7	12	9	8	9	11	8	11	7	3	2	26
25.02.20	CC	77754	322	51	6	17	95	14	1	13	977	0	2	1	11	0	3
	T(°C)	9	17	12	18	11	12	11	12	8	8	10	17	10	3	0	25
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Figure 1. COVID 19 infected confirmed cases counts statistics per day



Now this data is being analysed with the data of the confirmed infected cases of COVID-19 at different countries mentioned above in order to find the relationship of COVID-19 with temperature and analysing the data (Guan et al., 2020; Bai et al., 2020). The above data consists of temperature on different dates (trying to cover maximum seven days interval) in the month of January, February and March and the number of confirmed cases in the subsequent year which gave us the data of the number of confirmed cases in subsequent days of the month suffered and confirmed for COVID-19 epidemic (Beck et al., 2020; Steel 2011). This data help us to understand the relationship between temperature and number of cases spreading in these countries with COVID-19 epidemic which help us to maintain a relationship between COVID-19 and temperature that weather temperature is really a parameter for rise or spread of COVID-19.

2. DATA PRE-PROCESSING

The scale and distribution of the collected data drawn from the domain differ for both the input variables. Due to the difference in the scales across the input variables for examples weather temperature $\left(^{\circ}C\right)$ and COVID 19 confirmed number of counts (for example hundreds and thousands) that in turn may mean the input variables having different scales. Differences in the scales across input variables may increases the difficulty of the problem being modelled. Therefore, data analysis requires data scaling methods. For applying data scaling research used data normalization and standardization methodologies are as follows.

2.1. Data Normalization

Data normalizing is a variable that most frequently means dividing by a norm of the variable. It also often refers to rescaling by the minimum and range of the vector, to make all the elements lie between 0 and 1 thus bringing all the values of numeric columns in the dataset to a common scale. This scaling method requires minimum and maximum observable values. For normalization the data input variables following formula applied:

$$X_{norm} = 0.847 \times \left(\frac{\left(X_i - X_{\min}\right)}{\left(X_{\max} - X_{\min}\right)} \right) + 0.1 \tag{1}$$

where, X_i denotes the specific value of the variable, $X_{\max}$ denotes the maximum value of the variable dataset, $X_{\min}$ denotes the minimum value of the variable dataset.

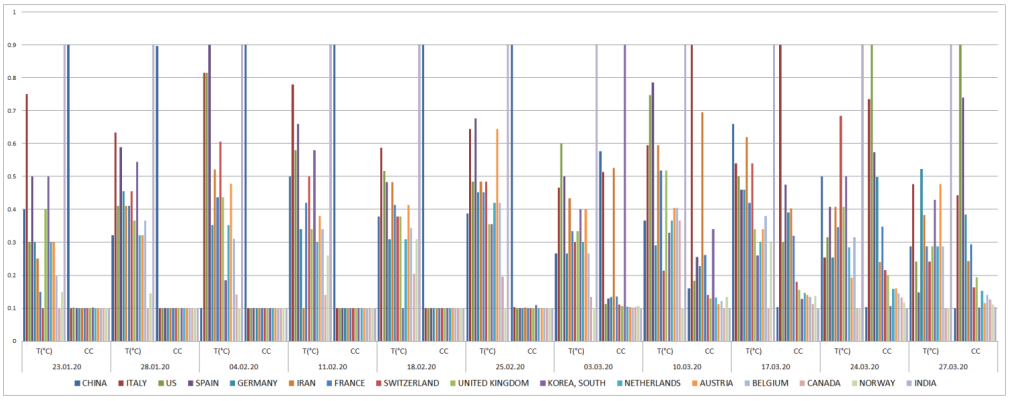
2.2. Data Standardization

Data standardization is a process of rescaling the distribution of dataset values so that the mean of the observed values is 0 and the standard deviation is 1. This data scaling method requires average and standard deviation value of the observable dataset. For standardizing the data input variables following formula applied:

$$X_{stnd} = \left(\frac{\left(X_i - Average\right)}{s\tan dard\_deviation} \right) \tag{2}$$

After applying the data normalization and standardization the collected data is graphically analysed, results are presented in Figure 2. At some points temperature provide significant impacts on the COVID 19 infected cases worldwide.

Figure 2. COVID 19 infected confirmed cases counts vs. Temperature per day



In this paper, we had also considered the number of death cases in these countries year wise taking from January to March and consolidated the data accordingly as (Table 3).

3. CASE STUDY FOR INDIA COVID-19

As of 31st January 2020, there are 106 cases confirmed outside china. In India, there is one confirmed cases which reported in Kerala where the patient is returned from Wuhan, China. At this stage 49 samples has been tested out of which 48 were negative. From 30 January to 3 February 2020, there are three confirmed cases in Kerala.

3.1. Objectives

In this paper, we had taken the study of temperature of different places within the world and analyse it with the number of COVID-19 patient around the globe and try to analyse the factors responsible for the rise and wide spread of the virus epidemic. This project will also try to analyse the cause and

Table 3. Number of death cases

Death	23.01.20	28.01.20	04.02.20	11.02.20	18.02.20	25.02.20	03.03.20	10.03.20	17.03.20	24.03.20	27.03.20
China	18	131	491	1112	2003	2665	2947	3139	3230	3281	3285
Italy	0	0	0	0	0	10	79	631	2503	6820	7503
US	0	0	0	0	0	0	7	28	108	706	942
Spain	0	0	0	0	0	0	1	35	533	2808	3647
Germany	0	0	0	0	0	0	0	2	24	157	206
Iran	0	0	0	0	0	16	77	291	988	1934	2077
France	0	0	0	0	1	1	4	33	149	1102	1333
Switzerland	0	0		0	0	0	0	3	27	122	153
United Kingdom	0	0	0	0	0	0	0	6	56	423	466
Korea, South	0	0	0	0	0	10	28	54	81	120	126
Netherlands	0	0	0	0	0	0	0	4	43	277	357
Austria	0	0	0	0	0	0	0	0	3	28	30
Belgium	0	0	0	0	0	0	0	0	10	122	178
Canada	0	0	0	0	0	0	0	1	5	26	30
Norway	0	0	0	0	0	0	0	0	3	12	14
India	0	0	0	0	0	0	0	0	3	10	12

environmental and other conditions favouring for the growth and spread of this virus. The study is primary performed with temperature to find out that temperature is really a factor for rise and spread of COVID-19 virus as per the conditions of the countries.

In order to proof the study and working, we had taken the result from 13 states including states from south, north, central, east and west as the demographic conditions vary from north to south and from east to west in terms of temperature. The selected 13 states are most affected states in their region which help us to formulate our result (Figure 3 and Table 4).

Figure 3. COVID 19 infected confirmed cases counts vs. Temperature per day in India state-wide

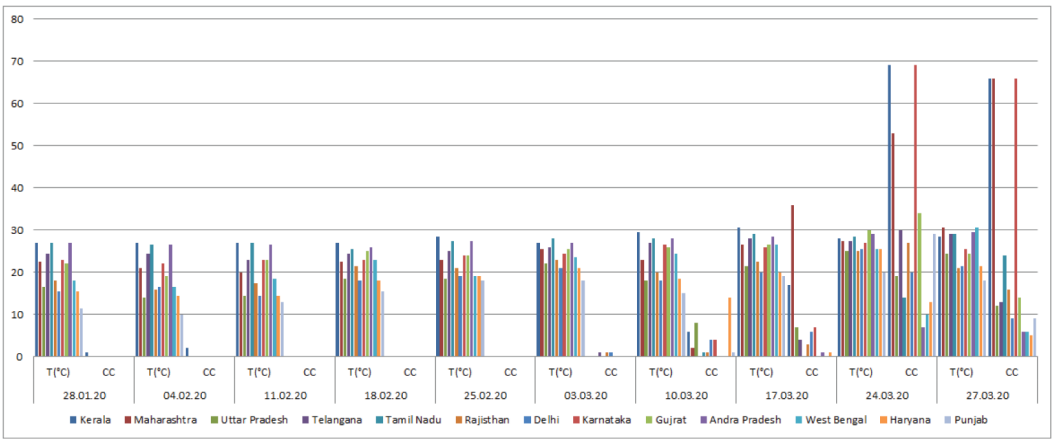


Table 4. Sample data with temperature and COVID 19 confirmed counts per week from January 23, 2020 to March 27, 2020

27.03.20	CC	66	66	12	13	24	16	9	66	14	6	6	5	9
	T(°C)	28.5	30.5	24.5	29	29	21	21.5	25.5	24.5	29.5	30.5	21.5	18
23.03.20	CC	69	53	19	30	14	27	20	69	34	7	10	13	29
	T(°C)	28	27.5	25	27.5	28.5	25	25.5	27	30	29	25.5	25.5	20
17.03.20	CC	17	36	7	4	0	3	6	7	0	1	0	1	0
	T(°C)	30.5	26.5	21.5	28	29	22.5	20	26	26.5	28.5	26.5	20	19
10.03.20	CC	6	2	8	0	1	1	4	4	0	0	0	14	1
	T(°C)	29.5	23	18	27	28	20	18	26.5	26	28	24.5	18.5	15
03.03.20	CC	0	0	0	1	0	1	1	0	0	0	0	0	0
	T(°C)	27	25.5	22	26	28	23	21	24.5	25.5	27	23.5	21	18
25.02.20	CC	0	0	0	0	0	0	0	0	0	0	0	0	0
	T(°C)	28.5	23	18.5	25	27.5	21	19	24	24	27.5	19	19	18
18.02.20	CC	0	0	0	0	0	0	0	0	0	0	0	0	0
	T(°C)	27	22.5	18.5	24.5	25.5	21.5	18	23	25	26	23	18	15.5
11.02.20	CC	0	0	0	0	0	0	0	0	0	0	0	0	0
	T(°C)	27	20	14.5	23	27	17.5	14.5	23	23	26.5	18.5	14.5	13
04.02.20	CC	2	0	0	0	0	0	0	0	0	0	0	0	0
	T(°C)	27	21	14	24.5	26.5	16	16.5	22	19	26.5	16.5	14.5	10
28.01.20	CC[1]	1	0	0	0	0	0	0	0	0	0	0	0	0
	T[2](°C)	27	22.5	16.5	24.5	27	18	15.5	23	22	27	18	15.5	11.5
		Kerala	Maharashtra	Uttar Pradesh	Telangana	Tamil Nadu	Rajisthan	Delhi	Karnataka	Gujrat	Andra Pradesh	West Bengal	Haryana	Punjab

4. RESULTS

Based on the data analysed above taking the examples of some most affected countries and compare the spread of epidemic during last three month with respect to the temperature parameter we came up with the results shown in Figures 4-8.

In terms of Indian context the relationship between temperature and number of cases variation presented in Figure 2.

5. CONCLUSION

The analysis Provides updated information about relationship between COVID-19 and temperature that weather temperature is really one of the parameters which is responsible for increase and rise of COVID-19 epidemic across the globe. The analysis was performed for the month of January, February and March for top 15 countries of the world and also considering the case study of INDIA taking 13 states from different regions in order to establish relationship between COVID-19 virus and temperature. The findings of the result states that temperature is having minor effect on the spread

Figure 4. Confirmed cases of COVID-19 in different month

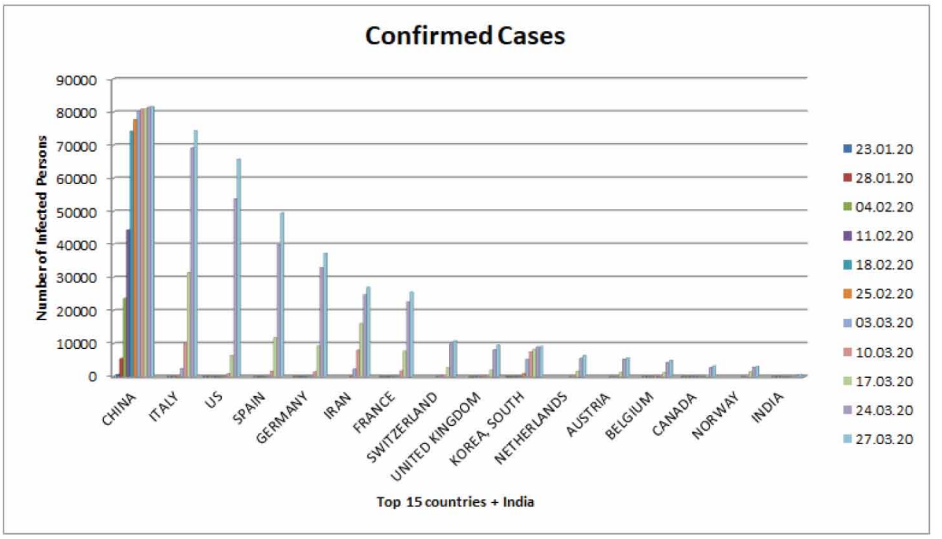
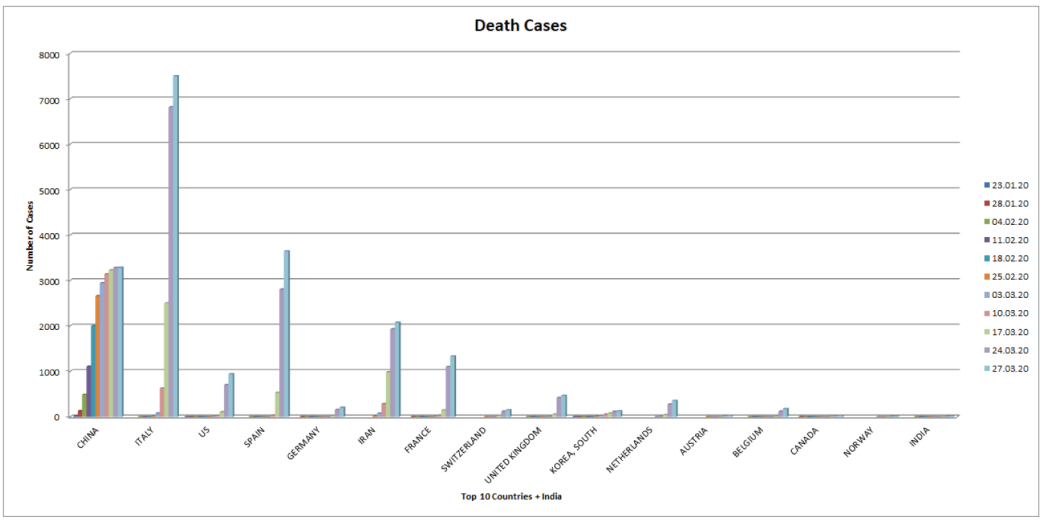


Figure 5. Death due to COVID-19 in different month



and rise of CORONA virus. There are findings that temperature around $20°C$ to $25°C$ is favouring the survival of COVID-19 virus. Whereas the cold conditions favour the spread of virus and temperature above $27°C$ to $28°C$ is not suitable for the virus spread.

Figure 6. Temperature and confirmed cases analysis in month of January

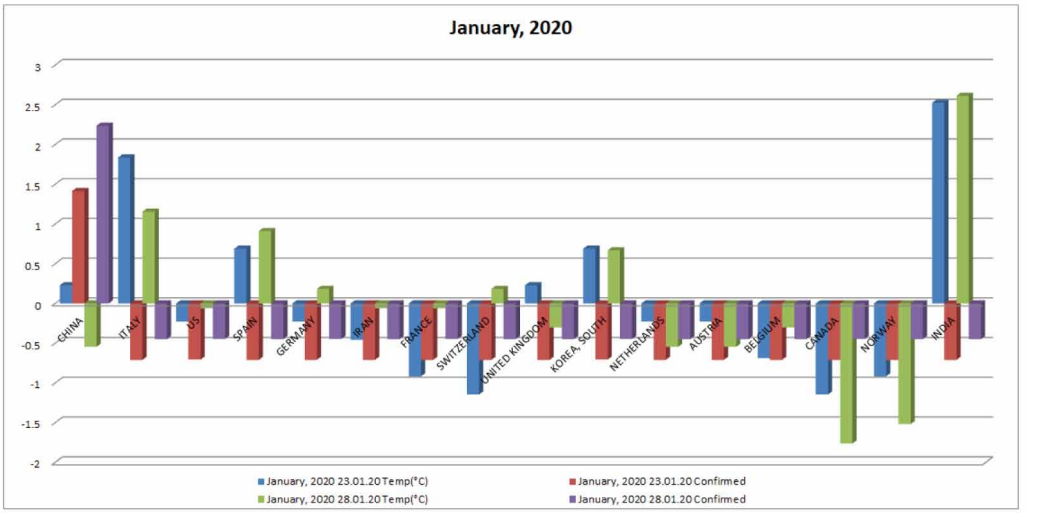


Figure 7. Temperature and confirmed cases analysis in month of February

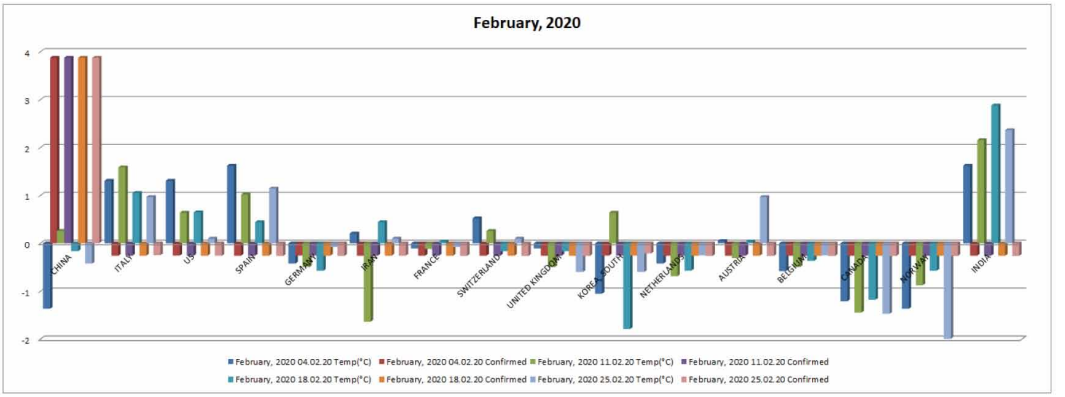
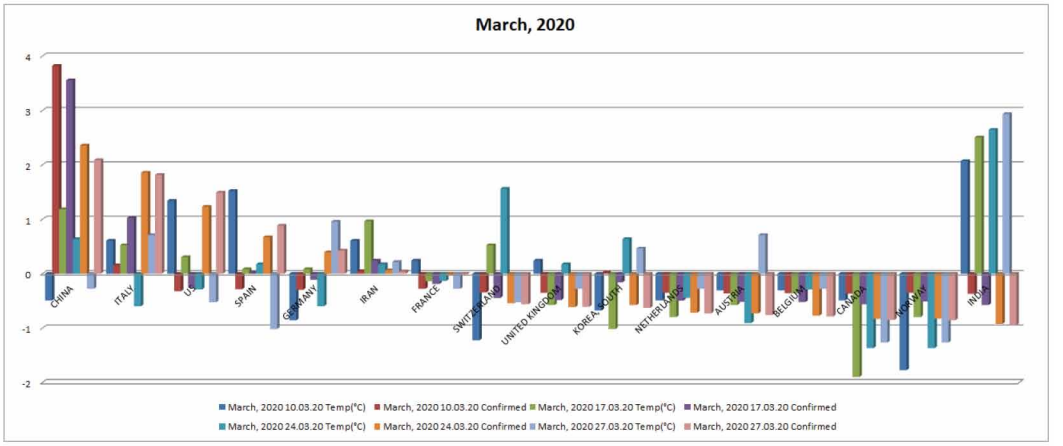


Figure 8. Temperature and confirmed cases analysis in month of March



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ENDNOTES

[1] COVID 19 Confirmed Cases (CC) counts.
[2] Temperature.

Parag Verma is working as Assistant Professor at Uttaranchal University, Dehradun. He is having a long experience of 8+ years in the field of industry and academics. He is having 15+ international papers in reputed conferences and journals. He has contributed 2 books with publishers like Nerosa and Alpha, and currently working on 2 more accepted books. He had also contributed 4 chapters for reputed publishers. He is also an editorial board member of many reputed conferences and journals including Scopus. He is also a guest editor of IJNCDS (Scopus Indexed Inderscience Journal) and many more. He is associated with many societies and organizations for the welfare of educationalist societies.

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