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SARS-COV-2 PREVALENCE IN INDIA COMPARED TO THE REST OF THE GLOBE AND ASCERTAINS EPIDEMIOLOGICAL CHARACTERISTICS ASSOCIATED WITH THE COVID-19 PANDEMIC DURING 2020 IN INDIA

HİNDİSTAN'DAKİ SARS-COV-2 PREVALANSI VE 2020 YILINDAKİ COVID-19 PANDEMİSİYLE İLİŞKİLİ EPİDEMİYOLOJİK ÖZELLİKLERİN BELİRLENMESİ

M. Rajesh Kumar RAO[1], Rabindra N. PADHY[2], Manoj Kumar DAS[1]

[1] Indian Council of Medical Research (ICMR), National Institute of Malaria Research (NIMR), IDVC Field Unit, Jharkhand, India
[2] Siksha 'O' Anusandhan Deemed to be University, Institute of Medical Sciences and Sum Hospital, Central Research Laboratory, Odisha, India

ORCID ID: M.R.K.R. 0000-0002-8217-5175; R.N.P 0000-0002-2522-9843; M.K.D. 0000-0002-7494-5969

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ABSTRACT

Objectives: SARS-CoV-2 triggers a pandemic of COVID-19. We ascertain the pandemic burden of COVID-19 disease between India and the rest of the world; monitor the burden of COVID-19 disease in Indian states and union territories compared to other countries with nearly equivalent population sizes, and study the epidemiological characteristics.

Material and Methods: A population-based comparative optimization algorithms study was conducted on all COVID positive cases reported by 31st December 2020.

Results: Confirmed cases resulted in India with a ratio of 1:7.2 to the rest of the world, with a lower mortality rate with a ratio of 1:12 (CMR per 100,000 people) than other countries. Many Indian administrative regions have lower morbidity rates (Z-values range from -2653.7369 to -11.6403) and mortality (Z-values range from -439.446 to -4.86) than the countries selected. In India, 184,728,001 tests were done, with 5.6% cases confirmed, 96.1% recovered, and 1.4% dying due to COVID-19. COVID-19 was more prevalent in males and patients aged 25–44, whereas SARS-CoV-2 killed the most people over the age of 60. Bihar had the most cases of infection, while Punjab had the most deaths.

Conclusion: SARS-CoV-2 disease led India to have a lower morbidity and mortality burden than the rest of the world. The pandemic curves of COVID-19 resulted in daily peaks most significantly, and the cumulative number of cases increased tremendously with an upward trend. Analytical, spatial, and temporal research studies will be carried out to understand the effect of climate change and indicators that correlate with the epidemiological characteristics of the emerging coronavirus.

Keywords: SARS-CoV-2, COVID-19, coronavirus, pandemic, epidemiological

ÖZ

Amaç: SARS-CoV-2, COVID-19 pandemisini tetiklemektedir. Çalışmamızda Hindistan eyaletleri ve yakın bölgelerinde COVID-19 hastalığının yükünün izlenmesi, epidemiyolojik özelliklerinin incelenmesi ve COVID-19 hastalığının pandemi yükü açısından Hindistan'ın eşdeğer nüfus büyüklüğüne sahip diğer dünya ülkeleri ile karşılaştırılması amaçlanmıştır.

Gereç ve Yöntemler: 31 Aralık 2020 tarihine kadar bildirilen tüm COVID pozitif vakaları üzerinde nüfus temelli karşılaştırmalı optimizasyon algoritmaları çalışması gerçekleştirilmiştir.

Bulgular: Doğrulanmış vakalar, Hindistan'da dünyanın geri kalanına göre 1:7,2 oranıyla sonuçlanırken, 1:12 oranıyla (100.000 kişi başına CMR) diğer ülkelere göre daha düşük bir ölüm oranı tespit edilmiştir. Hindistan'ın birçok idari bölgesinde, ekonomik durumu iyi ülkelerden daha düşük hastalık oranları (Z-değerleri -2653.7369 ile -11,6403 arasında değişmektedir) ve ölüm oranlarının (Z-değerleri -439.446 ile -4,86 arasında değişmektedir) olduğu görülmüştür. Hindistan'da 184.728.001 test yapıldığı, vakaların %5,6'sının COVID-19 tanısı yönünden doğrulandığı, %96,1'inin iyileştiği ve %1,4'ünün ise COVID-19 nedeniyle öldüğü tespit edilmiştir. COVID-19 erkeklerde ve 25-44 yaş arası hastalarda daha yaygın görülürken, SARS-CoV-2'nin ölüm oranlarının 60 yaş üstü kişilerde en yüksek olduğu saptanmıştır. En çok enfeksiyon vakasının Bihar'da, en çok ölümün ise Punjap'da olduğu bulunmuştur.

Sonuç: SARS-CoV-2 hastalığı Hindistan'da dünyanın geri kalanından daha düşük bir morbidite ve mortalite yüküne yol açmıştır. COVID-19'un pandemi eğrileri en net şekilde günlük piklerle sonuçlanmış ve kümülatif vaka sayısı yükseliş eğilimiyle muazzam bir artış göstermiştir. İklim değişikliğinin etkisi ve ortaya çıkan koronavirüsün epidemiyolojik özellikleriyle korele olan indikatörleri anlamak için analitik, mekânsal ve zamansal araştırma çalışmaları yürütülecektir.

Anahtar kelimeler: SARS-CoV-2, COVID-19, coronavirus, pandemi, epidemiyoloji

Corresponding Author/Sorumlu Yazar: M. Rajesh Kumar RAO **E-mail:** raomrajeshkumar@gmail.com

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INTRODUCTION

Viral infection can infect humans or animals (1). Respiratory viral infection, particularly respiratory tract infections (RTIs), affects the throat, nose, bronchi, and lungs (2). Viral respiratory infections have changed the epidemiology situation, and variations occur every six to ten years and contribute severe epidemics (3). In December 2019, an aggregation of unidentified etiology acute respiratory infection cases in the lungs was reported from Wuhan City, China (4). This unspecified infection has rapidly spread from Wuhan City, China, to other countries (5). Chinese scientists identified this causative etiology as a new variant of the coronavirus strain on 7th January 2020 (4). WHO renamed this new form of coronavirus infection, i.e. known as COVID-19 (6). Coronavirus has an enormous family of viruses belonging to Coronaviridae**,** subfamily Orthocoronavirinae**,** orders Nidovirales**,** and realm Riboviria (7). Some coronaviruses, including "Middle East Respiratory Syndrome (MERS)" and "Severe Acute Respiratory Syndrome (SARS)," affect humans (8). Chinese scientists sequenced the genomes of COVID-19 (2019-nCoV) isolates from patients and have facilitated the sequencing data, including band intensities, made available on the "Global Initiative for the Sharing of All Influenza Data (GISAID)" platform as a potential source for public concern. "International Committee on Taxonomy of Viruses (ICTV)" characterized the virus subtype of COVID-19 as being "Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2)" (9).

Trevor Bedford, a bioinformatics expert, assumed coronavirus was introduced into humans in a single intro and subsequently spread among humans (10). The first coronavirus infection in a human was documented on November, 17th 2019 in China (4, 5). The initial case of COVID-19 was beginning its count in India on 30th January 2020 in Trissur, Kerala (11). ICMR-National Institute of Virology has managed to retrieve the SARS-CoV-2 strain from its contagious patients, validating that the strain from Wuhan was structurally similar to 99.9% (12). Afterward, the coronavirus disease escalates to almost every Indian province. With an exponential escalation in daily COVID-19 cases worldwide, WHO coerced this as an international health emergency and designated this epidemic as a pandemic at the end of January 2020 (13). Except for the common symptoms of fever, exhaustion, and dry toux, a few patients have issues of nasal obstruction, nasal rinsing, sore throat, myalgia, and diarrhea (14). COVID-19 incubation can occur within 1-14 days, with an average incubation time of five to seven days (15). Asymptomatic or less symptomatic patients increase the infection's transmission possibilities (16).

With a total population of about 1.3 billion people, India is a massive country with a diversified population. India has the second-highest number of people infected with COVID-19 as of the end of the year 2020. Apart from the epidemiological trends in Government databases, there is no systematic research on COVID-19 pandemic burdens among India and the rest of the world, and the pandemic COVID-19 disease trend in Indian states and Union Territories (UT) compared to other countries with a nearly equal current population size. Furthermore, the influence of COVID-19 epidemiological indicators on population density in India has yet to be revealed. Therefore, a population-based comparative optimization algorithms study was performed on all cases reported by 31st December 2020 to ascertain the pandemic burden of COVID-19 disease between India and the rest of the world. Also, monitoring the pandemic burden of COVID-19 disease in Indian states and UTs compared to other countries with populations nearly equal to the current population size. Furthermore, it studied disease prevalence and epidemiological characteristics to identify crucial indicators for the transmission of coronavirus (SARS-CoV-2) in India.

MATERIALS and METHOD

Pattern of study

A retrospective research methodology was used in this study to determine the epidemiological measures. We used to population-base comparative optimization algorithms to ascertain the pandemic burden of COVID-19 disease between India and the rest of the world.

Study period

COVID-19 cases were evaluated from 1st January 2020 to 31st December 2020, during SARS-CoV-2 infections.

Data sources

I. Worldwide data for COVID-19 was obtained from:

i. https://www.worldometers.info/coronavirus/ (U.S. Digital media company).

ii. https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (World Health Organization).

II. Pandemic incidence data for COVID-19 in India was obtained from:

i. https://www.mygov.in/covid-19 (Ministry of Health & Family Welfare, Govt. of India).

ii. https://www.covid19india.org/ (Volunteer-driven, crowdsourced tracker for COVID-19 cases in India).

III. The current population of countries and union territories was obtained from:

i.https://worldpopulationreview.com/countries/ (U.S. Census Bureau).

ii. https://censusindia.gov.in/ (Office of the Registrar General & Census Commissioner, Ministry of Home Affairs, Govt. of India).

Data compilation

All population status as of 2020 and existing data for COVID-19 have been compiled in the Microsoft Excel 2007 database. The population status in 2020 of the Indian States and UTs, almost equal to the population of some countries worldwide, has been closely monitored (Figure 1). Infection cases of COVID-19 are classified as suspected (test done), confirmed (infected), recovered, and deceased. The relationship between four types of epidemiological measures, including "count, rate, proportion, ratio, prevalence, attack rate (AR), case fatality rate (CFR), the mortality rate (MR), and crude mortality rate (CMR)," was stu-

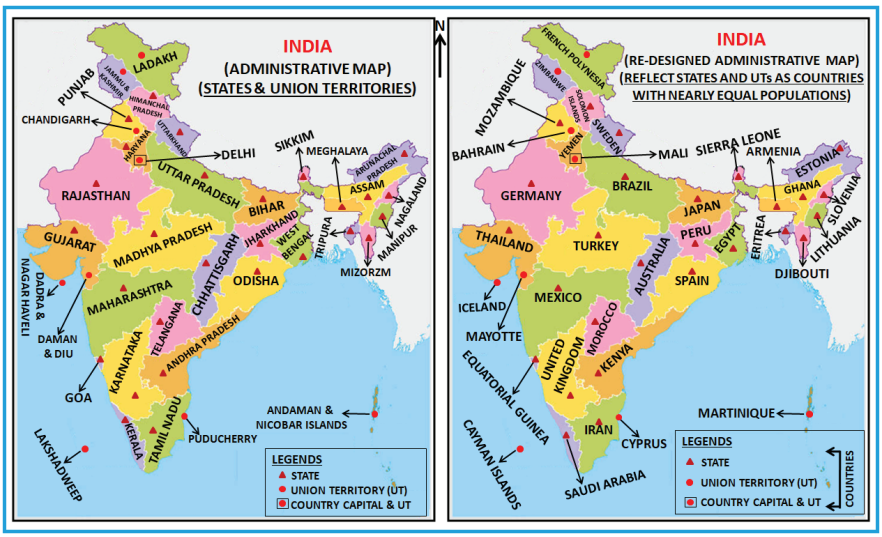

Figure 1: Map showing the Indian administrative map (states and union territories) vs. Re-designed Indian administrative map (Reflects states and UTs as selected countries around the world, in accord with nearly equal to the current population size) (9,28,37).

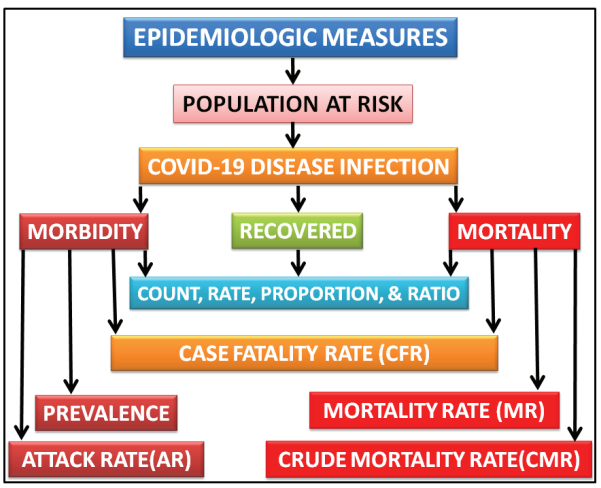

Figure 2: Flow diagram showing the epidemiological measures of disease frequency

died (Figure 2). Based on current COVID-19 data, we evaluated divergences in the COVID-19 pandemic burden and epidemiological factors between India and the rest of the world.

Population Group

The susceptible population comprises < 1 year (infants), 1–14 years (children), 15–24 years (young adults), 25–44 years (Adults), 45–60 years (middle-aged persons), and > 60 years (senior citizens).

Statistical data analysis

MS Excel version 2007 database has been used for graphics and statistical analysis. In this study, the statistics were used, which included rate, proportion, ratio, prevalence, AR, CFR, MR, and CMR, and the graph was designed using the line graph. Statistical analysis uses independent categorical variables between the two population groups. Null hypothesis (H_0) is that both proportions are almost nearly equal. The two-proportion test statistics were compared using the normal independent Z-test. The probability analysis (p-value) was performed using the statistical program, i.e., Social Science Statistics. Statistically significant was a probability value of $p<0.05$. The formula for the two-proportion test statistic is as follows:

$$z = \frac{(p_1 - p_2) - 0}{\sqrt{p(1-p)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

RESULTS

The COVID-19 pandemic burdens India compared to the rest of the world

More than 7,417 million people in 193 countries, two territories, and 22 unique islands worldwide are at risk of the COVID-19. The ratio between India and the rest of the world was 1:4.4. Of those populations, 1379.88102 million (18.6%) were Indians, and 6037.498999 million (81.4%) belonged to the rest of the world. COVID-19 affect more than 1,377 million (99.9%) of the Indian population in 36 regions of India, including 28 states and eight UTs. Suspected cases identified among the Indians were 184,728,001 (15.4%), and the remaining 1,015,773,314 (84.6%) were reported worldwide. Of those alleged cases of COVID-19, 10,280,606 (5.6%) cases had documents confirmed in India and 73,658,028 (7.3%) cases from the rest of the world. The CMR was 0.108 per thousand Indians, with the remaining 0.296 per thousand reported worldwide due to COVID-19. The prevalence of COVID-19 among Indians was 0.0075, and in the rest of the world was 0.0122. The AR was 0.75% of the Indian population, whereas the rest of the world was listed at 1.22% during the SARS-CoV-2 infection (Table 1).

Table 1: Comparison of COVID-19 pandemic burdens among India and the rest of the world during the coronavirus infections (SARS-CoV-2) as of 31st December 2020

Parameter	India	Rest of the World	Worldwide
Total states and union territories; and Total countries, territories, and unique islands	28-States, 9-UTs	192-Countries, 2-Territories, 22-Unique islands	193-Countries, 2-Territories, 22-Unique islands
Provinces at risk of Covid-19 pandemic disease	28-States, 8-UTs	192-Countries, 2-Territories, 22-Unique islands	193-Countries, 2-Territories, 22-Unique islands
Total Population	1.379,881,020	6.037,498,999	7.417.380,019
Population at risk	1.379,816,591	6.037,498,999	7.417.315,590
Population at risk (%)	99.9	100	99.9
Suspected cases	184.728,001	1.015,773,314	1.200,501,315
Suspected case rate	13.4	16.8	16.2
Proportion of suspected cases (%)	15.4	84.6	100
Suspected cases ratio	1	5	6
Confirmed cases	10.280,606	73.658,028	83.938,634
Confirmed case (Morbidity) rate	5.6	7.3	7.0
Proportion of confirmed cases (%)	12.2	87.8	100
Confirmed cases ratio	1	7	8
Prevalence	0.0075	0.0122	0.0113
Attack rate (AR)	0.75	1.22	1.13
Recovered cases	9.875,832	58.185,761	68.061,593
Recovered case rate	96.1	79.0	81.1
Proportion of recovered cases (%)	14.5	85.5	100
Recovered cases ratio	1	6	7
Active cases	404,774	15.472,267	15.877,041
Active case rate	3.9	21.0	18.9
Proportion active cases (%)	2.5	97.5	100
Active cases ratio	1	38	39
Death cases	148,981	1.786,699	1.935,680
Death case rate	1.4	2.4	2.3
Proportion of death cases (%)	7.7	92.3	100
Death cases ratio	1	12	13
Case fatality Rate (CFR)	1.4	2.4	2.3
Crude mortality rate (CMR) per 1000 populations	0.108	0.296	0.261

The COVID-19 pandemic disease scenario in Indian states and UTs compared to other countries is nearly equal to the population size

Table 2 and Table 3 show the variations in the pandemic scenario of COVID-19 disease between Indian states and UTs with population sizes similar to some countries.

Suspected cases

As a result, the suspected cases were significantly higher in 20 Indian states/UTs compared to other countries. The results were significant (Z-value ranges from 79.1123 to 3215.8398, $p<0.05$). However, the suspected cases were reported significantly lower than in other countries in the remaining 17 Indian states / UTs.

Table 2: The pandemic COVID-19 disease trend in Indian states and Union Territories compared to other countries with nearly equal to the current population size during the viral infections with corona (SARS-CoV-2) as of 31st December 2020

INDIA						Rest of the WORLD					
State/Uts	Population	Total number of cases				Country	Population	Total number of cases			
		S*	C*	D*	R*			S*	C*	D*	R*
Lakshadweep	64.429	0	0	0	0	Cayman Islands	65.623	56.819	338	2	296
Daman and Diu	242.911	33.818	1.426	0	1.414	Mayotte	271.922	51.648	5.890	55	3019
Ladakh	274.289	105.617	9.466	127	9.143	French Polynesia	280.704	23.640	16.926	114	4.956
Dadra Nagar Haveli	342.853	38.752	1.938	2	1.906	Iceland	340.964	582.761	5.754	29	5.607
Andaman and Nicobar	379.944	181.640	4.945	62	4.826	Martinique	375.301	90.932	6.091	43	141
Sikkim	658.361	68.828	5.889	127	5.139	Solomon Islands	686.884	4.043	17	0	10
Mizoram	1.091.014	177.387	4.199	8	4.091	Djibouti	986.127	80.290	5.831	61	5.789
Puducherry	1.244.464	488.451	38.132	633	37.115	Cyprus	1.206.248	2.088.108	22.651	119	10.390
Arunachal Pradesh	1.382.611	378.151	16.719	56	16.564	Estonia	1.326.425	307.336	27.989	229	18.555
Goa	1.457.723	397.386	50.981	737	49.313	Equatorial Guinea	1.396.494	76.206	5.277	86	5.222
Chandigarh	1.545.116	181.186	19.748	317	19.045	Bahrain	1.693.179	1.789.097	92.675	352	90.569
Nagaland	1.980.602	120.071	11.921	79	11.493	Slovenia	2.078.903	615.971	122.198	2.697	102.079
Manipur	2.721.756	474.524	28.139	354	26.601	Lithuania	2.726.669	1.779.426	145.277	1.802	93.263
Meghalaya	2.964.007	291.959	13.408	139	13.085	Armenia	2.960.000	776.005	159.409	2.823	145.624
Tripura	3.671.032	577.343	33.255	382	32.712	Eritrea	3.540.041	7.639	1.320	3	679
Himachal Pradesh	7.663.167	772.021	55.277	922	51.692	Sierra Leone	7.976.983	7.680.181	2.583	76	2.414
Uttaranchal	10.116.752	1.777.371	90.920	1.509	83.506	Sweden	10.091.340	4.263.118	454.758	9.707	266.747
Jammu and Kashmir	14.849.410	3.822.674	120.971	1.883	116.079	Zimbabwe	14.834.717	168.547	13.867	363	11.613
Delhi	20.188.648	8.659.830	625.369	10.536	609.322	Mali	14.834.717	147.191	7.090	269	4.919
Chhattisgarh	25.540,196	3.514,707	279.575	3.371	264.769	Australia	25.461.791	17.345.255	28.405	909	28.185
Haryana	29.808,027	4.554,156	262.325	2,905	255,853	Yemen	29.737,584	20,655	2,099	610	2,004
Assam	31.169,272	5.997,450	216.211	1,045	211,907	Ghana	30.986,096	678,726	54,771	335	53,929
Punjab	31.254,208	3.900,473	166.522	5,341	157,496	Mozambique	31.134,613	145,807	18,642	166	16,829
Jharkhand	32.966,238	4.799,240	115.113	1,030	112,424	Peru	32.912,133	6.657,725	1.015,137	37,680	990,855
Kerala	35.122,966	7.853,651	755.719	3,043	687,104	Saudi Arabia	34.742,883	15.473,708	362,741	6,223	360,076
Telangana	35.193,978	6.882,694	286.354	1,541	278,839	Morocco	36.854,173	5.504,967	439,193	7,388	414,892
Odisha	47.439,243	6.946,965	329.621	1,926	325,432	Spain	46.752,556	26.635,635	1.971,003	50,837	1.684,160
Andhra Pradesh	53.206,421	11.764,418	881.948	7,104	871,588	Kenya	53.611,938	1.023,453	96,458	1,670	50,407
Karnataka	70.462,375	14.078,158	919.496	12.090	896.116	United Kingdom	67.841.324	101.483.230	2.483.393	73.609	1.267.768
Gujarat	71.521.926	9.652.780	245.038	4.306	230.993	Thailand	69.778.286	350.029	6.884	61	4.301

INDIA						Rest of the WORLD (Continued)					
State/Uts	Population	Total number of cases				Country	Population	Total number of cases			
		S*	C*	D*	R*			S*	C*	D*	R*
Rajasthan	79.536.709	5.265.204	308.243	2.696	295.987	Germany	83.750.665	28.576.312	1.745.518	34.194	1.362.394
Tamil Nadu	82.722.262	14.191.494	818.014	12.122	797.391	Iran	83.853.830	8.384.477	1.225.143	55.23	1.044.056
Madhya Pradesh	86.044.251	4.641.648	241.791	3.606	228.831	Turkey	84.222.640	22.778.756	2.208.652	20.881	2.121.531
West Bengal	102.741.588	7.110.430	552.063	9.712	530.366	Egypt	102.078.159	1.484.602	138.062	7.631	119.736
Bihar	126.750.326	18.336.722	252.792	1.397	246.685	Japan	126.523.275	4.441.450	230.304	3.414	194.865
Maharashtra	128.466.921	12.747.633	1.932.112	49.521	1.828.546	Mexico	128.759.156	4.124.947	1.413.935	138.748	1.205.519
Uttar Pradesh	237.095.024	23.943.169	584.966	8.352	562.459	Brazil	212.368.566	22.959.582	7.675.973	194.976	6.942.041

S: Suspected cases (Test done), C: Confirmed cases (Infected), D: Death cases, R: Recovered cases

The results were significant (Z-value ranges from -20556.8045 to -48.8228, p<0.05).

Morbidity cases

Morbidity cases were significantly lower in 19 Indian states/ UTs compared to other countries. The results were significant (Z-value ranges from -2653.7369 to -11.6403, p<0.05). However, morbidity cases were reported to be significantly higher in the remaining 18 Indian states / UTs than in other countries. The results were significant (Z-value ranges from 31.7617 to 801.551, p<0.05).

Mortality cases

Mortality cases caused due to COVID-19 were reported to be significantly lower in 21 Indian states / UTs compared with the other countries. Of these, 19 Indian states / UTs compared with the other countries were lower but found significant (Z-values range from -439.446 to -4.8649, and the p<0.05). However, two Indian states/ UTs compared to the countries such as Lakshadweep vs. The Cayman Islands, and Chandigarh vs. Bahrain reported lower mortality, and the results were insignificant (Z-values=-1.4013 and -0.1708, and the p-values=0.16152 and 0.86502 were greater than 0.05, respectively).

Epidemiologic outcomes, demographic attributes, and prevalence of cases concerning COVID-19 infection persist in India

A total of 184.728,001 individuals, including 43.595,808 (23.6%) symptomatic cases and 141,132,193 (76.4%) asymptomatic cases, were suspected of coronaviral infection, and their swab samples were collected and tested in the COVID-19 laboratory, with 10,280,606 (5.6%) cases confirmed. Of the confirmed cases, 9.875,832 (96.1%) were recovered, while 148,981 (1.4%) died due to COVID-19. The maximum proportion of suspected cases tested in Andaman and Nicobar (47.8%). The highest proportion of confirmed cases found among the suspects was in Maharashtra (15.2%). The highest proportion of cases recovered in Daman and Diu (99.2%). Mortality due to COVID-19 occurred across six UTs and 28 states, with the highest mortality rates reported in Punjab (3.2%) (Table 4).

There were 10.280,606 cases confirmed as COVID-19 among whole Indians; however, only 472.164 (4.6%) of those cases had data available, and 9.808,442 (95.4%) of those cases were missing. Of these available data (N=472.164), data for the gender-based demography of COVID-19 patients were available in 119,593 (25.3%) cases. Of these (N=119,593), there were 78.363 males (65.52%), 41.212 females (35.56%), and 18 transgender individuals (0.02%). The gender ratio was 1.9:1, with men outnumbering females. Of the available data (N=472.164), data for the age group-based demographic classification in COVID-19 patients were available in 117.325 (24.8%) cases. Of these (N=117.325), the maximum cases occurred in adult age groups (41.5%). The lowest cases occurred in infant age groups (0.1%). Among the confirmed cases (10.280,606), 148,981 deaths have occurred, with a 1.4% CFR even so, only 50.183 (33.7%) of those cases had data accessible. Of these (N=50.183), data for the gender-based demography of deceased patients were available in 10.989 (21.9%) cases. Of these

Table 3: Comparison of the pandemic of COVID-19 disease scenario in Indian states and Union Territories compared to other countries with a nearly equal to the current population size during the viral infections with corona (SARS-CoV-2) as of 31st December 2020

Region		Comparison the COVID-19 disease patterns								
		Suspected case			Morbidity			Mortality		
INDIA	Rest of the WORLD	Total test done			Confirmed cases			Death cases		
State/UTs	Country	Z-Value	P-Value	Result	Z-Value	P-Value	Result	Z-Value	P-Value	Result
Lakshadweep	Cayman Islands	-314.7491	< .00001	Significant	-18.2405	< .00001	Significant	-1.4013	0.16152	Not significant
Daman and Diu	Mayotte	-48.8228	< .00001	Significant	-47.7863	< .00001	Significant	-7.0098	< .00001	Significant
Ladakh	French Polynesia	265.101	< .00001	Significant	-45.1314	< .00001	Significant	1.0171	0.30772	Not significant
Dadra Nagar Haveli	Iceland	-2293.3117	< .00001	Significant	-44.0006	< .00001	Significant	-4.8649	< .00001	Significant
Andaman and Nicobar	Martinique	213.3205	< .00001	Significant	-11.6403	< .00001	Significant	1.7914	0.07346	Not significant
Sikkim	Solomon Islands	252.7109	< .00001	Significant	78.227	< .00001	Significant	11.5115	< .00001	Significant
Mizoram	Djibouti	177.2141	< .00001	Significant	-21.4318	< .00001	Significant	-6.8087	< .00001	Significant
Puducherry	Cyprus	NaN	< .00001	Significant	59.7002	< .00001	Significant	18.3211	< .00001	Significant
Arunachal Pradesh	Estonia	79.1123	< .00001	Significant	-58.1804	< .00001	Significant	-10.6006	< .00001	Significant
Goa	Equatorial Guinea	494.9767	< .00001	Significant	189.5234	< .00001	Significant	22.0853	< .00001	Significant
Chandigarh	Bahrain	-1729.8493	< .00001	Significant	-205.9891	< .00001	Significant	-0.1708	0.86502	Not significant
Nagaland	Slovenia	-616.0483	< .00001	Significant	-297.29	< .00001	Significant	-48.4439	< .00001	Significant
Manipur	Lithuania	-1133.3517	< .00001	Significant	-285.4941	< .00001	Significant	-31.1492	< .00001	Significant
Meghalaya	Armenia	-518.1107	< .00001	Significant	356.7296	< .00001	Significant	-49.3654	< .00001	Significant
Tripura	Eritrea	762.6825	< .00001	Significant	168.8009	< .00001	Significant	18.9628	< .00001	Significant
Himachal Pradesh	Sierra Leone	-3421.2739	< .00001	Significant	224.2899	< .00001	Significant	27.4199	< .00001	Significant
Uttaranchal	Sweden	-1211.6043	< .00001	Significant	-500.268	< .00001	Significant	-77.5633	< .00001	Significant
Jammu and Kashmir	Zimbabwe	1964.9498	< .00001	Significant	292.1578	< .00001	Significant	32.0507	< .00001	Significant
Delhi	Mali	2824.2942	< .00001	Significant	684.923	< .00001	Significant	83.8799	< .00001	Significant
Chhattisgarh	Australia	-3948.174	< .00001	Significant	453.1092	< .00001	Significant	37.5338	< .00001	Significant
Haryana	Yemen	2203.3705	< .00001	Significant	506.576	< .00001	Significant	38.6407	< .00001	Significant
Assam	Ghana	2170.7518	< .00001	Significant	309.2701	< .00001	Significant	19.0034	< .00001	Significant
Punjab	Mozambique	1926.2239	< .00001	Significant	343.3474	< .00001	Significant	69.5963	< .00001	Significant
Jharkhand	Peru	-607.1615	< .00001	Significant	-854.8157	< .00001	Significant	-186.4948	< .00001	Significant
Kerala	Saudi Arabia	-1965.3115	< .00001	Significant	368.8008	< .00001	Significant	-33.5619	< .00001	Significant
Telangana	Morocco	519.4292	< .00001	Significant	-160.6584	< .00001	Significant	-59.7195	< .00001	Significant

Comparison the COVID-19 disease patterns (Continued)

Region		Suspected case			Morbidity			Mortality		
INDIA	Rest of the WORLD	Total test done			Confirmed cases			Death cases		
State/UTs	Country	Z-Value	P-Value	Result	Z-Value	P-Value	Result	Z-Value	P-Value	Result
Odisha	Spain	-4288.2013	< .00001	Significant	-1106.836	< .00001	Significant	-214.6729	< .00001	Significant
Andhra Pradesh	Kenya	3215.8398	< .00001	Significant	801.551	< .00001	Significant	58.3708	< .00001	Significant
Karnataka	United Kingdom	-20556.8045	< .00001	Significant	-893.9665	< .00001	Significant	-215.7997	< .00001	Significant
Gujarat	Thailand	3011.1041	< .00001	Significant	468.7476	< .00001	Significant	63.4275	< .00001	Significant
Rajasthan	Germany	-4333.4271	< .00001	Significant	-972.3893	< .00001	Significant	-159.1085	< .00001	Significant
Tamil Nadu	Iran	1349.2285	< .00001	Significant	-276.8263	< .00001	Significant	-164.3608	< .00001	Significant
Madhya Pradesh	Turkey	-3842.8602	< .00001	Significant	-1282.5506	< .00001	Significant	-112.0838	< .00001	Significant
West Bengal	Egypt	1950.8305	< .00001	Significant	496.5024	< .00001	Significant	15.3761	< .00001	Significant
Bihar	Japan	3047.4242	< .00001	Significant	31.7617	< .00001	Significant	29.1421	< .00001	Significant
Maharashtra	Mexico	2176.4504	< .00001	Significant	287.2302	< .00001	Significant	-205.222	< .00001	Significant
Uttar Pradesh	Brazil	-246.7233	< .00001	Significant	-2653.7369	< .00001	Significant	-439.446	< .00001	Significant

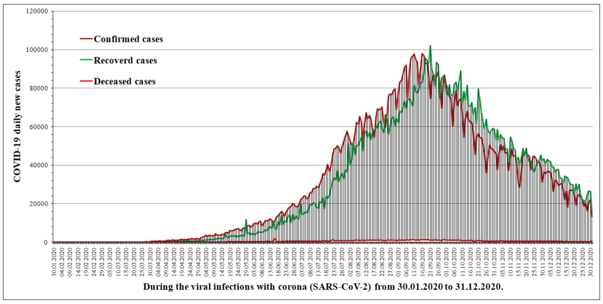

Figure 3: Pandemic curves concerning COVID-19 daily number of cases (Confirmed, recovered, and deceased) in the Indian continent during the viral infections with corona (SARS-CoV-2) as of 31st December 2020

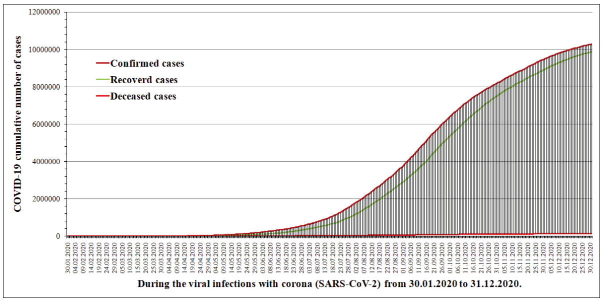

Figure 4: Pandemic curves concerning COVID-19 cumulative number of cases (Confirmed, recovered, and deceased) in the Indian continent during the viral infections with coronavirus (SARS-CoV-2) as of 31st December 2020

(N=10.989), males (69.74%) were more vulnerable than females (30.24%). The gender ratio was 2.3:1, with men outnumbering females. Of these available data on deceased patients (N=50.183), data for the age group-based classification in COVID-19 patients were available in 11,518 (23.0%) cases. Of these (N=11.518), senior citizens (52.2%) have the maximum mortality rate among any age group. However, 4112 (0.04%) non-Indians were positive for COVID-19 (Table 5).

COVID-19 pandemic curves with the daily new epidemiological cases

The epidemiological progression of 10.280,606 patients with COVID-19 was based on the patient database. During the 337 days of the pandemic, the average number of new confirmed, recovered, and deceased cases each day was 30506, 29305, and 442, respectively. The rapid growth of newly reported confirmed and dead cases has since been reported (Figure 3).

COVID-19 pandemic curves with the cumulative number of epidemiological cases

The confirmed, recovered, and deceased cases were 10.280,606, 9.875,832, and 148.981, respectively. Only 0.001% of cases of COVID-19 exits until 1st March 2020. COVID-19 reported the first death incident on 13th March 2020. After 48 days of the first case, there was a significant increase in confirmed, recovered, and deceased cases (Figure 4).

Table 4: Epidemiological trends of COVID-19 patients included India's contour during the viral illnesses with coronavirus (SARS-CoV-2) as of 31st December 2020

State/Uts	Population	Total number of cases			
		Suspected	Confirmed	Death	Recovered
Lakshadweep	64.429	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Daman and Diu	242.911	33.818 (13.9)	1.426 (4.2)	0 (0.0)	1.414 (99.2)
Ladakh	274.289	105.617 (38.5)	9.466 (9.0)	127 (1.3)	9.143 (96.6)
Dadra Nagar Haveli	342.853	38.752 (11.3)	1.938 (5.0)	2 (0.1)	1.906 (98.3)
Andaman and Nicobar	379.944	181.640 (47.8)	4.945 (2.7)	62 (1.3)	4.826 (97.6)
Sikkim	658.361	68.828 (10.5)	5.889 (8.6)	127(2.2)	5.139 (87.3)
Mizoram	1.091.014	177.387 (16.3)	4.199 (2.4)	8 (0.2)	4.091 (97.4)
Puducherry	1.244.464	488.451 (39.2)	38.132 (7.8)	633 (1.7)	37.115 (97.3)
Arunachal Pradesh	1.382.611	378.151 (27.4)	16.719 (4.4)	56 (0.3)	16.564 (99.1)
Goa	1.457.723	397.386 (27.3)	50.981 (12.8)	737 (1.4)	49.313 (96.7)
Chandigarh	1.545.116	181.186 (11.7)	19.748 (10.9)	317 (1.6)	19.045 (96.4)
Nagaland	1.980.602	120.071 (6.1)	11.921 (9.9)	79 (0.7)	11.493 (96.4)
Manipur	2.721.756	474.524 (17.4)	28.139 (5.9)	354 (1.3)	26.601 (94.5)
Meghalaya	2.964.007	291.959 (9.9)	13.408 (4.6)	139 (1.0)	13.085 (97.6)
Tripura	3.671.032	577.343 (15.7)	33.255 (5.8)	382 (1.1)	32.712 (98.4)
Himachal Pradesh	7.663.167	772.021 (10.1)	55.277 (7.2)	922 (1.7)	51.692 (93.5)
Uttaranchal	10.116.752	1.777.371 (17.6)	90.920 (5.1)	1.509 (1.7)	83.506 (91.8)
Jammu and Kashmir	14.849.410	3.822.674 (25.7)	120.971 (3.2)	1.883 (1.6)	116.079 (96.0)
Delhi	20.188.648	8.659.830 (42.9)	625.369 (7.2)	10.536 (1.7)	609.322 (97.4)
Chhattisgarh	25.540.196	3.514.707 (13.8)	279.575 (8.0)	3.371 (1.2)	264.769 (94.7)
Haryana	29.808.027	4.554.156 (15.3)	262.325 (5.8)	2.905 (1.1)	255.853 (97.5)
Assam	31.169.272	5.997.450 (19.2)	216.211 (3.6)	1.045 (0.5)	211.907 (98.0)
Punjab	31.254.208	3.900.473 (12.5)	166.522 (4.3)	5.341 (3.2)	157.496 (94.6)
Jharkhand	32.966.238	4.799.240 (14.6)	115.113 (2.4)	1.030 (0.9)	112.424 (97.7)
Kerala	35.122.966	7.853.651 (22.4)	755.719 (9.6)	3.043 (0.4)	687.104 (90.9)
Telangana	35.193.978	6.882.694 (19.6)	286.354 (4.2)	1.541 (0.5)	278.839 (97.4)
Odisha	47.439.243	6.946.965 (14.6)	329.621 (4.7)	1.926 (0.6)	325.432 (98.7)
Andhra Pradesh	53.206.421	11.764.418 (22.1)	881.948 (7.5)	7.104 (0.8)	871.588 (98.8)
Karnataka	70.462.375	14.078.158 (20.0)	919.496 (6.5)	12.090 (1.3)	896.116 (97.5)
Gujarat	71.521.926	9.652.780 (13.5)	245.038 (2.5)	4.306 (1.8)	230.993 (94.3)
Rajasthan	79.536.709	5.265.204 (6.6)	308.243 (5.9)	2.696 (0.9)	295.987 (96.0)
Tamil Nadu	82.722.262	14.191.494 (17.2)	818.014 (5.8)	12.122 (1.5)	797.391 (97.5)
Madhya Pradesh	86.044.251	4.641.648 (5.4)	241.791 (5.2)	3.606 (1.5)	228.831 (94.6)
West Bengal	102.741.588	7.110.430 (6.9)	552.063 (7.8)	9.712 (1.8)	530.366 (96.1)
Bihar	126.750.326	18.336.722 (14.5)	252.792 (1.4)	1.397 (0.6)	246.685 (97.6)
Maharashtra	128.466.921	12.747.633 (9.9)	1.932.112 (15.2)	49.521 (2.6)	1.828.546 (94.6)
Uttar Pradesh	237.095.024	23.943.169 (10.1)	584.966 (2.4)	8.352 (1.4)	562.459 (96.2)
Total	**1.379.881.020**	**184.728.001 (13.4)**	**10.280.606 (5.6)**	**148.981 (1.4)**	**9.875.832 (96.1)**

Table 5: The demographic attributes and epidemiologic outcomes concerning COVID-19 infection included in India's contour during the viral illnesses with coronavirus (SARS-CoV-2) as of 31st December 2020

Parameters	Patients (N)	Patients %
Confirmed cases	10.280.606	
Indian citizen	10276494	99.96
Non-Indian citizen	4112	0.04
Data available	472.164	4.6
Data missing*	9.808.442	95.4
Gender-based demography of confirmed cases	472.164	
Data available	119.593	25.3
Data missing*	352.571	74.7
Genders		
Male	78.363	65.52
Female	41.212	35.56
Transgender	18	0.02
Age group-based demographic classification of confirmed cases	472.164	
Data available	117.325	24.8
Data missing*	354.839	75.2
Age groups		
< 1 year (infants)	100	0.1
1–14 years (children)	7253	6.2
15–24 years (young adults)	15485	13.2
25–44 years (adults)	48723	41.5
45–60 years (middle-aged persons)	29434	25.1
> 60 years (senior citizens)	16330	13.9
Deceased cases	148.981	
Data available	50.183	33.7
Data missing*	98.798	66.3
Gender-based demographic classification of deceased cases	50.183	
Data available	10.989	21.9
Data missing*	39.194	78.1
Gender		
Male	7664	69.74
Female	3323	30.24
Transgender	2	0.02
Age group-based demographic classification of deceased cases	50.183	
Data available	11.518	23.0
Data missing*	38.665	77.0
Age group		
< 1 year (infants)	7	0.06
1–14 years (children)	41	0.34
15–24 years (young adults)	116	1.0
25–44 years (adults)	1246	10.8
45–60 years (middle-aged persons)	4101	35.6
> 60 years (senior citizens)	6007	52.2

*Data missing=Information not available in the crowd-sourced database of government information systems

DISCUSSION

Public access to a crowd-based information system is crucial in community-based public health approaches (17). The pandemic burden of COVID-19 disease between India and the rest of the world, as epidemiological factors, is assessed. We organized into groups of 37 Indian administrative regions comprising 28 states and nine UTs with 37 countries based on population sizes to determine the COVID-19 pandemic epidemiological variation between Indian states and UTs, with the selected countries.

SARS-CoV-2 infection result that, 7.417 million people at risk worldwide. COVID-19 affects 99.9% of Indians, affecting all parts of India except Lakshadweep. SARS-CoV-2 strain is typically considered unavoidable (12, 18). The disparity in confirmed cases between India and the rest of the world was 1:7.2. India had a lower mortality burden due to SARS-CoV-2 infection than the rest of the world. The COVID-19 pandemic was the most severe health hazard in the 21st century, with higher morbidity and mortality than previous global pandemics (13, 19). Our study revealed that India has 13.4% of suspected cases worldwide has 16.8. Compared to other countries, 17 Indian states/UTs reported fewer tests performed, which showed significant results. According to Reuben Abraham, the COVID-19 pandemic was spotted two months later in India than in other countries, resulting in fewer confirmed cases (20). According to print media sources, categorized persons are difficult to diagnose despite most asymptomatic cases due to their travel history (21). According to Battegay et al., due to the COVID-19 test's limited capacity, there were fewer suspects or clinically diagnosed cases (22). We concurred with these possible explanations for the suspected lower case rate than other countries in many of India's administrative regions. India had 5.6% confirmed coronavirus infections, while the global average was 7.3%. We found that morbidity in 19 Indian states/UTs was low compared to other countries. The outcomes were noteworthy, and experts had few hypotheses about why the morbidity remained low compared to other countries. According to Dr. Shahid Jameel, the early coronavirus lockdown in India contributed to minimal morbidity compared to other countries with nearly equal populations (23). According to Dr. Shiv Ayyar, the low confirmed case rate is due to limited COVID-19 testing in India (23). Ankita Sharma indicated that many cases are tested through RT-PCR and RDT (Antibody), so it is possible to perceive the exact numbers and classification of the infected cases of COVID-19 (23). According to the medical journal Lancet editor, the COVID-19 disease morbidity curve tends to flatten due to the Indian lockdown (24). We agreed with the Lancet editor's comments and shared experts' hypotheses in various newsletters. Compared to other countries, we found lower mortality due to COVID-19 in 21 Indian states/UTs. Of these, the mortality rate in 19 states/UTs was statistically significant, and two states/UTs were statistically insignificant ($p>0.05$). According to Miller et al., the Bacillus Calmette – Guérin (BCG) vaccine for tuberculosis, leprosy, Buruli ulcer, and bladder cancer is used in corona therapy in India, which reduces mortality rates (25). According to an expert, the hydroxyl chloroquine malaria vaccine was used in COVID-19, minimizing the number of deaths (26). Dr. Prabhat Jha states that over 80% of deaths in India occur at home or in rural regions without a proper medical death certificate. Such cases shall not be held liable for the fatality rates of COVID-19 (27, 28). In another expert's opinion, elderly populations are more vulnerable to corona and becoming more complicated. Furthermore, India's low COVID-19 mortality rates are due to a higher proportion of adults than other age groups (23). The findings of Miller et al. and the epidemiological hypothesis of experts on low COVID-19 mortality rates in India compared to other countries are possible facts that could be linked to our study outcomes.

In India, during the initial 337 days of the coronavirus infections, our findings, as indicated by the pandemic curves of epidemiological cases of COVID-19, 48 days after the first occurrence, the daily cases resulted in daily peaks most significantly. The cumulative number of confirmed, recovered, and deceased patients increased tremendously with an upward trend. COVID-19 spread rapidly to every corner of the Indian mainland except Lakshadweep, indicating that the strain of SARS-CoV-2 had the inherent potential to extend this epidemic (29). The suspected case rate of COVID-19 has ranged from 5.4% to 47.8%. Andaman and Nicobar reported the maximum cases of suspected individuals. SARS-CoV-2 has caused distinct illness characteristics, including 23.6% of symptomatic and 76.4% of asymptomatic patients. Our findings concurred with the previous studies undertaken by Guan et al. and Huang et al. (30, 31). Maharashtra had the most affected individuals. Daman and Diu had no reported deaths, whereas Punjab had the most. In India, the COVID-19 pandemic had a morbidity rate of about 5.6%, while the CFR was 1.4%. Indian morbidity rate remains high, and CFRs remain low compared to previous outbreaks in 2002-2003 (SARS) and 2012 (MERS) (32, 33).

Our study indicated that males outstripping females were susceptible to SARS-CoV-2, and the gender ratio was 1.9:1. According to Dr. Kyle Sue, sex hormones, including estrogen and testosterone, have a more vital role in severely affecting males than females in viral respiratory diseases (34). According to Schurz et al., the X-chromosome possesses the highest proportion of antibodies in the human genomes, which has a prominent influence in severely impacting males than females in viral respiratory problems (35). According to Voor, male blood plasma has higher angiotensin-converting enzyme 2 (ACE2) concentrations than female blood plasma, indicating a higher probability of COVID-19 (36). According to Harris and Jenkins, males are likely to spend more time engaging outside than females, which is a familiar concept and leads to higher opportunities for health-related risks (37). These studies corroborate our finding by Sue, Schurz et al., Voor, and Harris and Jenkins that infection with SARS-CoV-2 is more common in males than in females. We found that the age groups 25-44 years (adults) followed by 45-60 years (middle-aged individuals) were more susceptible to COVID-19 than the other four age groups studied. Our findings concurred with the study results of Jin Lv et al., that adults aged 25-44 and middle-aged individuals aged

45-60 are more affected by infectious diseases than other age groups (38). We found that most deaths occurred among senior citizens (> 60 years). Greenbaum et al., points out that older people with chronic deformities associated with COVID-19 have become more vulnerable, leading to death (39). According to Yi et al., senior citizens than other age groups experience health hazards and death from COVID-19 (40). Our findings corroborate Greenbaum et al. and Yi et al.'s conclusions.

Several researchers used innovative tools, i.e., mathematical models, to evaluate the trends of any ongoing epidemics and predict the spread of pandemics in the future, which can be utilized as a preventive perspective for the public (41-43). Meanwhile, the coronavirus that causes COVID-19 has mutated into new variants of the virus, resulting in the Seventh wave of a new coronavirus variant, i.e., Omicron's XBB to BA.7, will encounter in the Indian continent in recent days, as predicted by the International research organization GISIAD. According to GISIAD report, there have been around three hundred and eighty verified instances of XBB in India, with Tamil Nadu having the most recorded incidents (175 cases), followed by West Bengal (103 cases) (44).

Limitations of this study

We did not study the spatial and temporal correlations with COVID-19 in India and globally.

CONCLUSION

This prospective analytical study highlighted that the daily and cumulative number of confirmed and deceased patients increased drastically during the initial 337 days of corona in India. In India, COVID-19 was more prevalent in males and patients aged 25-44, while senior citizens mostly died due to SARS-CoV-2. Bihar had the most infections, and Punjab had the most deaths in India. India had lower confirmed cases and mortality than the rest of the world, with a ratio of 1:7.2 and 1:12, respectively. Contrasting COVID-19 trends between the Indian mainland with populations almost equal to the countries selected, many of India's administrative regions had lower morbidity and mortality rates. India's lockdown policy is gradually lifted as the new coronavirus variant weakens its havoc. Coronavirus has mutated into new variants at regular intervals. Undertake more analytical studies to understand the risk factors associated with COVID-19's epidemiological characteristics as the new coronavirus variant wave evolves. In addition, spatial and temporal-related analyses will require elucidating the role of climatic influence in coronavirus infection. Furthermore, advanced mathematical model-based studies are needed to forecast the severity and understand disease epidemiology, which would help plan and target preventive health care.

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Ethics Committee Approval: A population-based comparative optimization algorithms study was conducted on all cases reported by 31st December 2020, during SARS-CoV-2 infections. The epidemiological data on COVID-19 disease and population status in 2020 is gathered from government-approved web portals that are freely accessible to the public. Therefore, patient consent and ethical clearances are not required. We obtained pre-approval from the Director-General Sir of the Indian Council of Medical Research to publish this original research article.

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