Emerging COVID-19 Epidemiology in Tamilnadu India using GIS

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ABSTRACT

Introduction: Corona virus disease 2019 (COVID 19) brought about by serious intense respiratory disorder corona virus 2 (SARS CoV2).The World Health Organization manifest the flare-up a Public Health Emergency of International Concern on 30 January, and a pandemic on 11 March. Tamil Nadu has the second highest number of confirmed cases in India. The epi center of this ongoing outbreak is Chennai in Tamil Nadu. In the present study an attempt was made to identify the change in the rate of the COVID19 cases across various districts by performing spatial pattern assessment and to analyze high risk areas in Tamil Nadu.

Material and methods: The study was mainly based on secondary data. All COVID-19 cases detailed through May 15, 2020 were extracted from Department of Health and Family Welfare, Corona virus updates Tamil Nadu. Analyses included the following:1) Spatial Distribution of COVID -19 in Tamil Nadu, 2) Mapping and analyzing the early travel history of corona patients from international and interstate migration utilizing GIS Mapping, 3) Geo-temporal analysis of viral spread. 4) Disease progression and severity.

Result: Examining the total COVID -19 cases during the 51 days from March 26, 2020 to May 15, 2020 Tamil Nadu's capital Chennai district experienced a high incidence of COVID -19 disease transmission. High population density and high level of poverty, all of which play a major role for the high incidence in Chennai. In addition the international travel and migration of guest workers from other states played a major role in spread of disease.

Conclusion: Geographical Information System helps to organize present and analyze spatial and geographic data. In recent years, GIS has been used to study and tackle several communicable and non-communicable diseases. Covid-19 cases increasing day by day in Tamil Nadu. Population health and available infrastructure in the area to identify the population at risk. This article is the foundation for future pursue of investigation.

Keywords: Covid-19, International Travel, GIS, Z Score Analysis

INTRODUCTION

Corona virus disease 2019 (COVID 19) brought about by serious intense respiratory disorder corona virus 2 (SARS CoV2). The World Health Organization manifest the flare-up a Public Health Emergency of International Concern on 30 January, and a pandemic on 11 March. The principal instance of the 2019–20 corona virus pandemic in the Indian state of Tamil Nadu was accounted for on 7 March 2020. The Department of Health and Family Welfare has affirmed a sum of 10,471 cases, including 71 deaths. Tamil Nadu has the second highest number of confirmed cases in India. In the present study an attempt was made to identify the change in the rate of the COVID19 cases across various districts by performing spatial pattern assessment and to analyze high risk areas in Tamil Nadu.

All 37 districts of the state are affected by the pandemic, with capital district Chennai being the worst affected. More than half of the cases are from Chennai, which is also the most populous district of the state. The case fatality rate in the state is among the lowest in the country. As of 15 May 2020, the state has conducted 303,104 tests (4201 per million people). Three per cent of all tests returned positive. As per the Health Department, 80% of the patients are asymptomatic while most deaths are among the elderly and those with co-morbidities.[1]

Corona viruses are a group of related RNA viruses that cause diseases in mammals and birds.[2] In humans, these viruses cause respiratory tract infections that can range from mild to lethal. Mild illnesses include some cases of the common cold, while more lethal varieties can cause SARS, MERS, and COVID-19. Corona viruses mainly target epithelial cells.[3] They are transmitted from one host to another host, depending on the corona virus species, by either an aerosol, fomite.[4] In December 2019, a pneumonia outbreak was reported in Wuhan, China.[5] On 31 December 2019, the outbreak was traced to a novel strain of coronavirus.[6] They have characteristic club-shaped spikes that project from their surface, which in electron micrographs create an image reminiscent of the solar corona, from which their name derives[7]

The infection that causes COVID-19 taints individuals everything being equal. Nonetheless, proof to date suggests that two gatherings of individuals are at a higher danger of getting serious COVID-19 illness. These are older people (that is individuals more than 60 years of age); and those with underlying medical conditions and (for example, cardiovascular infection, diabetes, chronic respiratory disease, and cancer). The danger of serious illness

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slowly increments with age beginning from around 40 years.[8]

GIS is a system designed to capture and analyze data using spatial trends. In the context of disease surveillance and monitoring, it integrates data such as the area of outbreak, population health and available infrastructure in the area to identify the population at risk. In recent years, GIS has been used in a number of studies to tackle several communicable and non-communicable diseases.[9,10,11,12]

As of 15 April, the state has the number of corona virus hotspots in India with 22 districts However; the case fatality rate of 1.11% is among the lowest in the country. As of 20 April, the infection rate has dropped from 13% on 1 April to 3.6%. As per the Health Department, 88% of the patients are asymptomatic while most 84% of deaths are among the elderly and those with co-morbidities in Tamil Nadu**.** The state is under a lockdown since 25 March. The state government has responded to the outbreak by following a contact-tracing, testing and surveillance model.[13]

Medical geographers apply devices of geographic enquiry, for example, disease mapping and geographical relationship studies to health related issues[14] Some have called this exploration endeavor spatial epidemiology.[15,16] In the present study an attempt was made to identify the change in the rate of the COVID19 cases across various districts by performing spatial pattern assessment and to analyze high risk areas in Tamil Nadu.

MATERIAL AND METHODS

The present study was mainly based on secondary data. Inspecting the spatial distribution of Corona virus infection the data collected for 51 days. All COVID-19 cases detailed through May 15, 2020 were extracted from Department of Health and Family Welfare Corona virus updates Tamil Nadu. The regular updates of COVID -19 data were converted into week wise data. The technique Z score was used to analyze the spatial distribution of COVID -19 in 37 district of Tamil Nadu.

Inclusion criteria

a. Active cases, Death cases, Recovery cases.

Exclusion criteria

a. Age wise cases, Sex wise cases

Methods of data collection

All COVID-19 cases detailed through May 15, 2020 were extracted from Department of Health and Family Welfare Corona virus updates Tamil Nadu. The regular updates of COVID -19 data were converted into week wise data.

Study tools

The two important techniques used in the present study are statistical techniques and cartographic interpretation. It includes mapping of the study area using the GIS soft ware.

STATISTICAL ANALYSIS

The Z scores were calculated with the help of SPSS 14.0 Version software and used as attributes in Arc GIS for making maps. Z score (Standard score) shows what number of standard deviations a components is from the mean. A Z – score can be determined from the following formula.

$z=(x-\mu)/\sigma$

Where z is the Z score, X is the value of the element, μ is the population mean, and σ is the standard deviation.

The spatial distribution of district wise COVID -19 maps are created by using Z score values and classified according with figures. Analyses included the following:1) Spatial Distribution of COVID -19 in Tamil Nadu, 2) Mapping and analyzing the early travel history of corona patients from international and interstate migration utilizing GIS Mapping 3) Geo-temporal analysis of viral spread. 4) Disease progression and severity.

RESULTS

Tamil Nadu is the southern state of India (Figure: 1) It is located in the Indian peninsula between the Bay of Bengal in the east, bordering States with Kerala in the western side, Andhra Pradesh to the north and Karnataka on the north-west was selected as a study area.

The week wise analysis of COVID-19 cases reveals the disease transmission escalating serious in all districts in Tamil Nadu. The spatial distribution of COVID 19 diseases transmission (Table.1 and Fig 2) for the first week of 2020 March 26 to 31 reveals the peak Z score (greater than 2 standard deviation) found in Thirunelveli (5.08) and Chennai district (3.71) which has the highest population density. The Second week of covid-19 disease transmission 2020 April 1 to 7 the high Z score (greater than 2 standard deviation) found in Chennai (6.28),Coimbatore(2.71),Dindigul (2.58), Karur (2.07), Ranipet(2.13), Tiruvarur(2.07), Tiruchirappalli (2.64). Compare to previous two weeks the third week of covid-19 disease transmission 2020 April 8 to 14 reveals that disease spread increases in number of districts. The high Z score above the mean (0.80) found in 16 districts of Tamil Nadu.

As of the fourth week April 15 to 21.2020 the disease transmission were high (above 1 standard deviation) greater than the mean found in Chennai (6.23) Tenkasi (1.33) Villuppuram (1.09) Thanjavur (1.70) Tiruppur (1.58) the very high Z score recorded in Chennai district 6.23. (Table.1 and Fig 3). Incongruent other weeks the last week of April 22 to30.2020 the COVID -19 disease transmission decreases in a number of district. The disease transmission were high (3 standard deviation greater than the mean) found in Chennai (3.94) and neighboring district Chengalpattu (3.61). The COVID -19 disease transmission in Sixth week May 01-07.2020 the high Z score (0.80 above the mean) found in 3 district in Tamil Nadu. Chennai recorded (6 standard deviation greater than the mean level 6.48) Cuddalore recorded (1 standard deviation greater than the mean level 1.17) Ariyalur 0.83. Similar to sixth week the disease transmission in seventh week May 8-15.2020 the peak Z score continues in Chennai district. (Table.1 and Fig 4) The Z score value was (6 standard deviation greater than the mean) recorded in Chennai (6.35).

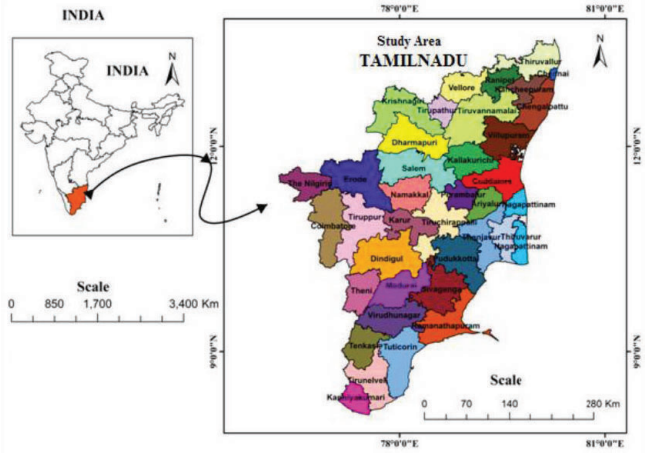

Figure-1: Study Area

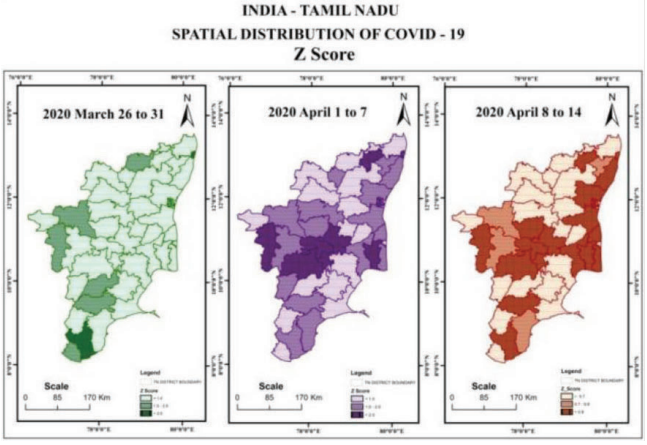

Figure-2: Distribution of covid-19 March-26.2020 to April 14.2020

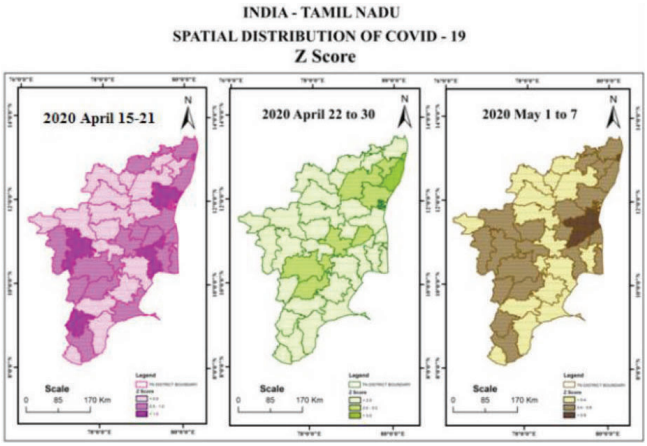

Figure-3: Distribution of covid-19 April-15.2020 to May .7.2020

Examining the total COVID -19 cases during the 51 days from march 26, 2020 to May 15, 2020 Chennai district experienced a high incidence of COVID -19 disease transmission (Table No.1 & Fig 2- 4) reveals the Very high Z score (6 standard deviation greater than the mean) recorded in Chennai (6.49). Subsequently the High Z score above the mean (0.80) found in Chengalpattu (0.86) which is neighboring district to Chennai. The moderate level of diseases transmission (0.40 to 0.80) recorded in 19 district of Tamil Nadu. The low level (below 0.40) found in 15 district of Tamil Nadu.

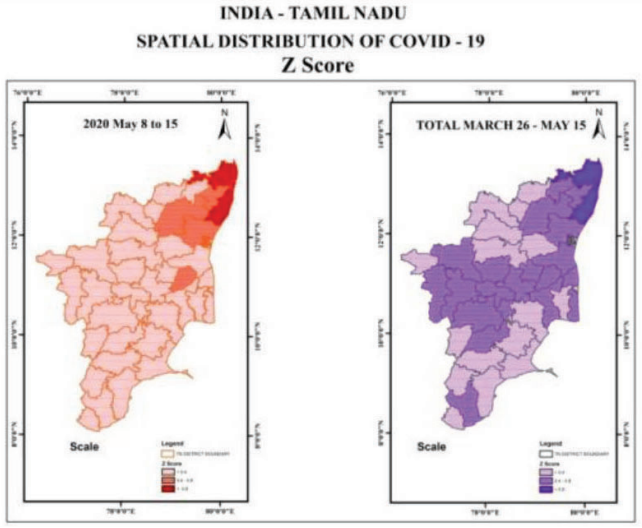

Figure-4: Distribution of covid-19 May.8.2020 to May .15.2020

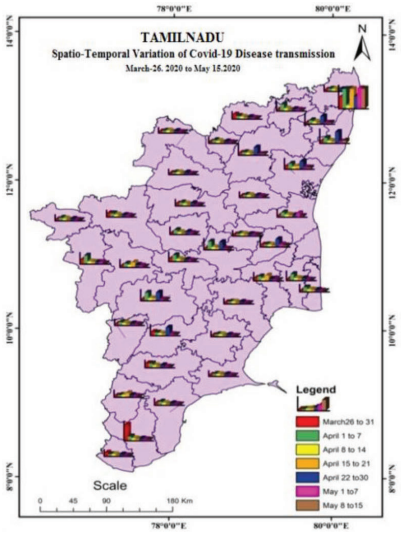

Figure-5: Spatio-temporal variation of covid-19

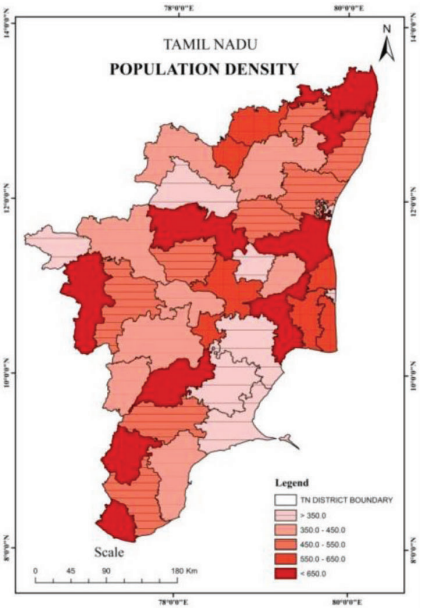

Figure-6: Population Density

Spatio- Temporal Variation Of COVID -19 Cases In Tamil Nadu March 26,2020 To May 15, 2020

The possible reason for geographical dissimilarities of COVID -19 incidence are as follows: The Z score analysis of COVID -19 for March 26,2020 to May 15, 2020 (Table 1 and Fig: 2-4) reveals that Chennai district have the highest concentration of COVID -19 incidence compare to other district since March 26, 2020. the Z score for Chennai had 3 standard deviation greater than the mean recorded in March 26,2020 (3.71), In the second week of disease contagious April 1 to 7,2020 the cases increases as 6 standard deviation greater than the mean recorded in Chennai district(6.28).The reason behind this was a number of international COVID -19 infected travelers entered inside Chennai district in addition to its highest population the disease transmission attains its secondary infection in a number of district. The third week of April 8 to 14.2020 the cases declines as 1 standard deviation (1.04) due to International lock down.

The disease spread had a sudden rice in the fourth week April 15 to 21,2020 in Chennai (6.23) and it decline in the fifth week April 22 to30.2020 as (3.94) and again it reaches a peak Z score in following two weeks May 01-07.2020(6.48) May 8-15.2020(3.94). Chennai is by far the most densely populated city in Tamil Nadu, with a density of 26,553 people per square kilometers (Fig:8) recorded 5,946 cases among these 86.02% are active cases13.16% are recovered cases compare to very far ahead of the next city Kanyakumari with (1,111 people per square kilometer) recorded 35 cases among these (45.71%) of cases are recovered,51.42% were active cases and 2.8% of death cases compare to Chennai only (0.80%) death cases. Due to good literacy rate (92.14%) in Kanyakumari the recovery rate is high but the high (2.8%) of death rate shows its failing in medical facilities than Chennai and highest density of population next to Chennai.

Chennai has the third largest expatriate population in the country behind Mumbai and Delhi. High population density (Figure-6) and high level of poverty, all of which raise disease incidence for instance the expanding number of individuals living in urban territories around the globe will keep on encouraging tuberculosis transmission and debilitate endeavors to control the ailment[17,18] this is true here that densely populated Chennai district recorded continuous highest covid-19 disease incidence (Table.1 and Figure 2- 5). Another important factor for the highest disease Transmission in Chennai might be the highest slum population. Tamil Nadu Slum Clearance Board (TNSCB) 2017 completed a socio-economic survey in 1,131 slums spread across 17.28sqkm in the city. It found that north Chennai that consists of Tiruvottiyur, Manali, Madhavaram, Tondirapet and Royapuram has the maximum slums in the city, with 470. It is followed by central Chennai (Thiru-Vi-Ka Nagar, Ambattur, Anna Nagar, Teynampet and Kodambakkam) with 389. There are 272 slums in South Chennai -in Valasaravakkam, Alandur, Adyar, Perungudi and Shnganallur. The city has no virus –free zone the worst hit area is Royapuram (164) cases Thiru vi ka nagar (128), Teynampet (81), Tondiarpet (70), Anna Nagar (65), and Kodambakkam (60) cases more men than women (65.28%) to 34.82%). While this city continues a steady growth pattern, many of its people are categorized as "slum people[19] who live far below the poverty line. This might be one of the reasons for hasty disease transmission in Chennai. People who live in close propinquity to one another to spread disease rapidly and easily.[20]

To evaluate disease progression and severity (Table 2 and Figure 7) the district wise Active cases, Death cases and Recovered cases as of May 15. 2020 were analyzed. High recovery rate and a low death rate found all over Tamil Nadu indicates better medical facilities with a suitable patient and doctor ratio. Chennai being the highly affected had the highest active cases 5,115(86.02%) with comparably lowest recovery 783 (13.16%) cases due to more COVID19 affected people than the available doctors and hospitals. Medical facilities at other district like Coimbatore performing well by providing a relatively high recovery rate (above 98.6%) and low death rate as per their total active cases.

Evaluating the death reports among the district by the end of May.15. 2020death cases seems to be high(above 3%) found in the districts of Thoothukudi(4.1), as compared to percentage of active cases in Thoothukudi (41%), the death rate i.e., 4.1% was found to be much high than the death rate of Chennai .e., (0.80%) as per its % of active cases cases (86.02%) (Table 2 and Figure 7), Secondly, Ramanathapuram recorded (3.2%) of death cases as per its active cases (29.0). The moderate level of death rate (2%-3%) found in Vellore (2.9%)Kanyakumari (2.8) Erode (1.4%) Madurai (1.3) Theni (1.2).The death rate were low (below 1%) found in the rest of state.

After evaluating the death reports among the district by the mid of May 15 2020, it was found that, as compared to the total number of positive cases in Chennai (6318), the death rate i.e., 48 (0.80%) was found to be much low than the death rate of highly affected locations like Thoothukudi (4.1), Ramanathapuram (3.2), Vellore (2.9) and Kanyakumari (2.8) as per their positive cases. Apart from the districts like Tiruvallur (580), Chengalpattu (450) and Cuddalore (416) which showed comparatively higher corona positive cases and lowest death cases. Other district showed relatively slower growth of corona positive cases with death reports.

The month wise analysis of COVID-19 early confirmed cases from international travel related and through contact infection in Tamil Nadu from March 26.2020 – April30.2020(Table 3 Fig 8) reveals migration play important role in COVID -19 disease transmission both international travel returnees and migration of guest workers from other states leads to high disease transmission. The end of March month, the status of COVID19 in Tamil Nadu was in second stage, which means, the virus is locally transmitted and can spread from an infected person having a travel history from the virus spread state or country can pass on the infection to another person when coming in contact. In this stage, the infected persons can be identified and isolated.

As of March 26 -31. 2020 although Tamil Nadu the state capital Chennai had experienced highest number of imported

District	2020 March 26 to 31	2020 April 1 to 7	2020 April 8 to 14	2020 April 15 to 21	2020 April 22 to 30	2020 May 01-07	2020 May 8-15	Total Cases March 26- May 15
Ariyalur	0.75	0.86	0.78	0.52	2.46	0.83	0.50	0.69
Chengalpattu	0.75	1.75	0.82	0.64	3.61	0.57	0.88	0.86
Chennai	3.71	6.28	1.04	6.23	3.94	6.48	6.35	6.49
Coimbatore	1.43	2.71	0.87	0.72	0.64	0.67	0.25	0.59
Cuddalore	0.52	1.49	0.81	0.64	0.64	1.17	0.36	0.74
Dharmapuri	0.52	0.73	0.77	0.39	0.70	0.32	0.26	0.32
Dindigul	0.52	2.58	0.86	0.84	2.62	0.49	0.33	0.52
Erode	1.20	1.18	0.79	0.39	0.64	0.49	0.25	0.43
Kallakurichi	0.52	0.86	0.78	0.39	0.64	0.46	0.26	0.37
Kancheepuram	0.52	1.24	0.80	0.43	2.46	0.46	0.47	0.53
Kanyakumari	1.20	0.73	0.77	0.39	0.64	0.36	0.28	0.36
Karur	0.98	2.07	0.84	0.43	0.64	0.43	0.27	0.41
Krishnagiri	0.52	0.73	0.77	0.39	0.64	0.34	0.27	0.33
Madurai	1.20	0.98	0.78	0.60	2.57	0.50	0.37	0.51
Nagapattinam	0.52	1.43	0.81	0.68	0.64	0.43	0.25	0.40
Namakkal	0.52	1.43	0.81	0.43	0.86	0.49	0.26	0.42
Nilgiris	0.52	0.98	0.78	0.39	0.64	0.35	0.25	0.33
Perambalur	0.52	0.79	0.77	0.56	0.64	0.50	0.37	0.45
Pudukkottai	0.52	0.73	0.77	0.43	0.64	0.33	0.25	0.32
Ramanathapuram	0.52	0.86	0.78	0.56	0.70	0.37	0.27	0.35
Ranipet	0.52	2.13	0.84	0.39	0.64	0.44	0.30	0.42
Salem	0.75	1.11	0.79	0.47	0.92	0.39	0.26	0.37
Sivagangai	0.52	0.79	0.77	0.43	0.64	0.35	0.25	0.33
Tenkasi	0.52	0.73	0.77	1.33	0.70	0.44	0.26	0.40
Thanjavur	0.98	1.43	0.81	1.70	0.70	0.47	0.26	0.43
Theni	0.52	1.05	0.79	0.52	0.64	0.45	0.29	0.40
Tirunelveli	5.08	1.37	0.80	0.60	0.70	0.48	0.38	0.48
Tirupattur	0.52	1.05	0.79	0.39	0.64	0.37	0.26	0.35
Tiruppur	0.52	1.24	0.80	1.58	0.81	0.59	0.26	0.52
Tiruvallur	0.52	0.86	0.78	0.52	0.70	0.78	0.84	0.83
Tiruvannamalai	0.75	0.98	0.78	0.39	2.46	0.38	0.46	0.50
Tiruvarur	0.52	2.07	0.84	0.68	0.75	0.39	0.25	0.39
Tiruchirappalli	0.52	2.64	0.86	0.72	2.46	0.39	0.32	0.45
Thoothukudi	0.75	1.18	0.79	0.43	0.64	0.39	0.28	0.38
Vellore	1.43	0.98	0.78	0.52	0.64	0.39	0.26	0.37
Villuppuram	0.98	1.81	0.82	1.09	2.51	0.63	0.57	0.69
Virudhunagar	1.43	1.37	0.80	0.47	0.81	0.40	0.28	0.38
Mean Deviation	2.27	11.41	15.13	9.62	11.68	134.97	137.97	319.78
St. Deviation	4.382	15.66	20.570	24.517	18.180	419.462	550.854	1023.443

Table-1: Emergence pattern Of Covid-19 disease transmission In Tamil Nadu as of March 26-May -15
Z Score Analysis

cases of covid-19 compared to other district in Tamil Nadu. In the State capital Chennai the month of March 2020 the COVID-19 patients were returned from UK, USA, Oman, Ireland, Newzeland and Swizerland and in the month of April, the COVID-19 confirmed patients were returned from USA and Spain to Chennai. A number of confirmed imported covid cases entered in Chennai might be the reason for highest disease transmission.

The Z score value (6 standard deviation greater than the mean) found in Chennai (6.49). The neighboring district of kancheepuram the covid patient returned from Indonesia in the month of April. Similarly other foremost district such as Trichy, Coimbatore Thanjavur Kancheepuram Thiruvarur, Cuddallore, Erode, Salem also recorded imported COVID -19 cases in March and April 2020.

Interstate migration also play important role in disease transmission. The Census 2011 information on migrants as of late had came as a convenient instrument in this specific situation. According to the 2011census 18.85 lakh migrants who were born outside Tamil Nadu were living in the State. This is generally 2.6% of the State's complete populace. Of the considerable number of migrants in Tamil Nadu, these migrants from different States comprise just 6.2%. The remaining were the individuals who have moved inside Tamil Nadu. Larger part of the migrants were from north-eastern and northern States, Census 2011 information shows that 77.2% of the migrants from different States were from neighboring Andhra Pradesh Kerala, Karnataka

Tamil Nadu	Diagnosed cases	Deaths	Deaths Cases in % 0.67	Recovered cases	Recovered cases in % 26.40%	Active cases	Active cases in % 73%	%
Total	10,471	71		2,765		7,635		100
Ariyalur	348	0	0	195	56.03448	153	43.96552	100
Chengalpattu	450	4	0.888889	68	15.11111	378	84	100
Chennai	6318	48	0.807265	783	13.16852	5,115	86.02422	100
Coimbatore	146	1	0.684932	144	98.63014	1	0.684932	100
Cuddalore	416	1	0.240385	37	8.894231	378	90.86538	100
Dharmapuri	5	0	0	1	20	4	80	100
Dindigul	114	1	0.877193	83	72.80702	30	26.31579	100
Erode	70	1	1.428571	69	98.57143	0	0	100
Kallakurichi	61	0	0	14	22.95082	47	77.04918	100
Kancheepuram	176	1	0.568182	71	40.34091	104	59.09091	100
Kanyakumari	35	1	2.857143	16	45.71429	18	51.42857	100
Karur	56	0	0	44	78.57143	12	21.42857	100
Krishnagiri	20	0	0	0	0	20	100	100
Madurai	143	2	1.398601	87	60.83916	54	37.76224	100
Nagapattinam	47	0	0	44	93.61702	3	6.382979	100
Namakkal	77	0	0	77	100	0	0	100
Nilgiris	14	0	0	11	78.57143	3	21.42857	100
Perambalur	139	0	0	30	21.58273	109	78.41727	100
Pudukkottai	7	0	0	2	28.57143	5	71.42857	100
Ramanathapuram	31	1	3.225806	21	67.74194	9	29.03226	100
Ranipet	78	0	0	42	53.84615	36	46.15385	100
Salem	35	0	0	35	100	0	0	100
Sivagangai	13	0	0	12	92.30769	1	7.692308	100
Tenkasi	56	0	0	34	60.71429	22	39.28571	100
Thanjavur	71	0	0	53	53.78667	35	44.23516	100
Theni	78	1	1.282051	42	53.84615	35	44.87179	100
Tirunelveli	136	1	0.735294	63	46.32353	72	52.94118	100
Tirupattur	28	0	0	18	64.28571	10	35.71429	100
Tiruppur	114	0	0	114	100	0	0	100
Tiruvallur	516	3	0.581395	84	16.27907	429	83.13953	100
Tiruvannamalai	140	0	0	14	10	126	90	100
Tiruvarur	32	0	0	29	90.625	3	9.375	100
Tiruchirappalli	67	0	0	56	83.58209	11	16.41791	100
Thoothukudi	48	2	4.166667	26	54.16667	20	41.66667	100
Vellore	34	1	2.941176	20	58.82353	13	38.23529	100
Villuppuram	306	2	0.653595	128	41.83007	176	57.51634	100
Virudhunagar	46	0	0	32	69.56522	14	30.43478	100

Table-2: Status of COVID19 in different district in Tamilnadu
Deaths, Recoveries and Active cases by District March 26 –May-15

and Pondicherry. In India, the first corona positive case was detected in Thrissur district of Kerala on 30th January 2020 which is neighboring state of Tamil Nadu. The patient was a student from Wuhan University, China.[21] As per the medical guidelines, the patient was kept in isolation until his complete recovery as per the Ministry of Health and Family Welfare. Only symptomatic patients are isolated other asymptomatic patients are not identified and quarantined. As per Department of Health and Family Welfare reports (80%) COVID -19 patients were asymptomatic which leads the transmission of SARC-CoV-2 from asymptomatic carriers to others. In Tamil Nadu the lockdown was announced in March 26.2020. The last case of International COVID- 19 confirmed case entered in Tamil Nadu in April 5. But till May 15 the number of COVID-19 cases increased in Tamil Nadu this proves that number of humans become the host of COVID-19 disease transmission.

DISCUSSION

Chennai had the third largest expatriate population in India behind Mumbai and Delhi. High population density and high level of poverty all of which raised disease incidence. Similarly Dhaval desai[22] studied the densification of New York and London both mega cities and how covid-19 crippled their public health system and find out a pandemic poses many risks to the millions who lives in dense mega cities, Whether in wealthy countries or developing ones. The sheer density of the population of these cities provides an ideal environment for infections to erupt, and fast spread. Among 10,471 total cases in Tamil Nadu Chennai being

Countries	March 2020		April 2020	
	Affected districts in Tamil Nadu	Date of Disease Diagnosed	Affected districts in Tamil Nadu	Date of Disease Diagnosed
United kingdom	Chennai,	March 26.2020	0	0
United kingdom	Vellore	March 28.2020	0	0
West Indies	Thanjavur	March28.2020	0	0
United states	Chennai,	March28.2020	Chennai,	April3.2020
Oman	Chennai,	March 07.2020	0	0
Spain	Coimbatore	March 22.2020	Chennai,	April 5
UAE	Trichy	March28.2020	0	0
Thailand	Eurode	March 30.2020	0	0
Ireland	Chennai,	March 20.2020	0	0
Newzland	Chennai,	March 24	0	0
Indonesia	Salem	March 26	Kancheepuram	April 1
Myanmar	0	0	Thiruvarur	April 1
Andaman	0	0	Cuddallore	April1
Swiz	Chennai,	March 24	0	0

Table-3: Covid-19 Early Confirmed Cases From International Travel Related And Through Contact Infection In Tamil Nadu – Month Wise Analysis March 26.2020 – April30.2020

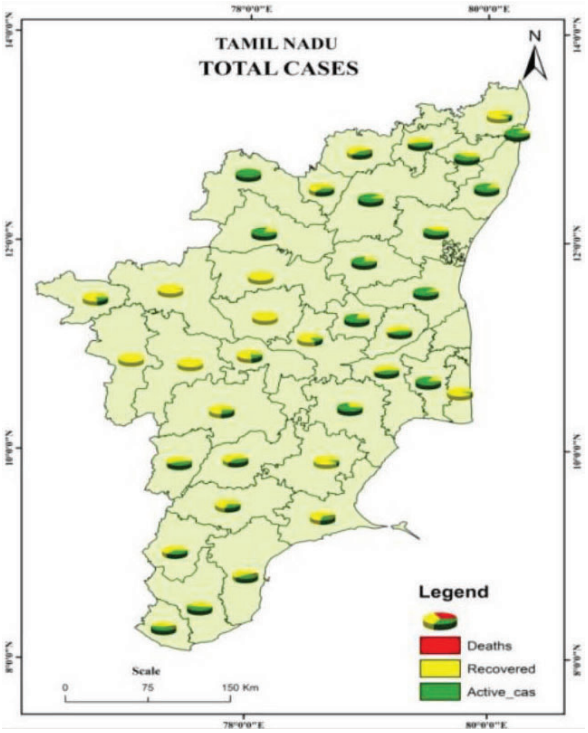

Figure-7: Deaths, Recoveries and Active cases

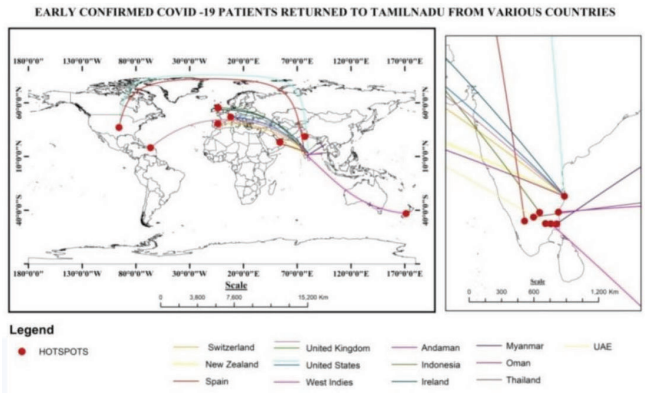

Figure-8: Early Confirmed Cases From International Travel Related and Through Contact Infection in Tamil Nadu

the worst affected more than half of the cases (6318) were recorded in Chennai, which is also the most populous district of the state. The case fatality rate(0.80) in the district was among the lowest in the state. As of 15 May 2020, the state had conducted 303,104 tests (4201 per million people). Three per cent of all tests returned positive. As per the Health Department, (88%) of the patients are asymptomatic while most deaths (84%) are among the elderly and those with co-morbidities**.** Similarly WHO[23] had issued advice for these two groups and for community support to ensure that they are protected from COVID-19 without being isolated, stigmatized, left in a position of increased vulnerability or unable to access basic provisions and social care**.** Older people (that is people over 60 years old); and those with underlying medical conditions (such as cardiovascular disease, diabetes, chronic respiratory disease, and cancer.

Due to 84% of asymptomatic cases, Chennai being the highly affected had the highest active cases 5,115(86.02%) with comparably lowest recovery 783 (13.16%) cases due to more COVID19 affected people than the available doctors and hospitals. Kit –San Yuen et al.,[24] also find out asymptomatic virus shedding by asymptomatic carriers raises the possibility for transmission of SARC-CoV-2 from asymptomatic carriers to others, which was later confirmed by others.

A number of confirmed imported COVID-19 cases in Chennai was another important reason for highest disease transmission. In Tamil Nadu the lockdown was announced in March 26.2020. The last case of International covid confirmed case entered in Tamil Nadu in April 5.2020 But till the month of May 15.2020 the number of covid cases increased in Tamil Nadu this proves that number of humans become the host of covid-19 disease transmission. Similarly Chand[25] demonstrate that travel restrictions cannot be expected to fully arrest the global expansion of COVID-19, but may decrease the rate of case exportations if enacted during the early stages of the epidemic

CONCLUSION

This present research was completed utilizing Z score and GIS mapping to represent the spatial dispersion of COVID19 disease all over Tamil Nadu. The primary goal was to assess the change in the rate of the COVID19 cases across various districts by performing spatial pattern assessment from 26 to May 15. 2020. By the mid of 15 May, it was discovered that, Chennai was the intensely influenced area by COVID19 disease followed by Chengalpattu 346 and Thiruvallur 325 according to the spatio- temporal change dissemination of COVID19 examination, it will be useful to make important strides by the government to manage and estimate the immense of further spread of the COVID19 contagious at the most influenced areas and the nearby locales to it just as to forestall the least influenced districts.

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