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ARTICLE

The prevalence, preventive measures and economic impact of pandemic COVID-19 in India: the initial phase

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ABSTRACT The novel coronavirus (SARS-CoV-2) is posing a serious threat to the mankind with its massive infection rate and potentially fatality. A total of 212 countries have been infected within the 112 days of first report causing 2 314 621 confirmed cases and 157 847 deaths worldwide. India, the country which is already battling with poverty, malnutrition and high population density is also at the second stage of coronavirus transmission. The situation is worsening and the attention has focused on the prevalence and preventive measures to be taken to protect 1.35 billion people of the largest democratic country of the world. In this review, a study has been designed to evaluate the prevalence, transmission, clinical symptoms, and preventive measures to control the community transmission of this fatal disease. The initial impact of coronavirus disease (COVID-19) outbreak on Indian economy has also been dealt with. This study reviews and summarizes the main points of the epidemic in India until the end of April 2020.
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Introduction

Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2), a contagious positive-sense single stranded RNA virus is the causative agent of ongoing global pandemic COVID-19 (Gorbalenya et al. 2020). Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) were well-known outbreaks of coronavirus that have been previously characterized as a major public health concern (Yin and Wunderink 2018). Prevalence and outbreak of novel coronavirus (2019-nCoV) from Wuhan, China has become pandemic, possessing an implausible threat to the mankind.

The situation of world trembled came in focus on New Year's Eve of 2019. On 31st December 2019, a cluster of 27 pneumonia cases of mysterious aetiology was first reported by Wuhan Municipal Health Commission in Wuhan City, Hubei province, China (Rapid Risk Assessment, ECDC). More arresting fact is that almost all of these people were directly or indirectly involved with the Wuhan's Huanan seafood wholesale market (a wholesale market of fish and live animals) which might point to a zoonotic origin (Wu et al. 2020). Clinical features common to several infectious diseases such as fever, dyspnoea, and bilateral lung infiltrations, pneumonia and its obscure aetiology call up the unintended consequences of previous exposure of SARS outbreak of 2002-2003 (Chen et al. 2020). Therefore, a surveillance definition and detection systems have been developed through World Health Organization (WHO). Laboratory investigations and bioinformatics analyses revealed novel coronavirus (2019-nCoV) as the causative agent of ongoing flu like illnesses on 9th January 2020 (Wu et al. 2020). Next day, the genome sequence of the novel coronavirus was made publicly available and uploaded in the GenBank database (accession number- MN908947) by the Shanghai Public Health Clinical Center & School of Public Health (Holmes 2020). WHO announced "COVID-19" and "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" as the name of this new disease and its causative agent respectively on 11th February 2020 (Wu et al. 2020).

Apart from the scientific investigation, SARS-CoV-2 starts to assert its terribleness. In a span of few days, a leading number of people got infected and most of them were fighting for their lives in hospitals. As of 20th January 2020, a total of 217 COVID-19 affected cases were reported from China (Wang et al. 2020). First confirmed case outside the China was reported from Thailand followed by Japan, South Korea and eventually spread to the other countries (Nishiura et al. 2020). As of 20th April, 2314621 confirmed cases of COVID-19 were reported worldwide, affecting more than 210 counties and territories (WHO, COVID-19 situation report- 91).

First case of death from COVID-19 was reported on 11th January 2020. On 15th January 2020, a second death has taken place. Both the deceased patients were more than 60-years old male who were suffering from other health issues as well (Hui et al. 2020). The World Health Organization declared the novel coronavirus outbreak as pandemic (WHO Director-General's opening remarks at the media briefing on COVID-19). Europe and United States gradually turned into the epicentre of the pandemic, infecting more than 1.4 million people worldwide. After the 112 days of first report, with over, 157 847 worldwide deaths, COVID-19 have wreaked large-scale damage throughout the world (WHO, COVID-19 situation report- 91).

India is the second most populated country in the world with the population density of 382/km^2 (niti.gov.in). It is also the seventh largest country in the world, covering an area of about 3 287 263 km^2 (https://www.india.gov.in). With a finest architectural heritage, spectacular landscapes and myriad attractions, the country is the most popular tourist destination in the world. It shares about more than 3 400 km border with China, the epicentre of COVID-19. Therefore, it bears a great possibility of human transmission of the disease and may possess a major rise in the case of fatality. At present, 18 601 confirmed COVID-19 cases were reported in India and the situation is worsening alarmingly (Ministry of Health and Family Welfare). The attention has focused on the prevalence and preventive measures to be taken to protect 1.35 billion people of the largest democratic country of the world. The present study evaluates the initial scenario of pandemic SARS-CoV-2 infection in India.

Transmission

COVID-19 is highly contagious disease, entitled pandemic (WHO Director-General's opening remarks at the media briefing on COVID-19) by WHO as the cases of the infection continued to swell with over 1.4 million confirmed cases reported globally so far. As per the early cases reported from Wuhan, it is assumed that the disease was spread from a zoonotic source (Report of the WHO-China Joint Mission on Coronavirus Disease 2019) followed by a massive human to human transmission and become a global health concern.

Person to person transmission mainly exhibits via direct contact with infected personals or by respiratory droplet produced during coughing and sneezing from an infected individual. However, SARS-CoV-2 may not be airborne (Khamsi 2020). Close contact with infected person, contact with contaminated surfaces, fomites or items are the most susceptible way of transmission of COVID-19. Viruses are inhaled into the body through mouth, nose or possibly by eyes. Infected people are thought to be most contagious when they are symptomatic. However, transmission is also possible from asymptomatic persons (Rothe et al. 2020).

India at present is in the second stage of coronavirus transmission and most of the positive cases have been reported in people with a travel history from affected countries. A lot of cases were observed where family members of the infected person also tested positive with COVID-19. However, community transmission has not been noticed so far.

Some report stated that peoples arriving from virus infected countries or suspected of coronavirus infection were escaping from quarantine centres or providing wrong information in India owing to isolation and social fears that can lead to the unnecessary spread of the deadly disease further (11 coronavirus suspects flee from a hospital in Maharashtra).

Prevalence of COVID-19 in India

First case of SARS-CoV-2 infection in India was reported on January 30th, 2020 (India's first coronavirus case confirmed in Kerala). In a span of four days, two other positive cases were also reported in Kerala (Second case of coronavirus confirmed in Kerala, Kerala now confirms third case of coronavirus, patient had returned from China's Wuhan), prompting the local government to declare a state disaster on February 3 (Kerala government declares coronavirus as state disaster). Surprisingly, all three patients were students who had returned on vacation from Wuhan to Kerala. They have recovered and stable now (Kerala defeats coronavirus; India's three COVID-19 patients successfully recover). Consequently, more than 3400 persons who came in contact with these patients have been quarantined in Kerala to contain the coronavirus outbreak. After 3rd February, India passes through a calm phase of about a month in regard to the global coronavirus outbreak as no new case was reported. The next positive report was obtained in a 45-year-old person in Delhi on 2nd March who had a travel history from Italy (Coronavirus hits Delhi: Two new cases detected in national capital and Telangana). On the same day, a 24-year-old engineer in Hyderabad who had travel history from Dubai was tested positive (Nichenametla 2020). The Govt. of Telangana identified 36 people who had been in contact with the Hyderabad engineer had developed symptoms of coronavirus infection. The next report of infection emerged from Jaipur where an Italian couple have tested positive and were immediately hospitalized. In addition, the entire tourist group including the

Table 1. Prevalence of COVID-19 pandemic in India by states and union territories (as of 20th April 2020)

States & Union Territory of India	Total confirmed cases	Deaths	Cured/Discharge /Migrated	Fatality rate (%)	Recovery rate (%)
Andhra Pradesh	722	20	92	2.77	12.74
Arunachal Pradesh	1	-	-	0	0
Assam	35	1	19	2.85	54.28
Bihar	113	2	42	1.76	37.17
Chhattisgarh	36	-	25	0	69.44
Goa	7	-	7	0	100
Gujarat	1939	71	131	3.66	6.76
Haryana	254	3	127	1.18	50
Himachal Pradesh	39	1	16	2.56	41.02
Jharkhand	46	2	-	4.34	0
Karnataka	408	16	112	3.92	27.45
Kerala	408	3	291	0.73	71.32
Madhya Pradesh	1485	74	127	4.98	8.55
Maharashtra	4666	232	572	4.97	12.26
Manipur	2	-	2	0	100
Meghalaya	11	1	-	9.09	0
Mizoram	1	-	-	0	0
Nagaland	-	-	-	0	0
Odisha	74	1	24	1.35	32.43
Punjab	245	16	38	6.53	15.51
Rajasthan	1578	25	205	1.58	13
Sikkim	-	-	-	0	0
Tamil Nadu	1520	17	457	1.11	30.06
Telangana	873	23	190	2.63	21.76
Tripura	2	-	1	0	50
Uttar Pradesh	1184	18	140	1.52	11.82
Uttarakhand	46	-	18	0	39.13
West Bengal	392	12	73	3.06	18.62
Andaman and Nicobar	16	-	11	0	68.75
Chandigarh	26	-	13	0	81.25
Dadra, Nagar Haveli, Daman and Diu	-	-	-	0	0
Delhi	2081	47	431	2.25	20.71
Jammu and Kashmir	314	4	38	1.27	12.10
Ladakh	18	-	14	0	77.78
Lakshadweep	-	-	-	0	0
Puducherry	7	-	3	0	42.86
TOTAL	**18601**	**590**	**3252**	**3.17**	**17.48**

driver has been shifted to an ITBP facility at Chhawla for testing. Of them, fourteen tourists and the driver were tested positive on 4th March and quarantined (Italian tourist in Jaipur tests positive). Meanwhile, on the same day a man from New Delhi with a travel history from Italy, was also tested positive, taking the total number of positive cases in India to 29 (tracing the Italian connection to India's fresh coronavirus count). On 8th March, five new cases were reported from a family in Kerala (five more people from Kerala test positive for coronavirus). Five new cases of COVID-19 were reported on 9th March, and another six Tuesday, bringing the total count to 50 by 10th March (Rawat 2020). India's first fatality from the virus was reported on 12th March in Delhi (India's first COVID-19 death confirmed in Karnataka). On 13th March 2020, a second death has taken place (Perappadan 2020). Both the deceased patients were more than 60-years aged and also suffering from other health issues. Fresh cases have continued to emerge every day, since peoples returned from abroad and subsequently spread to almost

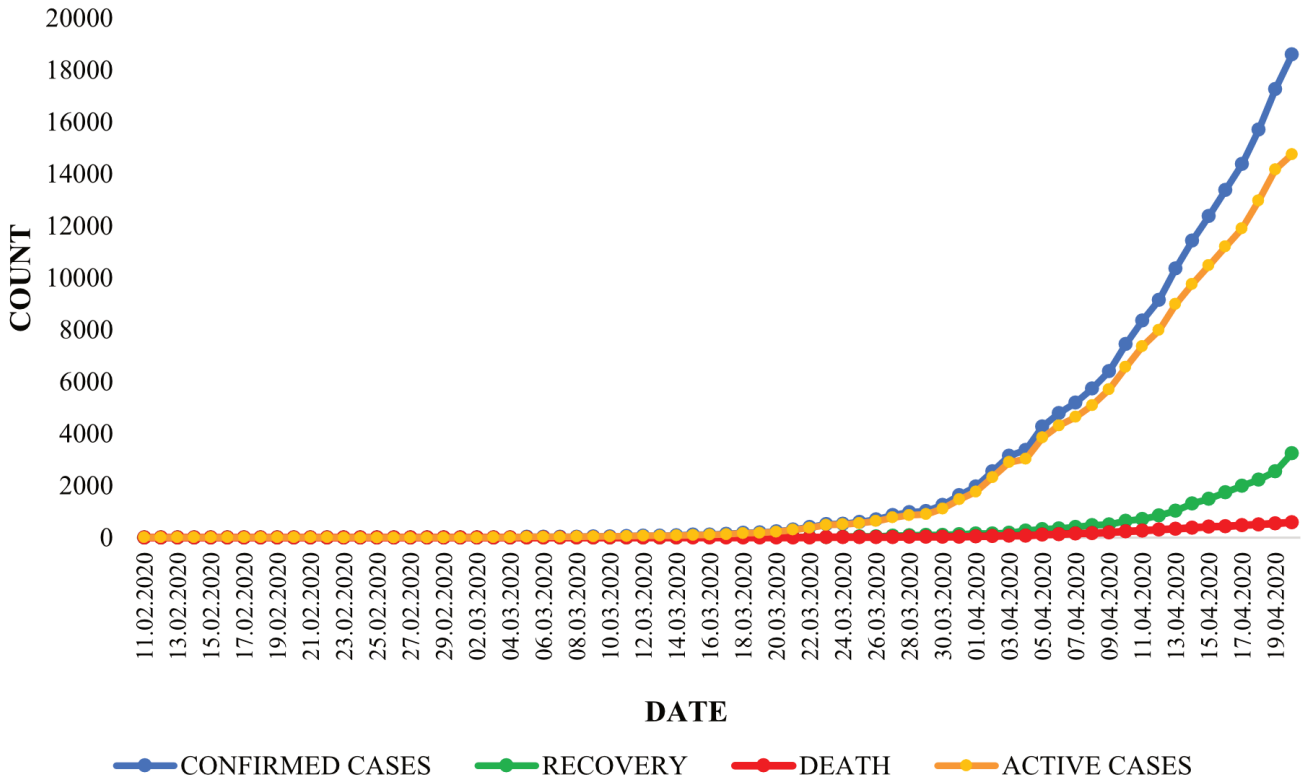

Figure 1. Day wise increase of COVID-19 cases in India (As of 20th April, 2020).

all other states and Union Territories throughout India.

Cases of local transmission increases alarmingly from an international religious event in which over 3400 people from India and abroad had gathered at the Nizamuddin area of New Delhi. Many of them have returned to their locality through public transport (Haider 2020). The matter came in focus when 10 Indonesians who attended the event in Delhi test positive in Telangana on 20 March (nearly 100 Delhi Mosque-linked coronavirus cases, 2100 evacuated). That lead the central government as well as state government to carried out an intensive contact tracing and sampling process in the states where the attendees of this event had travelled to. Some of the deaths in states like Karnataka, Jammu and Kashmir also have links to this event (Suffian 2020).

The initial prevalence of COVID-19 in India is represented in Table 1. The total number of active COVID-19 cases in India rose beyond 5000 on 7th April, less than a week after the crossing of 1000 marks. Within next two weeks, number of confirmed cases surge up to 18 601 (Fig. 1) (Ministry of Health and Family Welfare). As of, 20th April, a total of 18 601 persons have tested positive across India out of which 590 peoples have succumbed to the disease and 3252 peoples got recovery (Table 2). The epidemiological curve of COVID-19 in states and union territories of India is represented in Fig. 2. Most of the confirmed cases in India were noticed from Maharashtra followed by Delhi, Gujrat and other 29 states and union territories (Fig. 3). It was noticed that, 42% of the total corona infected patient in India belongs to the age between 21-40 years old but account for 7% of the fatalities so far. Report also stated that the rate of infection and fatality were higher in males compared to females (Dey 2020). Though most of the deceased patients in India were above 60 years old (63%) and had other health issues and co-morbidities (Dey 2020). Highest number of death was reported from Maharashtra; while the highest fatality rate was seen in Meghalaya. Remarkable number of recoveries was also noticed from Kerala, Chandigarh, Chhattrishgarh. However, the total fatality rate and recovery rate in India was 3.17% and 17.48%, respectively.

The government has identified 170 districts in 27 states as the existing hotspots across the country including major metropolitan cities like Delhi, Mumbai, Chennai, Bengaluru, Hyderabad and Kolkata, where the cases were largely concentrated (Govt. identifies 170 Covid-19 hotspots: here's the full list). Among the hotspot's areas, 10 districts including South Delhi, New Delhi, Mumbai City, Thane, Pune, Indore, Ahmedabad, Jaipur, Hyderabad and Chennai are worst affected and account for at least 45%

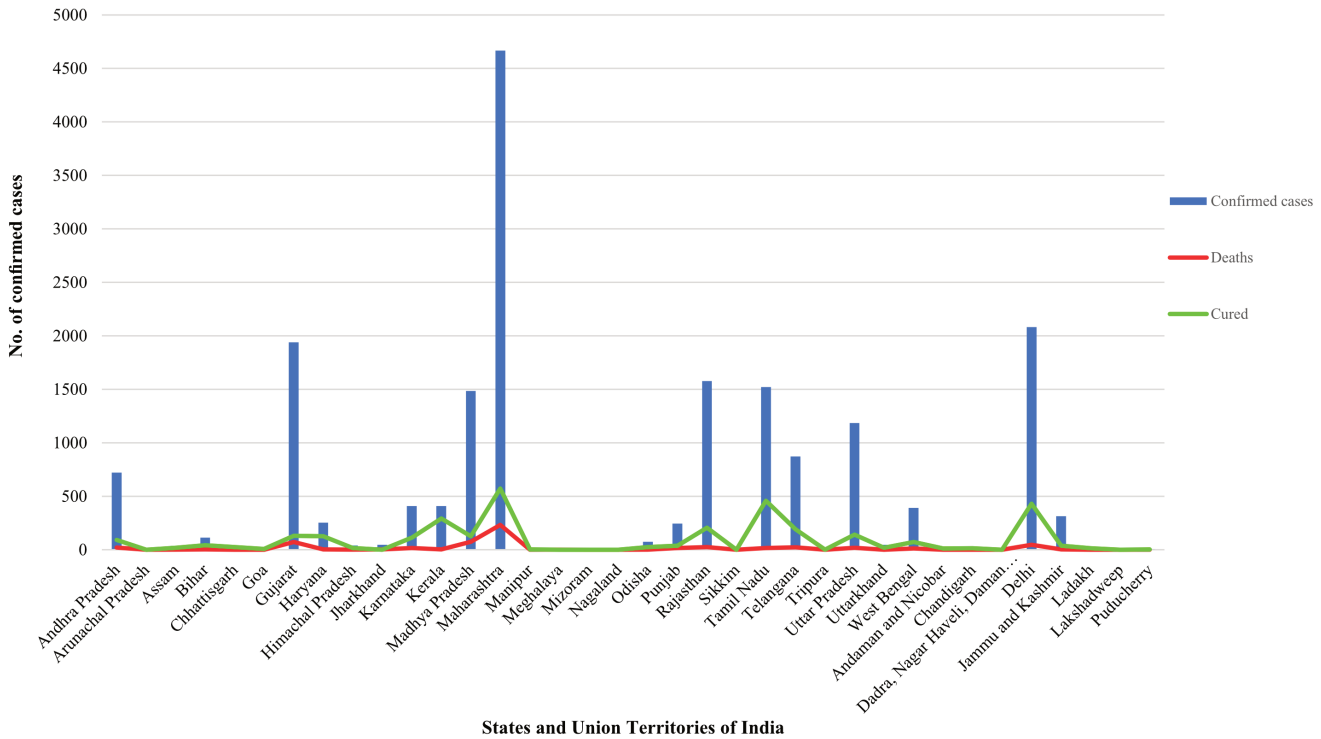

Figure 2. Epidemiologic curve of COVID-19 laboratory cases in different states and union territories of India (As of 20th April, 2020).

of the total COVID-19 cases in India (Govt. identifies 170 Covid-19 hotspots). All these hotspots areas are classified as red zones and sealed totally as well as an embargo has imposed on the movement of citizens. However, complete lockdown and quarantine programmes have vastly helped to contain the spread in India till now. Though, with the sharp spike in the number of Novel Coronavirus cases and reports of local transmission emerging across the country in last few days, at present India is on the brink of community transmission.

Clinical manifestations

Symptoms are the subjective evidence of any bodily disorder or inner turmoil or disease that is apparent to the patient. Infected patients start to show symptoms within a period of 2-14 days after the exposure to the corona virus (Backer et al. 2020). Clinical signs and symptoms of COVID-19 infected patients are non-specific and varied according to the degree of immunity of the patients as well as the virulence of the SARS-CoV-2 virus (Table 3). It is also possible to be infected with the virus without showing any symptoms of illness. Such asymptomatic cases are noticed in a leading percentage (80%) in India (Thacker 2020). Most common symptoms seemed in COVID-19 infection are fever (≥38 °C), asphyxia, tiredness and dry cough that are almost like common cold or flu (Huang et al. 2020). Some patients may have mild symptoms like nasal congestion, runny

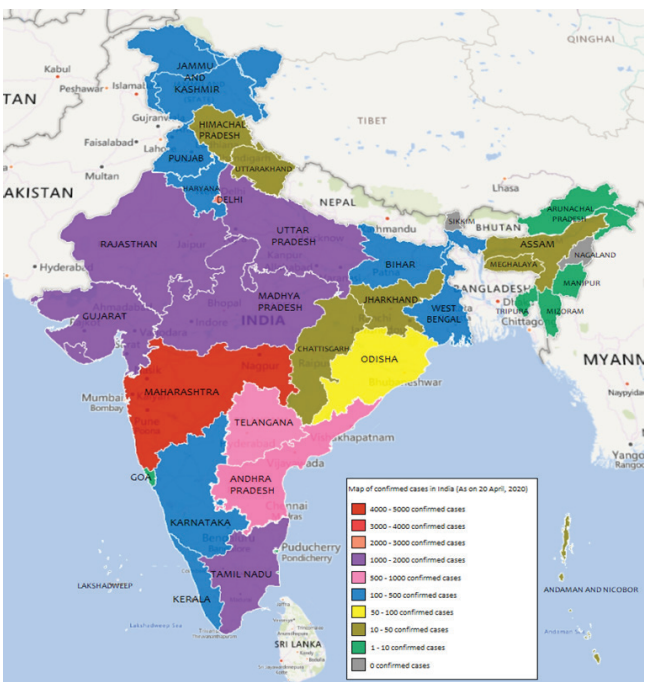

Figure 3. Map of COVID-19 pandemic prevalence in India.

Table 2. Date wise COVID-19 case count in India (As of 20th April, 2020).

	Confirmed cases		Recovery		Death		
Date	**New**	**Total**	**New**	**Total**	**New**	**Total**	**Active cases**
30.01.2020	1	1	-	-	-	-	1
31.01.2020	-	1	-	-	-	-	1
01.02.2020	-	1	-	-	-	-	1
02.02.2020	1	2	-	-	-	-	2
03.02.2020	1	3	-	-	-	-	3
04.02.2020	-	3	-	-	-	-	3
05.02.2020	-	3	-	-	-	-	3
06.02.2020	-	3	-	-	-	-	3
07.02.2020	-	3	-	-	-	-	3
08.02.2020	-	3	-	-	-	-	3
09.02.2020	-	3	-	-	-	-	3
10.02.2020	-	3	-	-	-	-	3
11.02.2020	-	3	-	-	-	-	3
12.02.2020	-	3	-	-	-	-	3
13.02.2020	-	3	-	-	-	-	3
14.02.2020	-	3	-	-	-	-	3
15.02.2020	-	3	-	-	-	-	3
16.02.2020	-	3	-	-	-	-	3
17.02.2020	-	3	-	-	-	-	3
18.02.2020	-	3	-	-	-	-	3
19.02.2020	-	3	-	-	-	-	3
20.02.2020	-	3	-	-	-	-	3
21.02.2020	-	3	-	-	-	-	3
22.02.2020	-	3	-	-	-	-	3
23.02.2020	-	3	1	1	-	-	2
24.02.2020	-	3	-	1	-	-	2
25.02.2020	-	3	-	1	-	-	2
26.02.2020	-	3	-	1	-	-	2
27.02.2020	-	3	-	1	-	-	2
28.02.2020	-	3	1	2	-	-	1
29.02.2020	-	3	-	2	-	-	1
01.03.2020	-	3	-	2	-	-	1
02.03.2020	-	3	-	2	-	-	1
03.03.2020	2	5	-	2	-	-	3
04.03.2020	1	6	-	2	-	-	4
05.03.2020	23	29	1	3	-	-	26
06.03.2020	1	30	-	3	-	-	27
07.03.2020	1	31	-	3	-	-	28
08.03.2020	3	34	-	3	-	-	31
09.03.2020	9	43	-	3	-	-	40
10.03.2020	1	44	-	3	-	-	41
11.03.2020	16	60	-	3	-	-	57
12.03.2020	13	73	-	3	1	1	69
13.03.2020	1	74	2	5	1	2	67
14.03.2020	8	82	1	6	-	2	74
15.03.2020	25	107	4	10	-	2	95
16.03.2020	7	114	-	10	-	2	102
17.03.2020	23	137	3	13	1	3	121

Table 2. Continued.

	Confirmed cases		Recovery		Death		
Date	**New**	**Total**	**New**	**Total**	**New**	**Total**	**Active cases**
18.03.2020	45	182	-	13	-	3	166
19.03.2020	14	196	-	13	1	4	179
20.03.2020	44	240	1	14	-	4	222
21.03.2020	75	315	-	14	1	5	296
22.03.2020	88	403	9	23	2	7	373
23.03.2020	116	519	-	23	3	10	486
24.03.2020	19	538	1	24	-	10	504
25.03.2020	69	607	17	41	3	13	553
26.03.2020	87	694	4	45	5	18	631
27.03.2020	176	870	31	76	1	19	775
28.03.2020	106	976	11	87	5	24	865
29.03.2020	48	1024	9	96	6	30	898
30.03.2020	227	1251	6	102	6	36	1113
31.03.2020	386	1637	31	133	1	37	1467
01.04.2020	327	1965	17	151	13	50	1764
02.04.2020	581	2546	11	162	12	62	2322
03.04.2020	608	3154	22	184	6	68	2902
04.04.2020	220	3374	83	267	9	77	3030
05.04.2020	907	4281	51	318	34	111	3851
06.04.2020	508	4789	35	353	13	124	4312
07.04.2020	405	5194	49	402	25	149	4643
08.04.2020	540	5734	71	473	17	166	5095
09.04.2020	677	6411	30	503	33	199	5709
10.04.2020	1036	7447	140	643	40	239	6565
11.04.2020	918	8356	73	716	34	273	7367
12.04.2020	796	9152	141	857	35	308	7987
13.04.2020	1211	10363	179	1036	31	339	8988
14.04.2020	1076	11439	270	1306	38	377	9756
15.04.2020	941	12380	183	1489	37	414	10477
16.04.2020	1007	13387	259	1748	23	437	11201
17.04.2020	991	14378	244	1992	43	480	11906
18.04.2020	1334	15712	239	2231	27	507	12974
19.04.2020	1553	17265	316	2547	36	543	14175
20.04.2020	1336	18601	705	3252	47	590	14759

nose, aches and pain, sore throat and diarrhea. Elderly (aged over 60 years) and immune-suppressed peoples (such as hypertension, diabetes, cardiovascular disease, chronic respiratory disease and cancer) are more likely to develop serious illness, ranging from severe pneumonia to multi-organ dysfunction and seek medical attention. Chest radiography revealed the evidence of pneumonia with bilateral ground-glass opacities and consolidation (Huang et al. 2020).

Preventive measures

India is an emerging and developing country (Silver 2020). However, despite its expanding economy, poverty in India is widespread. About 64 million people in India live in slum in an inscrutable unhygienic condition (India census says 1 in 6 lives in unsanitary slums) and approximately 21.9% people of India's total population are thriving under poverty (Habitat for Humanity in India). Therefore, if the community transmission starts in India, it may become the next epicentre of the SARS-CoV-2. However, India has a proud history to lead the world in eradicating fatal diseases like small pox and polio (India has tremendous

Table 3. Clinical signs and symptoms of COVID-19.

Number of days	Symptoms
1st -3rd	Fever, mild sore throat
4th	Extreme sore throat, increased body temperature, loss of appetite, headache, diarrhea
5th	Tiredness, muscle pain, dry cough
6th	Fever (100˚ F), dry cough, asphyxia, vomiting or diarrhea
7th	High fever (>100˚ F), severe cough, entire body pain, vomiting and diarrhea
8th-9th	Increase of all of the above symptoms, extreme high fever, increased asphyxia

capacity in eradicating coronavirus pandemic: WHO).

Revising its capacity to fight against pandemic, several measures have been taken both in national and state level in India. India started to screen passengers arriving from China, Hong Kong, Thailand and Singapore from the early week of February at 21 identified international airports by the Airport Health Organisation (Coronavirus: India starts screening passengers from Singapore). On 14th February 2020, Directorate General of Civil Aviation (DGCA) asked airports and airlines to screen passengers also coming from Japan and South Korea (Coronavirus: DGCA extends airport screening to passengers arriving from Japan, South Korea). Later on 4th March, compulsory screening was announced for all the international travellers, including aircraft crew members upon arrival from all the countries to contain outbreak or spreading of coronavirus in India (Coronavirus: All international arrivals to India to share travel history at airports). According to health officials, more than 1.5 million passengers had been screened at airports, limiting the entry of coronavirus. Besides it, thermal screening of passengers and crew members were conducted in twelve major ports (Kandala, Mumbai, JNPT, Marmugao, New Mangalore, Cochin, Chennai, Ennore, VO Chidambarnar, Visakhapatnam, Paradip and Kolkata) since February for disembarking seafarers and cruise passengers as a preventive measure to prevent the spread of Covid-19 infection (Coronavirus: Govt directs 12 major ports to put in place screening, quarantine system). Screening measures had also been implemented at 65 minor seaports and land borders (High level Group of Ministers reviews current status, and actions for prevention and management of COVID-19).

In light of the ongoing pandemic, on 11th March Government of India suspended all visas to India except diplomatic, official, United Nations/International organisations, employment and project visas from 13th March to 15th April 2020 (Coronavirus a pandemic: India shuts doors for outsider, under self-imposed quarantine). However, visas already issued for nationals of Italy, Iran, South Korea, and Japan were cancelled previously on 3rd March 2020 (Coronavirus outbreak: Govt. cancels Visas for Italy, Iran, Japan and South Korea, issues new travel advisory). Visa facilities had been suspended earlier from

Table 4. List of evacuated citizens from coronavirus affected countries (As of 20th April 2020

Date	Evacuated citizens		From	Quarantined at
	Indian	Foreigner		
1st February, 2020	324	-	Wuhan city, China	ITBP Chhawla camp and Army facility at Manesar
2nd February, 2020	323	7	Wuhan city, China	ITBP Chhawla Camp and Army facility at Manesar
27th February, 2020	76	36	Wuhan city, China	ITBP Chhawla Camp and Army facility at Manesar
27th February, 2020	119	5	Diamond Princess docked in Yokohama, Japan	Army facility in Manesar
10th March, 2020	58	-	Iran	Medical facility in Ghaziabad
11th March, 2020	74	9	Italy	Army facility in Manesar
13th March, 2020	44	-	Qom city, Iran	Indian Navy quarantine facility at Ghatkopar, Mumbai
15th March, 2020	218	-	Italy	ITBP Chhawla Camp
15th March, 2020	236	-	Iran	Indian Army Wellness Centre, Jaisalmer, Rajasthan
16th March, 2020	53	-	Tehran and Shiraz, Iran	Indian Army Wellness Centre, Jaisalmer, Rajasthan
22th March 2020	263	-	Rome, Italy	ITBP Chhawla Camp
25th March 2020	277	-	Tehran, Iran	Indian Army Wellness Facility, Jodhpur, Rajasthan
29th March 2020	275	-	Iran	Indian Army Wellness Facility, Jodhpur, Rajasthan
30th March 2020	35	-	Kabul, Afghanistan	ITBP Chhawla Camp

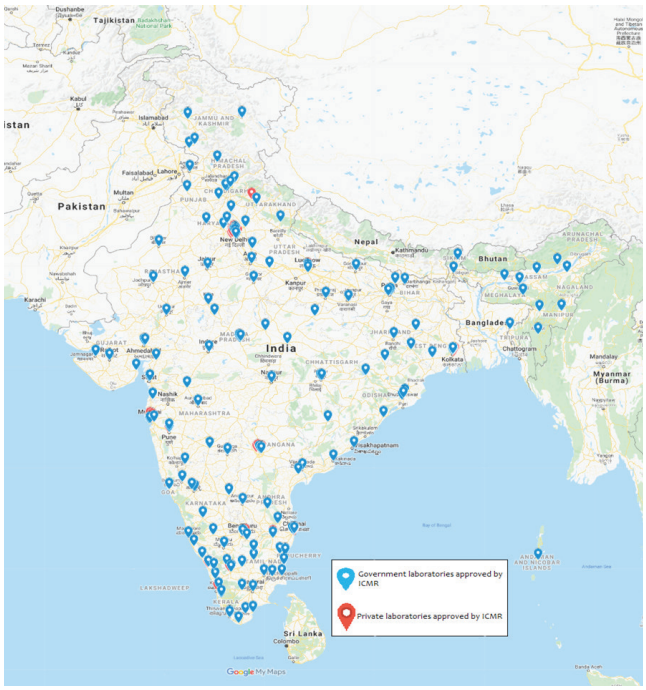

Figure 4. Map of diagnostic centre of COVID-19 disease in India approved by ICMR.

the mainland China, countries where the virus is on a rampage (Singh 2020).

However, in the wake of the COVID-19 outbreak, Government of India has undertaken evacuation operations from several countries to bring back Indian citizens as well as some nationals of other countries in order to ensure their safety and security and subsequently quarantined them to contain community spread (Table 4).

On 19th March, the DGCA had banned all international commercial flights landing in India for a week from 22 March (Kulkarni 2020) that was further extended till 14th April (Government extends ban on international flights till April 14). The domestic passenger flight operations were also suspended from midnight of March 24 (Coronavirus outbreak: Govt suspends all domestic flights from midnight of March 24). On 22nd March, the Union government suspended all passenger train services in the country followed by all inter-state passenger services including interstate transport buses and metro services in a bid to stop the spread of coronavirus (Coronavirus impact: Railways cancels all passenger trains till March 31).

After a surge of Covid-19 cases in India and a possible threat of community transmission, set up of new quarantine facility, isolation ward, specialized hospital for treatment of COVID-19 patients started in full swing throughout the country. Nine quarantine facilities, each of 200-300 personnel capacity had been established by Indian Air Force at nodal Indian Air Force (IAF) bases (IAF creates nine quarantine facilities at its nodal bases across country as coronavirus cases multiply). Besides it, quarantine facilities had been established at Jaisalmer and Jodhpur (army), Manesar (army), Kolkata (army), Chennai (army), Kochi (navy), Dundigal near Hyderabad (IAF), Bengaluru (IAF), Kanpur (IAF) and Jorhant (IAF). Defence forces were also prepared for any eventuality and ready to ramp up the capacity of the quarantine facilities (Gurung 2020). 285 beds had been designated by Ordnance Factory Board (OFB) for isolation wards (OFB designates 285 beds for coronavirus cases). A chain of 32 paramilitary forces hospitals with 1 900 beds earmarked for isolation and treatment of COVID-19 patients across the country (https://www.tribuneindia.com/news/nation/32-hospitals-for-paramilitary-forces-with-1-900-beds-to-treatcovid-19-patients-mha-61388. Accessed 26 March 2020). Government also granted emergency financial powers to army corps and divisional commanders for acquisition of medical equipment to set up quarantine facilities. West Bengal government converted the entire Calcutta Medical College Hospital, which has 2 200 beds, into an isolation and treatment centre for persons suspected to be infected with the novel coronavirus. All OPDs, Casualty ward in this hospital was closed temporarily, and no patients except COVID-19 could be admitted (West Bengal converts state-run hospital into COVID-19 isolation, treatment facility). Similar kind of approach was also taken by Bowring and Lady Curzon Medical College and Research Institute in Bengaluru (List of hospitals designated for treatment of COVID-19 patients in south India). Hospital with 1000 bed was constructed in Odisha (Mohanty 2020). Assam government started work to set up four temporary hospitals with 300 beds each across the state for treatment of COVID-19 patients. The government also established an isolation facility for 700 persons at the Sarusajai Sports Complex, Assam (Assam govt to set up 4 temporary hospitals for COVID-19). On 26th March Government of India also directed the private hospitals to begin treatment and admission of Covid-19 patients (Sharma 2020). Rajasthan government reserved 84 private hospitals in Jaipur district (Iqbal and Karmakar 2020). West Bengal government has also transformed 59 hospitals to treat COVID-19 patients covering all the districts of the state (https://m.economictimes.com/news/politics-andnation/all-22-districts-in-bengal-to-have-nodal-covid-19-hospital-mamatabanerjee/articleshow/74896587.cms. Accessed 30 March 2020). The Indian Railways were converted Non-AC sleeper coaches into isolation wards to meet the increasing demand for beds (Athrady 2020).

As of 21st April, a total number of 304 laboratories

(Governmental = 217; Private = 87) had been authorized by the Indian Council of Medical Research (ICMR) to process testing for COVID-19 (Indian council of medical research) (Fig. 4). Among them, National Institute of Virology (NIV), Pune functions as the nodal lab and resource centre for the Viral Research and Diagnostic Laboratories (VRDL) network and also performs quality control and quality assurance activities as well as provide technical training across India. National Pharmaceutical Pricing Authority and Drug Controller General of India instructed to ensure the availability of APIs (Active Pharmaceutical Ingredient) and drugs in the country amid the pandemic. The organisation had also been asked to monitor black-marketing or illegal hoarding. On 3rd March 2020, the Director General of Foreign Trade (DFGT) had issued notice to restrict the export of 26 APIs and formulation (Suneja 2020).

Central government assured that the frontline fighter of coronavirus outbreak including sweepers, ward-boys, nurses, paramedics, technicians, doctors and specialists would be covered by a special insurance scheme of 50 lakh (Noronha 2020). Insurance of Rs. 25 lakh and 10 lakh has been announced respectively by Gujrat (Coronavirus: Rs 25 lakh compensation for Guj frontline staff) and West Bengal (Combating COVID-19: West Bengal increases insurance coverage from Rs 5 lakh to Rs 10 lakh) state government for all those medical and supporting staffs. Some hotels and shared-living facilities across the mega-cities of India were earmarked as potential venues for accommodating healthcare workers. Central government directed the district magistrates, zonal deputy commissioners of municipal corporations and the deputy commissioner of police to take "strict penal action" against landlords for any harassment of doctors and paramedical staff to vacate their rented premises (Govt gives power to zonal DCs to take strict action against landlords evicting dics, paramedics). Government also arranged transport facility for medical staffs amid the lockdown.

Several government agencies along with private sector stepped up for mass production of ventilators, sanitizer, high grade protective material such as N-99 masks, gloves and personal protective equipment (PPE). The Ordnance Factory Board (OFB) increased the production rate of sanitizer, masks and body suits (Siddiqui 2020). Defence Research and Development Organisation (DRDO) designed ventilators and ramped up its production rate up to 10000 units per month (DRDO is stepping in to build ventilators and manufacture masks). State-run Bharat Electronics Limited (BEL) has been ordered to manufacture 30,000 ventilators amid shortage in wake of outbreak (Automobile manufacturers asked to make ventilators: Health Ministry). An order to manufacture 10,000 ventilators within a month had been given to Agva Healthcare, Noida (Coronavirus: Maruti, Noida firm got nod to supply 10 000 ventilators). Several automobile companies were also asked to focus on ventilator manufacturing (Automobile manufacturers asked to make ventilators: Health Ministry). Considering the shortage of ventilators and the rising number of cases in India, a group of doctors and engineers had been developed and tested 3D-printed splitters that can provide ventilator support to four patients using just one life support system (Badve 2020). A small IoT pendant called Kawach (shield) has been designed by a B-Tech student to promote social distancing among people (Ansari 2020).

Telecom agencies had set up a 30-seconds voice message to convey Do's and Don'ts as a default caller tunes to raise awareness on the coronavirus outbreak (Now, a caller tune for COVID-19). Public awareness campaigns had also saturated in every television channel. Telecom firms has taken initiative to post bulk SMS (Short Message Service) and Push notification on the simple 'Do's and Don'ts' to all the clients. Ministry of Health and Family Welfare, Government of India had been issued an indicative list of Do's and Don'ts for wide dissemination. A toll-free 24×7 helpline number, email ID for each state as well as countrywide have been activated by Union Health Ministry to address all queries concerning the disease (Health Ministry launches new toll-free number, email ID for queries on COVID-19). An App has been designed and promoted by the Central Government which will warn its user about the nearby presence of any corona-infected person.

As the coronavirus cases creeping forward, the government on 16th March declared a countrywide suspension of schools, colleges, universities, gyms, cinema halls, swimming pools and also asked to avoid mass gatherings as a precautionary measure. On the same day, Government has advised people to avoid non-essential travel and requested private companies to allow their employees to work from home (Schools Closed, Travel To Be Avoided, Says Centre On Coronavirus: 10 Points). All board examinations had been postponed.

Most of the COVID-19 infected individual of India had recent travel history in foreign countries. Therefore, in order to prevent local transmission, India's Prime Minister Mr. Narendra Modi appealed all citizens to observe 'Janata Curfew' (people's curfew) on 22nd March from 7 am to 9 pm. Later on 24th March, nationwide lockdown had been imposed for 21 days from 25th March to 14th April which was further extended till 3rd May under the provisions of the Disaster Management Act, 2005. The Prime Minister has also announced that the Centre had created a 'COVID-19 Economic Response Task Force' under the Union Finance Minister to deal with the economic repercussion of the current situation

(PM Narendra Modi forms economic response task force, calls for 'Janata Curfew'). Police were advised to follow the policy of explaining; persuading and requesting public to stay indoors. However, strict measurements had also been advised to maintain social distancing countrywide.

Aimed at avoiding panic among consumers, government decided to give permission to shops including ration shops (under Public Distribution System), dealing with food, groceries, fruits and vegetables, dairy and milk booths, meat and fish, animal fodder and pharmacy to remained available during lockdown. Home delivery of all essential commodities including food, pharmaceuticals, medical equipment through E-commerce also remained functional (Shops selling essentials, medicines will remain open throughout 21-day lockdown: Govt). The central government as well as state governments have issued free ration, required cash and other emergency facilities to the unorganised labour sector and all needy (Govt to provide 5 kg grains, 1 kg pulses for free over next 3 months: Nirmala Sitharaman). Jharkhand government decided to provide two months ration in advance (COVID-19: Jharkhand to give 2 months' ration in advance). Telangana government announced to provide extra 6 kg of rice to 87.59 crore (1 crore = 10 million) white ration card holders (Telangana Lockdown: 12 kg free rice per person, Rs 1 500 per family to be supplied for each white ration card). One month of free ration was also announced by Bihar Government for all ration card holders of the state (Bihar CM Nitish Kumar announces free ration for cardholders during coronavirus lockdown). West Bengal government has announced to provide rice from ration shops to a large sector of people free of cost for the next six months till September (Free foodgrains to all till September: CM). Paramilitary forces and Marine Commandos (MARCOS) of Indian Navy were also engaged to spread awareness and distribute rations among the tribal community living in inaccessible region of India (Combating COVID-19: Navy's MARCOS commandos reach out to fisherman at Wular Lake). Apart from ration assistance, 8.70 crore farmers across India to get Rs. 2000 as one-time relief through direct cash transfer before April first week (FM Nirmala Sitharaman announces Rs 1.7 lakh crore relief package for poor). They have also stated that the expenditure on the diagnosis and treatment of COVID-19 in Government premises will be carried out by the Government itself. Hence, it is assumed that the trajectory of the pandemic COVID-19 can be somewhat controlled in India.

Diagnosis

At a time when India's cumulative coronavirus infections have breached the 10000-mark, demand of testing kits and infrastructure has become the need of the hour. In India, laboratory tests were generally recommended and performed after appearance of severe breathing problem, sore throat like clinical manifestations. For diagnostic purpose, WHO recommended collection of samples from expectorated sputum, broncho-alveolar lavage or endotracheal aspirate from suspected individual (Hassan et al. 2020). These clinical samples were screened at the laboratory with RT-PCR. Use of specific primers and probes in the ORF1ab and N gene regions of SARS-CoV-2 were recommended by Chinese center for Disease Control and Prevention (China CDC) (Jung et al. 2020). Patient was confirmed as positive when both targets came positive. In case of discordance, or if the result was judged a weak positive, another clinical sample was requested and analyzed. Chest radiography, chest CT was done in selected patients as per the discretion of attending doctors when clinically instructed. Apart from this, viral isolation also performed from the specimen's airway epithelial cells and VeroE6 and Huh7 cell lines (Kothai and Arul 2020). However, isolation of viral genome from clinical samples is quite difficult and stringent biosafety level 3 (BSL 3) is required. In recent time a series of reliable and sensitive diagnostic tools were developed and deployed for rapid diagnosis of COVID 19. A molecular diagnostic company, Mylab, first Indian company to develop ICMR approved a Covid-19 test kit which has the ability to screen and detect the infection within 2.5 hours that is less than half of the hours taken by current protocols (Bose 2020). Mylab has the capacity to produce one lakh test kits per week and also ready to scale up the production to meet the increasing demands in India at an affordable price (Thacker 2020_b). ICMR had also recommended the use of rapid antibody test kit in hotspots, area with many cases across the country. Antibody test indicated the patient is infected or not by determining the presence of antibodies for coronavirus and it takes only 15-30 min (Shekhar 2020).

Though 217 government laboratories and as many as 87 private laboratories were made functional for testing till date (Fig.4), the numbers of tests being conducted daily are still insufficient. The ICMR has also allowed Truenat technology and Cartridge Based Nucleic Acid Amplification Test (CBNAAT) for the rapid and cheap detection of Covid-19 positive cases. As of 21st April, a total of 462621 tests had been conducted throughout India, just a minuscule portion given its population size. Therefore, Government should focus to increase the testing capacity to get a better grip on the situation.

Treatment

Since it's a new strain, there are no approved therapies till date. However, treatment is crucial to save the infected persons, especially high-risk patients – the elderly, those with debilitated immune-system and chronic illnesses, such as diabetes, respiratory disease and cardiovascular diseases. The preliminary treatment to manage severe acute respiratory infection (SARI) includes supportive oxygen care and mechanical ventilation (Hassan et al. 2020). Several clinical trials are recruiting globally as well as in India to assess the effect of antiviral medicines on infected personals. Remdesivir, a drug similar to a nucleotide, adenosine and intended to fight viral replication was tested in clinical trials through a compassionate use program in SARS-CoV-2 infected patients of the United States (NIH clinical trial of remedesivir to treat COVID-19 begins). Similar kind of clinical trials was also implemented in China (Joseph 2020). Treatment with intravenous remdesivir has no solid data till now to indicate its efficacy. Another report showed that the use of Favilavir (Favipiravir), an antiviral drug has secured approval as an investigational therapy from the National Medical Products Administration of China to treat Covid-19 infected patients (Favilavir approved as experimental coronavirus drug). Furthermore, a pilot investigator-initiated clinical trial (IIT) with APN01, a recombinant human angiotensin-converting enzyme 2 (rhACE2), is ongoing in the People's Republic of China to treat patients with SARS-CoV-2 infection (Apeiron begins pilot clinical trial with APN01 to treat coronavirus infection in China). India also expressed interest to participate in WHO solidarity trial for developing vaccines for COVID 19 (Thacker 2020$_c$). The treatment that has so far been attempted in India, using a combination of HIV, swine flu and malaria medicines. Doctors of Sawai Man Singh (SMS) Hospital in Jaipur treated an Italian lady with a dose of lopinavir 200 mg / ritonavir 50 mg twice a day in a combination with oseltamivir (drug used to treat swine flu), and chloroquine (used to treat malaria). Following this treatment, a remarkable improvement occurred and the woman got recovery from the COVID-19 (Indian doctors successfully cure Italian coronavirus patients). Use of this combination of anti-HIV drug (lopinavir and ritonavir) had also recommended by Union Health Ministry on a case-to-case basis especially for high-risk groups patients having hypoxia, hypotension, and organ dysfunction (Coronavirus: Health Ministry recommends anti-HIV drug combination lopinavir-ritonavir on case to case basis). ICMR recommended the limited use of hydroxy-chloroquine as a preventive medication for high-risk population such as healthcare workers involved in the treatment of suspected or confirmed cases of COVID-19 and peoples contact of positive cases (ICMR recommends hydroxychloroquine for high-risk population). US Centre of Disease Control and Prevention suggested the use of a combination of hydroxychloroquine and an antibiotic azithromycin (Information for Clinicians on Therapeutic Options for COVID-19 Patients). French doctors were also expanding use of hydroxychloroquine (Duqueroy 2020).

Economic effect

The effect of corona pandemic on global economy is a burning issue to discuss. In this section of the paper, we would like to address this issue on the perspective of Indian economy. In terms of notional Gross Domestic Product (GDP), India is the 5th largest country in the world and stood 3rd in terms of purchasing power Parity (PPP) in 2019 (World Economic Outlook Database, IMF, October- 2019). More or less 7% annual GDP growth has been recorded from 2014 to 2019 and Nominal GDP was 3.202 trillion US dollar in 2019 (IMF Database, Jan 28, 2020). However, growth of Indian economy shows a decline trend in the F-Y 2019–20. The situation seems to be further deteriorate due to the corona crisis in the last quarter in 2019-20 and estimated loss would be Rs. 9 lakh crore in the F-Y2019-20 which is equivalent to 3% of national GDP. The adverse effect of nationwide lockdown could be actually realised in 2020-21. Credit rating agencies like Fitch and Moody predict mere 3% to 3.5% growth rate in the 1st quarter of 2020-21 (Noronha and Sharma 2020). FICCI survey showed 53% of Indian businesses have indicated a marked impact of COVID-19 on business operations (Roychoudhury 2020). Economists also warn that the situation turns into worse further on the fact that how long the crisis lasts and what measures are taken by the government of the affected countries. Corona virus crisis will impact the Indian economy to a great extent. Productions as well as consumption of consumer durables, textiles, and automobiles are going to be effected badly. Apart from these sectors, tourism, aviation, hospitality, logistics sector would face a serious crisis even struggle for their existence in this situation. This crisis surely affects the small and marginal farmers due to problem of marketing their agro-products or force selling at low price to the local intermediaries and also to the daily workers for losing their jobs in both unorganised industrial sectors and agriculture.

Suggested economic measures/remedies

The present situation is very alarming for Indian economy and there was no indication for this sudden attack on In-

dian as well as on global economy. The situation could be tackled to a large extent if both short-term and long-term measures are taken by the central and state governments and central bank of India (R.B.I.). Central Government has already announced a stimulus package of Rs. 1.70 lakh crore for the weaker and needy section of the society to combat the crisis. Reserve Bank of India also has announced various measures like 3-month moratorium on term loans and EMIs outstanding as on 1st March, 2020, cut the REPO rate by 75 basis point (rate of interest at which RBI lends money to the commercial Banks) and Reverse REPO rate (rate of interest at which RBI lends money from the commercial Banks) by 90 basis point in order to generate more liquid money to the market, increase the limit of sanctioning loan without guarantee to the self- help groups. But these measures are temporary to fight the crisis and boost the economy immediately. The situation seems to be difficult in the next financial year where the main challenge of the government would be to bring back the growth of economy into the right track (maintain at least 6-7% annual growth) along with restore the upward demand- production-consumption cycle. India needs coordinated long-term fiscal actions and monetary stimulus to overcome this crisis. Fiscal and monetary stimulus package including subsidy, provision of loan at low interest rate, waive or moratorium of loan for at least 1 year to the farmers, marginal and small-scale industries would help to increase investment and production. CII also urged that RBI to consider relaxing the non-performing asset recognition norms from 90 days to 180 days till 30th September 2020. Slash down of rate of GST and direct tax (both for corporate and non-corporate assessee) is another weapon that government could exercise to provide more liquid money to the manufacturers and consumers. Government may also act as a partial guarantor of loan provided by the bankers to the small and medium businessmen and industrialists.

Conclusion

A perspective of COVID-19 in India including the transmission, prevalence, preventive measures and economic impact has been depicted in the study. As of now community transmission is not evident but gradually India is approaching towards 3rd phage of infection. The Govt. of India whole solely combating the situation by initial imposing of 21 days countrywide lockdown (seize of movement) to maintain social distancing as an immediate measure to curb the spread of infection which actually pays off in last few days. India's numbers are still small and coercible compared to many other developed countries and that's largely due to the early actions taken by both Government and social sectors. However, it's still a very early stage, though, and Government will have to do extensive testing and contact tracing. Primarily, the urgent need is to locate and seal all the hot spots of COVID-19 in the country and do mass testing of every citizens of that locality. The random testing of persons residing in slum areas, red-light areas must be the next priority. All the institutes, gymnasiums, cinema halls, swimming pools must be kept closed until the situation comes under control. Hospitals, police stations, banks, post office and marketplaces must be decontaminated at regular intervals. Decontamination is also essential to strengthen the health care infrastructure of the country. As the number of cases increases, it would be important to appropriately prepare health systems and use the existing resources strategically. The rapid test kits have to be made more available to every part of the country with top priority. In conformity with WHO, India has to go rapid test for every suspect and their contacts. The medicines, supportive care and ventilation facilities must be made available even to the underdeveloped rural areas. Every suspected person must be quarantined and tested. People must also be well aware about the current situation and extend their hands to the Govt. by restricting their unnecessary movements and gatherings. We are at verge of crisis where a huge number of people can get affected at once. With India's numbers of population, even small percentages shall generate millions of cases. Henceforth, mass awareness not only by the Government sectors but also by spiritual leaders would be effective. Besides it, NGOs and civil society, and those icons of the society, will have to do everything to minimize stigmatization of victims. As well as the whole country must stand united to cope with this extraordinary pandemic as the disease does not distinguish between rich or poor, between white or black skin. On the other hand, the length and depth of corona pandemic indicate the sign of global recession. India needs coordinated long-term fiscal actions and monetary stimulus to overcome this crisis. We only hope that the Indian economy will be mildly affected by the present crisis and there will be minimum adverse impact on it. Government must extend the period of lockdown but also allow essential sectors, farmers and traders by maintaining a delicate balance between medical emergency and economy.

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