



Statistical data analysis of risk factor associated with mortality rate by COVID-19 pandemic in India

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Abstract

The coronavirus is an infection caused by severe acute respiratory syndrome (SARS) coronavirus, known as SARS-CoV-2. It was first determined in Wuhan, China in December 2019. WHO named this virus as COVID-19. Virologist says that COVID-19 is similar to SARS and MARS virus. This deadly disease affected worldwide economically, hammering people lifestyle and also the environmental condition. After a few months, there is no vaccine to build the barricade between this virus and life. Many countries have tried to improve the methodology to control the disease and also the actual vaccine for coronavirus but not yet successful. Rapid testing, quarantine and social distancing slow down the social and economic movement. Although India, as one of the largest populated country, takes some respectable initiative after the pandemic of the novel coronavirus. According to WHO 24th May 2020 report, total 131,868 confirmed cases and killed over 3867 people by this COVID-19 pandemic. Indian government takes the initiative like janta curfew, lockdown all over the country. The main focus or aim of this study is to find the mortality rate and the recovered people at the fourth phase of lockdown, but the infected graph is daily increased in India. In the relation between active cases and the death cases, the R^2 value is 0.8754. The relation between active cases and the recoveries, the R^2 value is 0.9246. In between 116 days, the mortality rate is less in before lockdown (0.129%) and third phase lockdown is facing a huge mortality rate (43.496%).

Keywords COVID-19 pandemic · Global issues · People health · Lockdown · Mortality rate · India

Introduction

Pandemics are mostly serious cases on people health-related concern and the pandemics hammering the socio-economic condition of every infected country. COVID-19 is greatest influential pandemic to destroy public health. As is implied in the name COVID-19, ‘CO’ for ‘corona’, ‘VI’ stand for ‘virus’ and ‘D’ means ‘disease’, and ‘19’ represent the year of its occurrence (Chakraborty and Maity 2020). The worldwide 5,370,375 confirmed cases and 344,454 deaths (Fig. 1) were registered by the World Health Organisation (WHO, 26th May 2020 on 9:20 am CEST). After the

COVID outbreak in Wuhan, China, it created a massive loss of life in other countries like Italy, Iran, France and Spain. This virus protection has not any medicine or treatment currently; all the affected countries are situated in national lockdown, rapid test and quarantines (Hamzelou 2020). In this current situation, the epicentre located in the United States of America (USA). Over 1,592,599 confirmed cases and 95,863 deaths were registered by 25th May 2020 (WHO 2020).

In between 2002 and 2003, SARS infested around 8000 people and 774 people has died. In 2012, WHO registered the 2494 people infected and 858 kills by other coronavirus named MERS-CoV (Middle East respiratory syndrome coronavirus) and spreading around 27 countries (WHO report 2003, 2013). Coronaviruses are a group of related RNA viruses and this disease is originated in mammals and birds. In the case of the human body, COVID-19 symptoms are the common cold, chest pain and many more. Scientists have divided the virus into four groups like alpha, beta, gamma and delta. The four common are 229E (alpha), NL63 (Alpha), OC 43 (Beta) and HKU1 (Beta) (strains of

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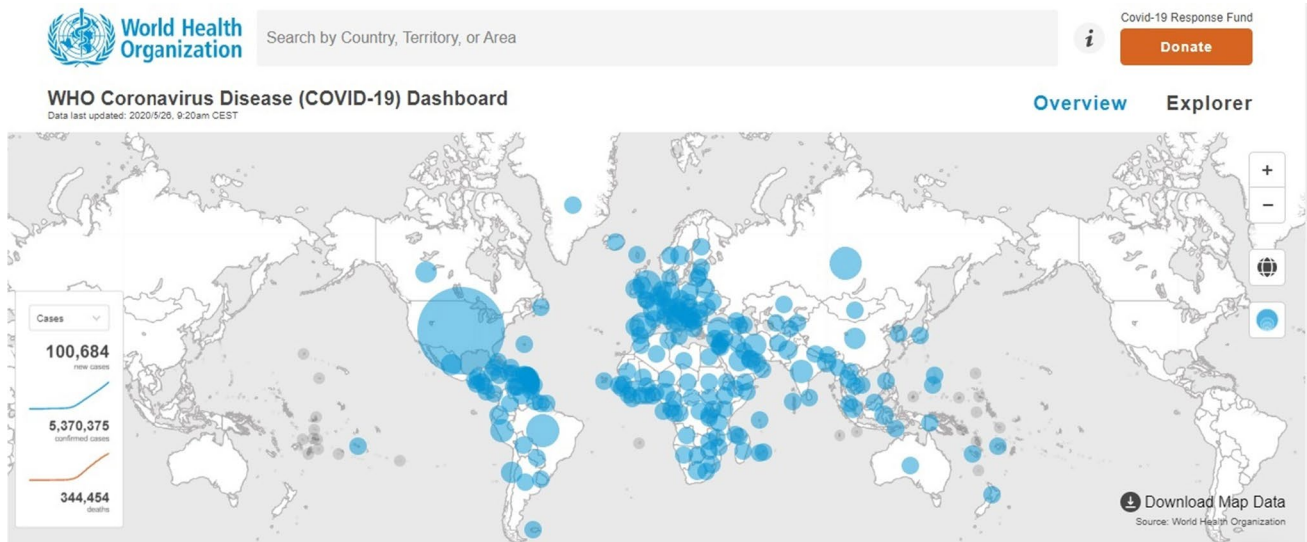


Fig. 1 World Health Organization report of COVID-19 situation worldwide

coronavirus 2020). But the SARS-like bat CoV was transmitted to the human body after having evolved in the Himalayan palm-civet (Song et al. 2005). In some decades, the world facing five types of pandemics named, H1N1 in 2009, Polio in 2014, Ebola (West Africa in 2014), Zika in 2016 and the Ebola (Democratic Republic Congo in 2019). WHO registered the sixth worldwide pandemic on 30 January 2020 named, COVID-19. The worldwide rates of fatalities, morbidities are a high and huge amount of economic losses in current days (Allocati et al. 2016; Fan et al. 2019).

Economies during COVID-19 effect

The analysis by the UN Department of Economic and Social Affairs (DESA) says that the coronavirus pandemic affected global supply chains and international trade. More than 100 countries had to close their borderline and stop international marketing (<https://economictimes.indiatimes.com/news/international/>). During this pandemic, many workers over worldwide lost their jobs and gradually the global economy were laid down. During the lockdown, global trade like industrial, garment supply is discontinuing. Another major economic challenge during COVID-19 would be a high out-of-pocket (OOP) expenditure in the developing countries (Rodela et al. 2020). The international trade was lost during this pandemic. Oil and copper 18% cheaper in Mid-January, Zinc price was 20% lower in global trade (<https://www.bbc.com/news/>). In the global gross domestic product (GDP) was lost during the COVID-19 pandemic (Congressional Research Service 2020) (Fig. 2). Many countries have to face this worldwide pandemic and affected in their economy. Greece, Portugal and Spain are more reliant on tourism (more than 15% of

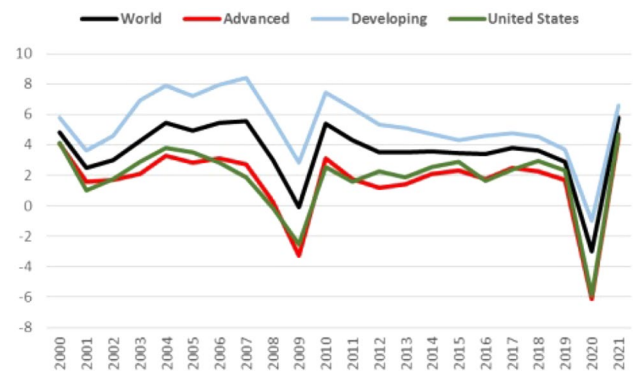


Fig. 2 Gross domestic product (GDP) effected by coronavirus during the 2020 year and estimated the 2021 data

GDP) will be affected in this global crisis (Fernandes 2020) (Table 1).

COVID-19 situation in top 10 infected countries

COVID-19 first case was registered in China. But after this pandemic was spreading worldwide and gradually it was infected in other countries. In the report, 8915 new cases and 174 deaths were registered (WHO 26th May 2020). The USA is the most affected countries and the total cases were 1,706,227 and overall 99,807 persons were killed by this deathliest virus (Fig. 3). In coronavirus pandemic, world health condition was breakdown (Table 2). In India, a huge amount of people was infected due to coronavirus. In 26th May, 146,376 cases were registered and the death was 1426 (<https://www.worldometers.info/coronavirus/>).

Table 1 COVID-19 most effected countries situation, 25th May 2020

Country name	Total cases	Total deaths	Total recovered	Actives cases
USA	1,706,277	99,807	464,727	1,141,743
Brazil	376,669	23,522	153,833	199,314
Russia	362,342	3807	131,129	227,406
Spain	282,480	26,837	196,958	58,685
UK	261,184	36,914	0	0
Italy	230,158	32,877	141,981	55,300
France	182,942	28,432	65,199	89,311
Germany	180,808	8432	162,000	10,376
Turkey	157,814	4369	120,015	33,430
India	146,376	4187	61,151	81,038

Data source: Worldometer data, 2020

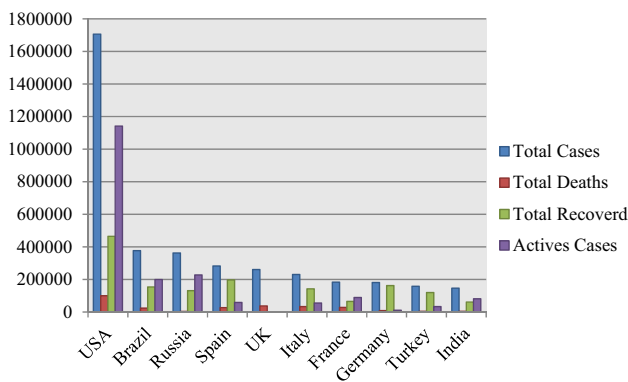


Fig. 3 Most effected countries by Coronavirus

Global environment during coronavirus pandemic

COVID-19 was affected in the global economy and social contact also as global production and unemployment, but at this time they have also been significantly reduced the air pollution and greenhouse gas (GHG) emission. The emission of carbon dioxide (CO₂), nitrogen oxides (NOX) and related ozone (O₃) are low, reported by United Nations (<https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=2333>). Not all the environmental condition is the result for positive. The amounts of unrecyclable waste have risen and those volumes were high. The world ecosystems are very much affected during coronavirus because at lockdown people stay at home and leaving the land, mining area, fishing and protected area. That the reason for illegal deforestation, wildlife hunting and many more. The natural resources are a relief in those days, like petroleum, diesel, coal and other natural resources mining area are stopped right now in huge amount. The international market is affected during coronavirus and the traffic condition like airlines is at rest. In some countries are starting the airline on a domestic basis.

Worldwide the environment is now breathing properly during coronavirus pandemic because industrialization is much more affected in the ecosystem and it causes various types of disease during climate change.

Indian economy

The global economy was shrinking by up to 1% in 2020 due to COVID-19 pandemic. India is one of the developing country and during the struggle by this virus pandemic a huge amount of economic loss in India. The unemployment was increased from 6.7% on 15th March, 26% on 19th April and 24.5% on 26th May (<https://www.cmie.com/kommon/bin/sr.php?kall=warticle&dt=2020-04-21%2010:40:01&msec=873>). First 21 days of lockdown, every day India lose over 32,000 crore Indian rupees (US 4.5 billion dollars). The economic losses are affected during the lockdown periods. Many industries were locked during the country lockdown phases. In this situation, daily labour and small scale industries are mostly affected and created food scarcity during the lockdown.

Study area

India is the developing country in the recent era. Many developments are built in India. The populated country India bounded by the Indian Ocean in the south, the Arabian Sea in the southwest and the Bay of Bengal in the southeast parts. The huge populated country, India has 121 million people located with 382/sq.km (Census of India 2011). This huge amount of population during coronavirus cannot stop spreading (Fig. 4). The Government of India takes an initial step for battle with this pandemic. In this study, we estimated the state-wise coronavirus condition and over mortality rate during the lockdown.

Materials and methods

Data used

In this study, the World Health Organization (WHO), Worldometer website data are used for computing the coronavirus condition in India throughout the before lockdown and fourth phase of lockdown. The website and also the WHO provided the present situation of COVID-19 data on the country-wise to recognizing the global community and health organization to build an improved sustainable judgement on this contemporary pandemic.

This study comprised the current condition of India during the before lockdown to fourth phase of lockdown. The total cases, active cases, death and recovered situation of COVID-19 pandemic in India. The statistical data

Table 2 Indian state-wise condition of COVID-19 pandemic

SL.No	State/union territory	Total cases	Deaths	Recoveries	Active cases
1	Andaman and Nicobar Islands	33	0	33	0
2	Andhra Pradesh	2823	56	1856	911
3	Arunachal Pradesh	1	0	1	0
4	Assam	378	4	55	319
5	Bihar	2587	13	702	1872
6	Chandigarh	238	3	186	49
7	Chhattisgarh	252	0	67	185
8	Dadra and Nagar Haveli and Daman and Diu	2	0	0	2
9	Delhi	13,418	261	6540	6617
10	Goa	66	0	19	47
11	Gujarat	14,056	858	6412	6786
12	Haryana	1184	16	765	403
13	Himachal Pradesh	203	3	63	137
14	Jammu and Kashmir	1621	21	809	791
15	Jharkhand	370	4	148	218
16	Karnataka	2089	42	654	1393
17	Kerala	847	4	521	322
18	Ladakh	52	0	43	9
19	Lakshadweep	0	0	0	0
20	Madhya Pradesh	6665	290	3408	2967
21	Maharashtra	50,231	1635	14,600	33,996
22	Manipur	32	0	4	28
23	Meghalaya	14	1	12	1
24	Mizoram	1	0	1	0
25	Nagaland	0	0	0	0
26	Odisha	1336	7	550	779
27	Puducherry	41	0	12	29
28	Punjab	2060	40	1898	122
29	Rajasthan	7028	163	3848	3017
30	Sikkim	1	0	0	1
31	Tamil Nadu	16,277	111	8324	7842
32	Telangana	1854	53	1090	711
33	Tripura	191	0	165	26
34	Uttarakhand	317	3	58	256
35	Uttar Pradesh	6268	161	3538	2569
36	West Bengal	3667	272	1339	2056
	Total	136,203	4021	57,721	74,461

Data Source: Health, Ministry of India

are analysed for understanding the difference between pre-lockdown and fourth phases of lockdown condition of coronavirus in India. Statistical analysis is developed by those data. Mortality rate, relation between active and death cases, active cases and recover cases in India are calculating corona affected data. All the data area calculated in MS-Office and state-wise data are estimated in ArcGIS software to show the state-wise cases and situation of covid-19 cases in India (Fig. 5). The multiplication of the correlation coefficient is maximum implemented method to identifying the statistical

relationship of two variables. Linear regression method is used to calculate the ratio between different variables.

Active cases

Active cases of coronavirus are daily increased in India. During the lockdown phase of every stage are showing the increasing condition of coronavirus cases. The active cases graph is increased gradually. Coronavirus active case data are available in the WHO coronavirus dashboard in their

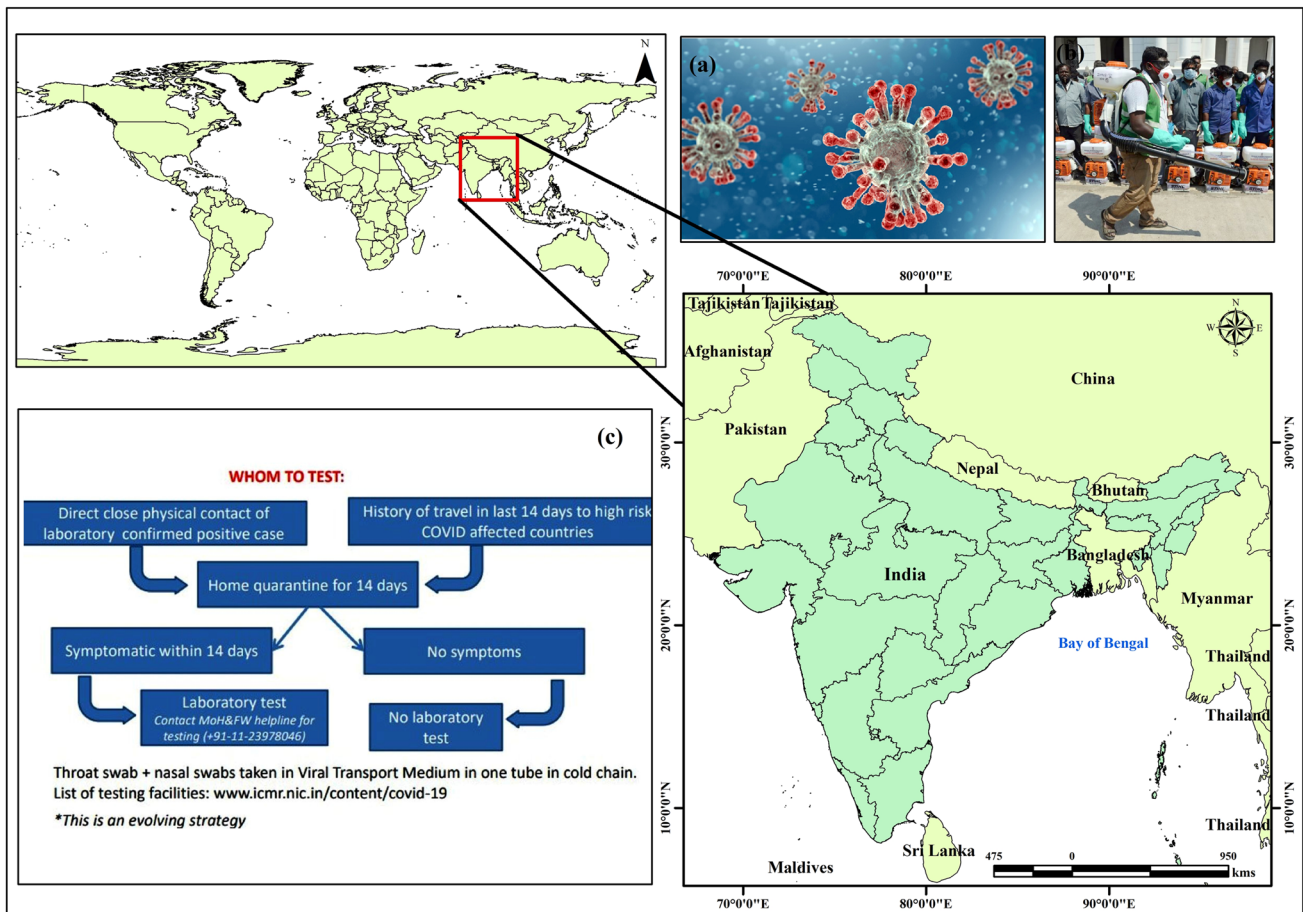


Fig. 4 The study area shows that the geographical situation of India. **a** The picture shows that the structure of coronavirus (Harvard University 2020); **b** the strategy in India during coronavirus pandemic; **c** testing strategy guidelines for coronavirus pandemic (ICMR 2020)

notified website. These data are calculated in the MS-Office software and increasing results recorded the situation of the active case in India.

The relation between active cases and deaths

The relation between active cases and deaths is considering the actual condition of any pandemic. Active case and death ratio estimate the health condition of an area. Active cases and deaths data are calculation in MS-Office and estimate the active and death cases scenario in India during the pre-lockdown to all fourth phase of lockdown.

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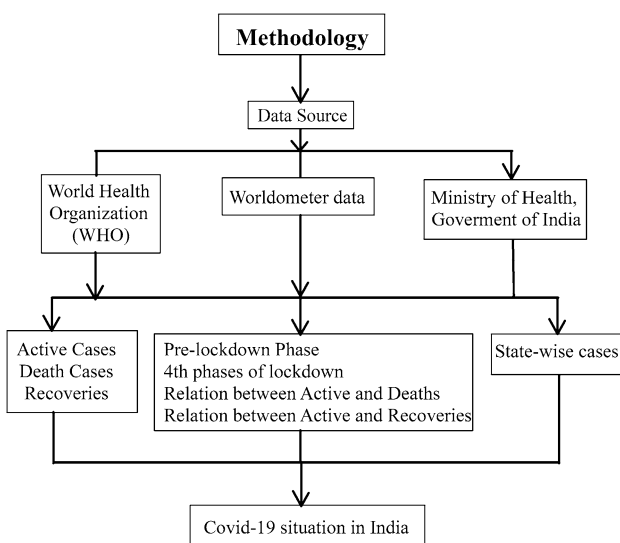


Fig. 5 Methodology of this study

Lockdown phase's condition

Before and after fourth phase of lockdown, data are individually calculated and the plot those data in MS-Office to identify the condition of coronavirus cases in different part. Active cases are showing in simple bar graph and death cases area showing the line graph for the understanding of this data.

Mortality rate calculation

Mortality rate or death rate is calculated in a particular population. To estimate the total number of mortality rate due to COVID-19 pandemic during the before and after lockdown, the individual and total number of death cases are used. The mortality rate is calculated using this equation:

$$\text{Mortality rate} = \frac{\text{No. of death cases from a specific time} * 100}{\text{Total No. of death in the population}} \quad (1)$$

If we look into all stages of pre-lockdown to all four lockdown phases, the active cases increased gradually and the recovery data also increased. Health condition, immunity power, pandemic control strategy and other facility improved the recovery rate. If the recoveries are high that the reason for the health and immune system of the particular person.

Result

Coronavirus is an acute disease, it causes high fever, cough, fatigue, breathing problem, loss of sense smell, etc. and in some cases finally death. All over the world is facing this problem; more than 54.1 lakhs confirmed cases are registered as of now; however, more than 3.45 lakhs people are dying due to this pandemic disaster (WHO 2020). Every day many people are inflected by this coronavirus in the world. The scenario is not different for India as well. As per current scenario, every day more than 6000 cases are registered as a new confirmed case and more than 120 people are dying due to this (<https://www.mohfw.gov.in/>).

State/UT wise affected condition

Coronavirus is first discovered at Wuhan and then spread to the other countries of the world. Approximately, 216 countries are suffering from this health disaster (WHO 2020). More than 3.54 lakhs people are immolated by this disaster. Many developed countries with better treatment are suffering the same problem. It highly affects old people (more than 60 years) and the children (below 10 years). Although

the doctors are continuously trying their best and save the patients from death. The patients are recovering rapidly, like death 21.80 lakhs people are recovered.

State-wise Indian situation is different in the different parts of India. Maharashtra is highly affected all across India. Around 50,231 total cases were registered and (WHO 25th May 2020) over 14,600 recovered (Table 2). The Arunachal Pradesh and Sikkim total case is 1 people and another side Lakshadweep and Nagaland have not registered any COVID positive cases (Fig. 6). Those UT and state are free from this epidemic. Maharashtra, Delhi, Gujarat and Tamil Nadu registered huge COVID positive in last decades.

Indian fight against COVID-19

Coronavirus first discovered or reported in India on 30th January 2020. First some days, the active cases are not too high. From this trend line, it is very clear to find that the active cases are increased day by day. Also, the recovery ratio is increased. More than 40% of patients are already recovered. As per the data, the more than 57,000 patients recover properly where the active cases are 74,461. In the relation between active cases and the deaths cases, the R^2 value is 0.8754 (Fig. 7). The relation between active cases and the recoveries, the R^2 value is 0.9246 (Fig. 8).

In India, the spreading of the novel coronavirus was divided into some phases. From the 30th January 2020 to 25th May 2020, lockdown is divided into five phases. From 30th January 2020 to 22nd March 2020 is considered as before lockdown phase (Fig. 9). On 30th January 2020, a case was registered from Karnataka, then the second case was registered on 2nd February 2020 from Delhi. The third on 3rd February 2020 and the fourth one registered almost after a month on 2nd March 2020. Also, the first death case came out on 13th March 2020 from Karnataka and the second news came from Delhi on 14th March 2020. On 17th, the third case was registered. The total death cases are before the lockdown phase is only 5 where the confirmed cases are 341. After “Janta Curfew” on 22nd March of 14 h, the Govt. of India decided to the lockdown the country from 23rd March (5:00 pm) to 14th April it considers as the lockdown Phase 1 (Fig. 10). In the first 5 days, the average of confirmed cases is about 76.6 people where the last 5 days of phase 1 lockdown is 899.6 people. Also, the number of death of first 5 days average 2.4 people and in the last 5 days, it increases to average 34.

Lockdown phase 2 (Fig. 11) was started from 15th March 2020 and ended on 30th March 2020. In these 16 days, more than 1000 confirmed new cases were registered except one or 2 days, overall the average of new cases is 1417.9. The death cases are also increased rapidly average of 45.9 and more than 30 death cases registered per day. The next 17 days which is 1st May 2020 to 17th

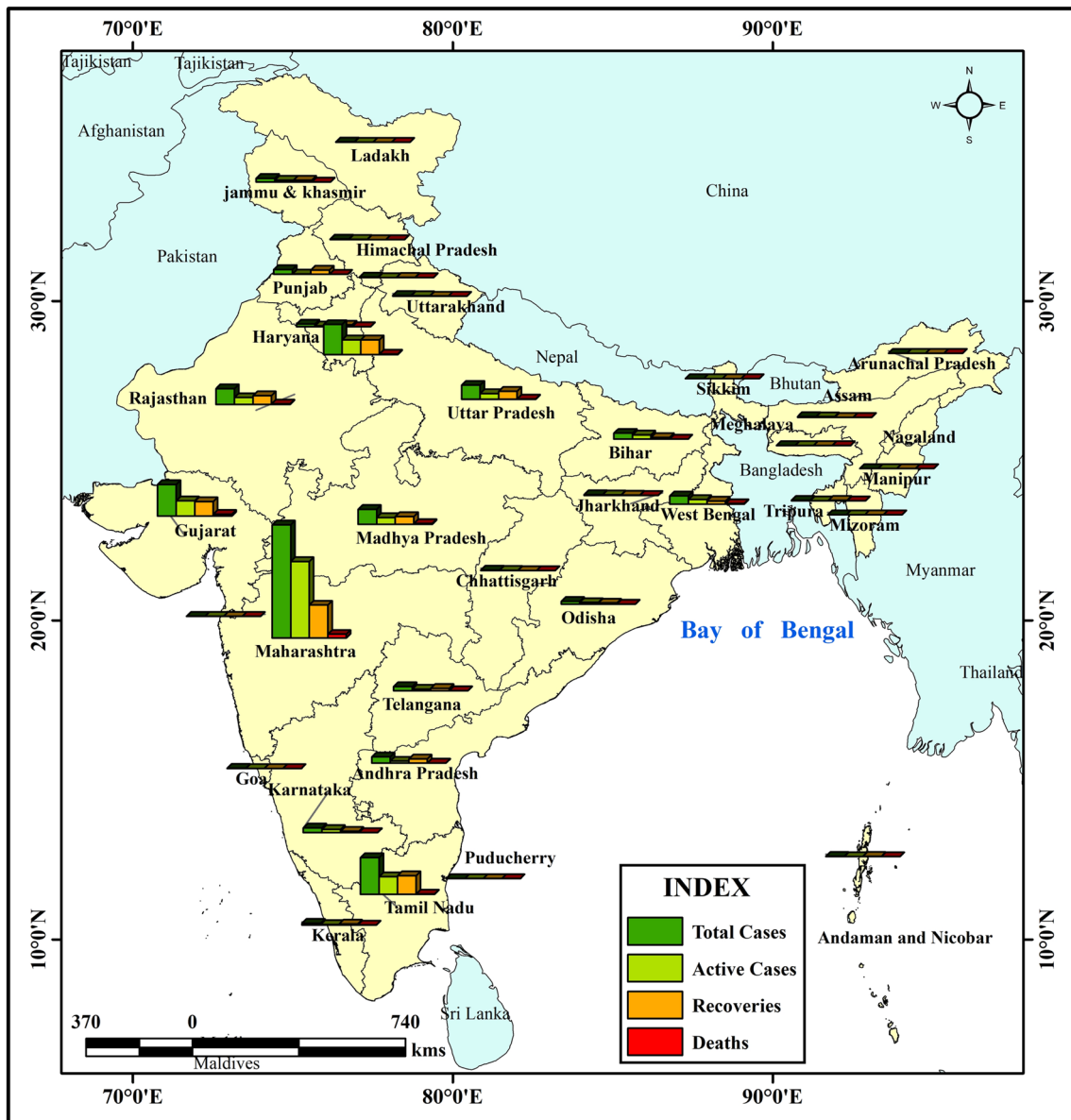


Fig. 6 Indian state/UT wise total cases, active cases, recoveries and deaths situation during coronavirus

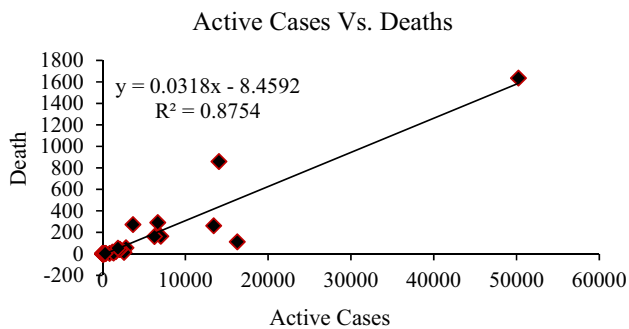


Fig. 7 Relation between active cases and deaths

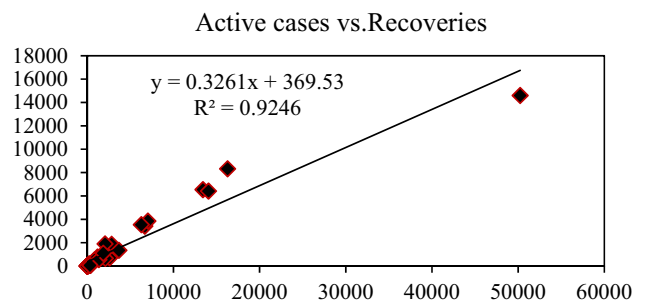


Fig. 8 Relation between active cases and recoveries

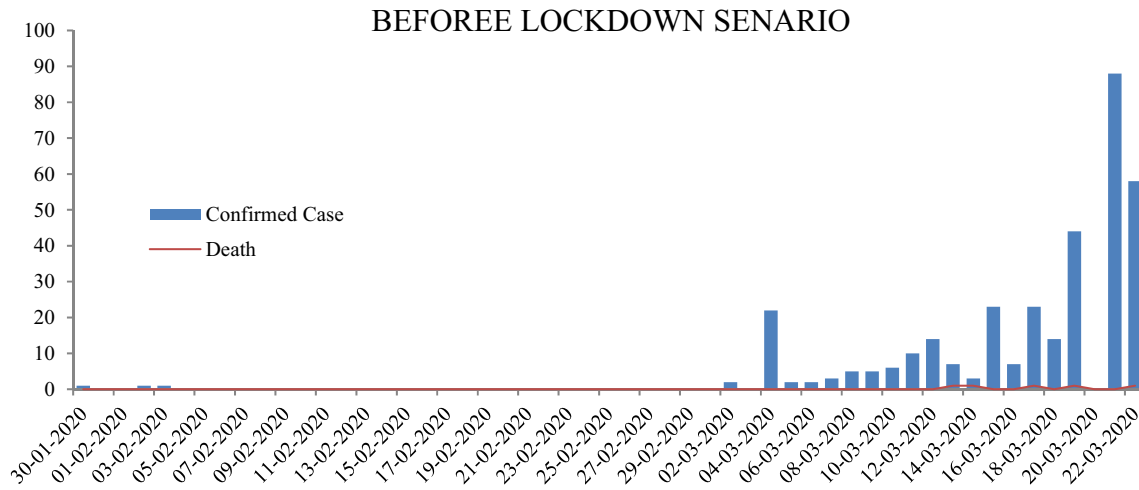


Fig. 9 Before lockdown situation

Fig. 10 Lockdown phase 1

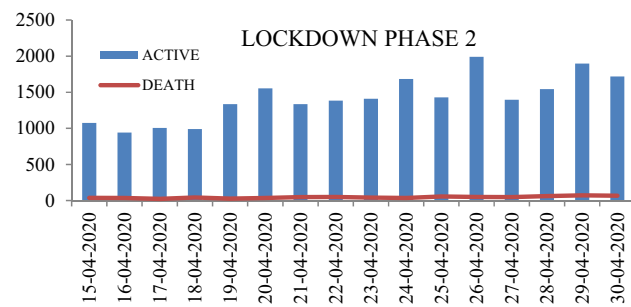
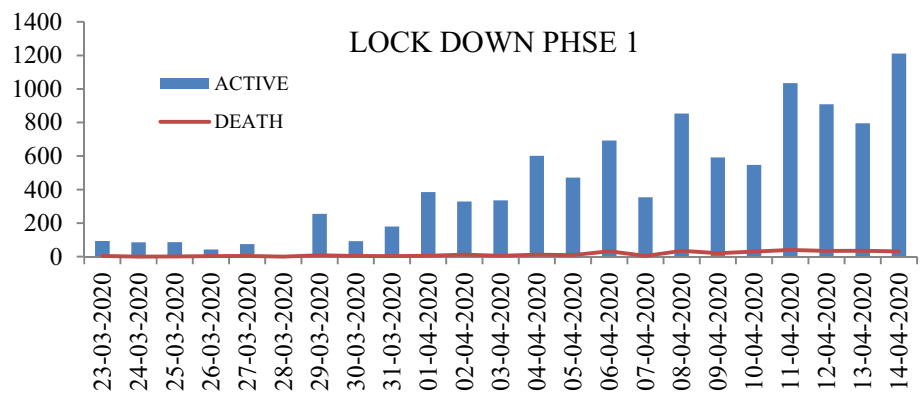


Fig. 11 Lockdown phase 2

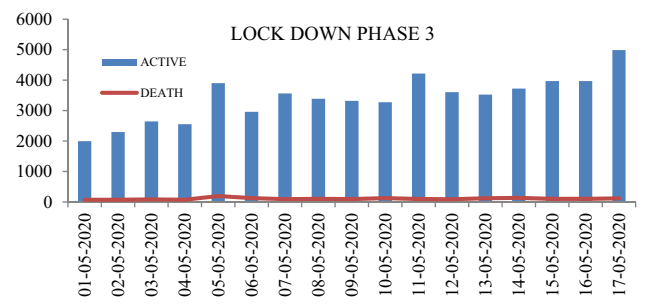


Fig. 12 Lockdown phase 3

May 2020 considered as third lockdown phase (Fig. 12). In this phase, the government gave some relaxation except essential commodities. If the phase divided into two parts then in the first part represents the average new confirmed case is 2912 people and the death is 102. However, in the second phase, average confirmed new cases are 3843 and the death average is increased to 110. The last phase of

the study of phase 4 of the lockdown is calculated from 18th May 2020 to 24th May 2020. In these 7 days, more than 5000 new confirmed cases are registered per day and more than 130 new death cases are registered every day (Fig. 13). The average of new confirmed cases is 5848.7 where the average new death cases are 142.1.

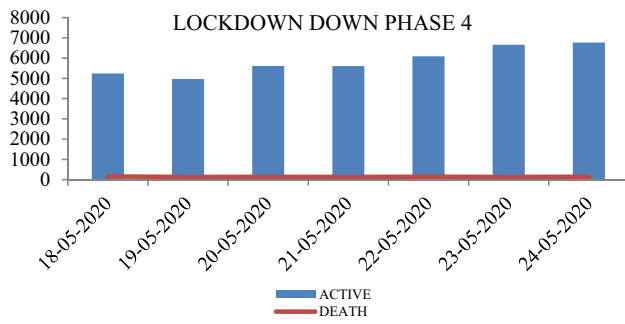


Fig. 13 Lockdown phase 4

Table 3 Active and death cases scenario

Stages	Active cases	Active cases rate	Death	Death rate
Before lock-down	341	0.259	5	0.129
Lockdown phase 1	10,022	7.600	334	8.637
Lockdown phase 2	22,687	17.204	735	19.007
Lockdown phase 3	57,877	43.890	1798	46.496
Lockdown phase 4	40,941	31.047	995	25.731
Total	131,868	100	3867	100

Mortality and active cases rate

The corona confirmed case registered first on 30th January 2020. If the total period, consider till 25th May 2020 total 116 days, then the confirmed ratio may be less. But in the first 53 days (22nd March 2020) or before lockdown scenario, 341 new confirmed cases registered 0.258% of total 116 days cases. After the “Janta Curfew” of 22nd March 2020, lockdown is started all over India from 23rd march, 2020 at 5:00 pm. In lockdown phase 1 from 23rd March to 14th April 2020, the new cases are increased 7.60% of total registered confirmed cases. In this phase except for essential commodities, all other commodities export and import process is closed. In phase2 of lockdown from 15 to 30th April 2020, the total registered cases are registered of this phase is 22687 which are 17.20% of total cases. After that, the lockdown extended from 1st to 17th May 2020. In this phase the some any relaxation is given by the government, not only on essential but also on the other commodities. Basically in this stage, total country is divided into three zones (red, orange, green). Full relaxation is given in the green zones, moderately gave in orange and slowly gave some relaxation in the red zones.43.89% (Table 3) of total cases are registered in this phase (Fig. 14). In the

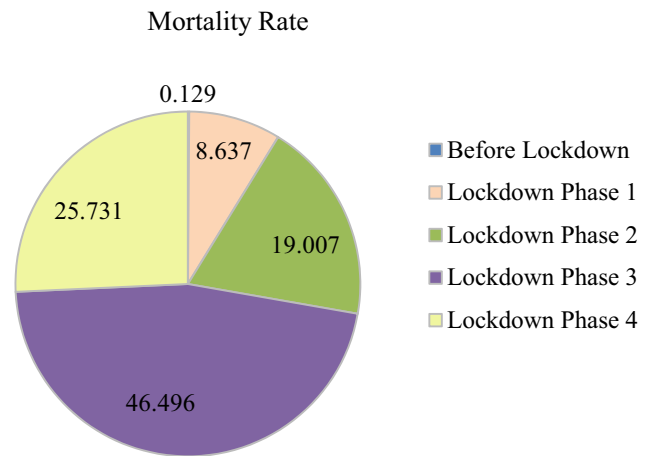


Fig. 14 Total cases registered before and during the lockdown

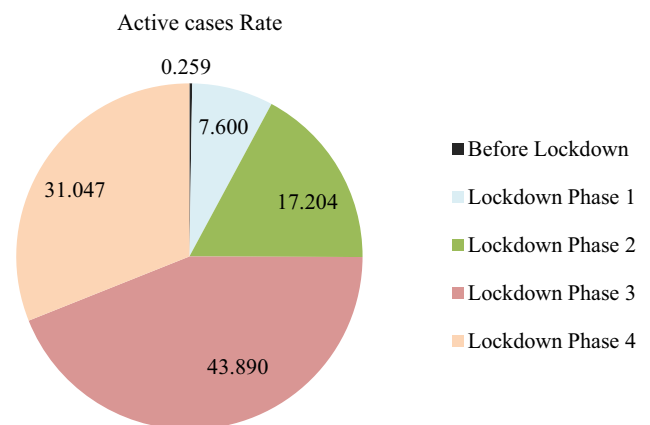


Fig. 15 Deaths cases registered before and during the lockdown

fourth phase of lockdown, all zones got so many relaxations and are given in all kind of commodities. The first 7 days of the fourth phase of lockdown 31.04% of cases of total cases are registered. About more than 6000 cases are registered per day.

From 30th January 2020 when the first case is registered at Karnataka to till 24th May 2020 total 3087 death cases registered. In the first 53 days till 22nd March, 2020 total 5 patient died due to COVID-19, which is 0.13% of total death. In the first lockdown phase (23rd March–14th April 2020) it is increased to 334 only in 23 days, 8.64% of total death. After the extension of lockdown for more 16 days till 30th March 2020, the total cases are registered 22,687, 19.01% of total cases. In phase 3, the 46.495% (Fig. 15) of total death cases are registered. After that, the first 7 days of fourth phase is registered almost 25.73% of the total cases.

Discussion

Novel coronavirus indicates a “new pathogen of a previous know type” of the virus. The acute disease was first found at Wuhan, China in December 2019. After that, the virus spread to other places in China. Then after the disease affects the other countries of the world, also India do not get relief from this. On 30th January, India reported its first case of COVID-19 or novel coronavirus. By the 3rd February 2020, three cases were registered; all are students who just come from Wuhan. On 4th March 2020, 22 new cases come to light, where the Italian tourists are included (14 infected). First death due to the COVID-19 is on 12th March 2020. A 76 years old man died at Karnataka, State of India. On the next day the second news comes from Delhi, a 60 years woman died. In 2 days, two confirmed cases have come and both of them had contact with abroad at the time of return. On the other side, active cases are increased gradually. By 17th February, it has increased to three and by 20th, five confirmed death cases were registered all over India. Government of India decided to protect people from this viral disease took action like “Janta Curfew” on 22nd March from 7 A.M to 9 P.M and declared the 1st phase of Lockdown from 23rd to 14th April 2020. In between of lockdown, the main focus of Government is not only to recover the infected person but also to control the growth of spreading. Govt. of India wants to control the virus into the 1st stage, because in the stage of community spreading. In a developing highly populated country, it is not possible to control the spreading any more where people do not understand the current problem. The lockdown phase was increased gradually but the infected number is also increased side by side. In the fourth stage, every day almost 5000 cases are registered and the death comes to about 120 per day.

India as one of the largest populated country of the world also trying to protect people from this disaster and save the corona affected patients. According to the details, the death ratio is higher than the last three phases of lockdown. Per day more than 100 people are losing their life. More than 57,000 patients are recovered from this pandemic disaster; more than 40% of patients are won the acute disease. Also, the trend line seems this same scenario. In respect of other developed countries, the situation is quite good but from the trend line, it is clear that the death ratio is similarly growing with confirmed cases in all over India. In most of the states of India, the death ratio is higher according to the confirmed cases ratio. Basically, in the last few days, the ratio increased than the other phases of lockdown.

Conclusion

This study evaluated the COVID-19 situation on a global basis and in the special context of India. The coronavirus is more harmful to the people and over the environment. This virus started in Wuhan, China in December 2019. At present time, this virus was spreading over 216 countries (WHO report, 2020). USA, Spain, France, Russia, Italy and India are the most affected country over the globe. There were no medicines to protect against this pandemic. Many countries fail their health facility and some countries built a positive report from this pandemic. Currently, the recovered people from COVID-19 are increased. World-wide people, researcher, Government, health worker and doctor are struggling with this virus.

In India, the situation is the same as the world. The most populated country is affected in COVID-19 in the time of 30th January 2020. There is not the same situation as in the initial phase. Gradually, the affected numbers are increased and the government is fighting with them. Central and state government are working together for fighting this worldwide pandemic. The government take “Janta curfew”, fourth time of lockdown is not controlled by any more. Infected number increased and gradually the recovered number was improved. Some states/UT is free from this pandemic like Nagaland and Lakshadweep. The economy of India is very much affected by this situation. Some industries are facing a huge amount of financial degradation or loss. The GDP is decreased gradually and it is at the lowest. It's depending on people common situation, Government cannot stop this pandemic for their policy or other related information till the peoples are not cautious about the pandemics and built social distance. In this situation, more life-threatening and if people will not follow the WHO guidelines, and it may play more havoc very soon.

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Compliance with ethical standards

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical approval This study based on World Health Organization (WHO), Health, Ministry of India and Worldometer COVID-19 data and literature review.

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