MONITORING COVID19 SITUATION AT DISTRICT LEVEL

Epidemiology

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ABSTRACT

India is passing through Covid19 pandemic. As on 19 August 2020, there are 2.76 millions of confirmed cases in the country. The present paper proposes the use of a composite tool in the name of 'Covid19 Index' to monitor the Covid19 situation at district level. The Covid19 Index was formulated by pooling number of active cases, number of deaths, number of recovered cases, number of Covid tests done and population of the districts. For the purpose of exercise, five districts were selected and Covid19 Index was calculated in those districts on every third day for a continuous period of 43 days from 23 June 2020 to 04 August 2020. The results showed a varied picture among five districts over those 43 days. There was spectacular improvement of situation in one district to very meager improvement and moderate improvement in other districts with or without consistency. It was found that, despite some limitations, this simple tool could be useful for District health officials to monitor the Covid19 situation in district or any defined smaller administrative area, particularly in developing countries. Covid19 Index can be used as an efficient management tool. As supplement, Covid19 Index of four additional districts for 15 days (04 August 2020 to 19 August 2020) were calculated and presented in tabular and line diagram forms. The second exercise also showed varied situations.

Introduction: Current population of India is about 1.38 billion[1]. The country is divided into 28 states and 8 Union Territories (UTs)[2]. Each state and UT is further divided into different districts, which are the smallest administrative units. There are 739 districts in India at present[3].

India has been passing through Covid19 pandemic. In respect of total number of confirmed cases India, with 2.76 million cases on 19 August 2020[4], is at third position in the world after USA and Brazil[5]. India observed lockdown for 68 days in 4 phases between 25 March 2020 and 31 May 2020[6]. Thereafter, graded restrictions and lockdown were imposed in different parts/localities of the country as per local needs. As an example, Thane district of Maharashtra state was under additional lockdown from 2 July 2020 to 12 July 2020[7].

The objective of the study was to monitor Covid19 situation in five districts from five states in India for continuous 43 days period from 23 June 2020 to 04 August 2020 by using a new and simple tool. There were already existing tools like 'Moving Average', 'Doubling Time' and 'Regression Analysis' to monitor Covid19 situation. But these were comparatively complex tools and couldn't be used by health officials in small and defined areas of populous and developing countries. The proposed new tool could even be used by health workers in such areas. Simplicity and scientific nature of this new tool were its main strength.

Methodology: For the purpose of monitoring, a tool named 'Covid19 Index', was developed and used. Covid19 Index = [{No. of recovered cases / (No. of active cases + No. of deaths)} x No. tested per 1000 population] / District population in million.

One district with second highest number of reported cases, as on 23 June 2020, from each of five high case reporting states of India were selected for monitoring. The districts were Thane, Surat, Agra, Chengalpattu, and Jodhpur from the states of Maharashtra, Gujarat, Uttar Pradesh (UP), Tamil Nadu, and Rajasthan respectively.

Covid19 Index of each of those five districts was calculated every third day between 7.00 PM and 7.30 PM from 23 June 2020 to 04 August 2020. Covid19 Index of ≥20 was accepted as 'Good' situation for the reason that the best situation on first day of monitoring (23 June 2020) was in Jodhpur district with Covid19 Index of 11.53. This figure was doubled and rounded to 20.

Below 'Good' situation, the Covid19 Index was categorized further such as: Covid19 Indices up to <5 were labeled as 'extremely bad'; 5 to <10 were called 'very bad'; 10 to <15 were called 'bad', 15 to <20 were called 'fair' situations respectively. So, higher the Covid19 Index better was the Covid19 situation of a district.

Since this exercise did not attempt to measure any rate or ratio, but estimated a composite Index by pooling in five variables, issue of Numerator and Denominator was superfluous in the case. One can use the variables in any combination, but there won't be any difference except in the change in 'Cut off' value of Covid19 Index.

Results:

Table-1 Calculated Covid19 Index of five districts of India from 23 June 2020 to 04 August 2020

Date Index	Thane (Maharashtra)	Surat (Gujarat)	Agra (UP)	Chengalpattu (Tamil Nadu)	Jodhpur (Rajasthan)
23 June	0.36	1.77	2.41	4.90	11.53
26 June	0.44	1.50	3.04	5.86	12.82
29 June	0.47	1.62	3.53	5.86	17.17
02 July	0.47	1.81	3.79	5.94	14.57
05 July	0.49	1.80	3.88	6.92	14.88
08 July	0.51	1.62	4.26	9.31	11.85
11 July	0.68	1.60	4.46	10.48	10.06
14 July	0.71	1.64	5.10	17.91	8.64
17 July	0.89	1.90	6.34	27.38	8.34
20 July	0.93	2.44	6.86	25.83	10.31
23 July	1.27	2.67	7.43	27.13	9.28
26 July	1.62	2.98	8.90	25.80	10.00
29 July	2.11	3.24	9.10	23.49	9.46
01 August	2.59	3.65	9.22	34.20	10.24
04 August	2.85	4.08	10.18	41.53	14.35
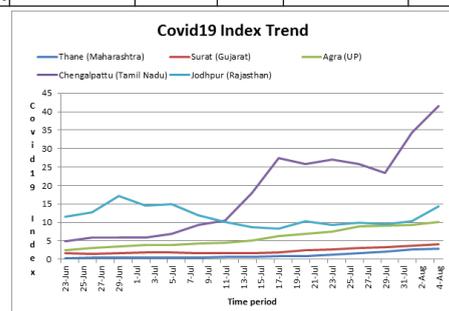
Line Diagram-1 Line diagram showing the Covid19 Index trends in five districts of India from 23 June 2020 to 04 August 2020. (Higher the Covid19 Index, better the situation)

Interpretations: During the period of monitoring, Thane district remained in 'extremely bad' situation with very tiny but consistent improvement of Covid19 Index from 0.36 to 2.85. Surat district also

remained in 'extremely bad' situation, but the Covid19 Index value, after initial oscillation, showed tiny but steady improvement to 4.08. The Covid19 Index consistently improved in tiny amount in Agra district from 2.41 and elevated the district from 'extremely bad' to 'bad' situation with Covid19 Index of 10.18 in the process. Chengalpattu district showed spectacular improvement of Covid19 Index over time and elevated the district from 'extremely bad' to 'good' situation and maintained consistently 'good' situation for last 18 days. Jodhpur district did not show any consistency of Covid19 Index over time which oscillated between 'very bad', 'bad' and 'fair' situation.

Discussions: The results shown may not reflect exact picture. But those could give fair amount of idea about the trend of the public health response to Covid19 pandemic, in form of Covid19 Index, in the five districts during continuous 43 days period under study. Higher the Covid19 Index better was the situation.

Covid19 test data of state were used for respective district, as district data were readily not available always. Use of 'district Covid test data' would have improved upon the Covid19 Index estimation. Districts with low number of reported cases (≤100) may give distorted picture, because of small data size. Where number of tests per 1000 population was > 25, it was restricted to 25 to avoid unnecessarily high numerator value.

The proposed "Covid19 Index" could be useful for District health officials to monitor the current pandemic situation and manage response mechanism and activities within districts or any defined area from a 'composite perspective' by using number of 'active cases', 'recovered cases', 'deaths', and 'laboratory tests' within 'standardized population'. This would also help in taking appropriate public health measures wherever required. The methodology would be very useful for developing and populous countries like India.

Addendum: From 04 August, 2020 another four districts of Pune, East Godavari, Ballari and Ghaziabad from the states of Maharashtra, Andhra Pradesh (AP), Karnataka and Uttar Pradesh (UP) of India were monitored by calculating Covid19 Index of each district for next 15 days (up to 19 August, 2020) in above mentioned method. This time, the Covid Test data of respective district were available.

The Table-2 and Line Diagram-2 given below included Covid19 Index trend of those additional four districts over 15 days. It was observed that situation in Ghaziabad district was 'good' all along. Ballari improved from 'extremely bad' to 'bad' situation. Whereas East Godavari remained in 'very bad' situation, Pune showed marginal improvement from 'extremely bad' to 'very bad' situation.

Table-2 Calculated Covid19 Index of four districts of India from 04 August, 2020 to 19 August 2020

Date Index	Pune (Maharashtra)	East Godavari (AP)	Ballari (Karnataka)	Ghaziabad (UP)
04 August	4.52	6.10	2.19	38.29
07 August	5.28	5.09	8.39	36.20
10 August	6.12	5.37	9.51	40.26
13 August	6.88	5.56	10.71	42.57
16 August	7.10	6.47	11.02	42.10
19 August	7.98	7.42	13.68	43.41
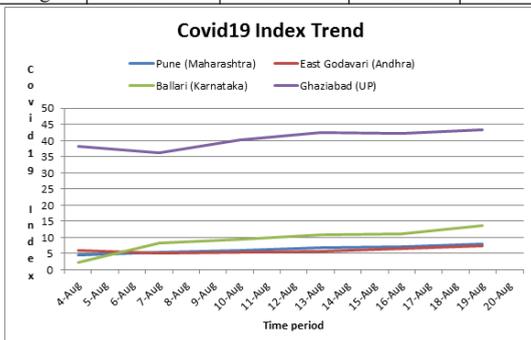
Line Diagrame-2 Line diagram showing the Covid19 Index trends in four districts of India from 04 August to 19 August 2020. (Higher the Covid19 Index, better the situation)

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