

A Study on Composite Health Index of Bhavnagar District's Talukas



Mayuri Pandya

Professor & Head,
Dept. of Statistics,
Maharaja Krishnakumarsinhji
Bhavnagar University,
Bhavnagar, Gujarat, India



Jayvantsinh Parmar

Research Scholar,
Dept. of Statistics,
Maharaja Krishnakumarsinhji
Bhavnagar University,
Bhavnagar, Gujarat, India

Abstract

Health is major area of concern from very evolution of human kind, Health sector has improved a lot with time due to economic and scientific growth. Nowadays with advance in medical technology, equipment and medicines life expectancy and health outcomes are improving at great extent. Despite of significant improvement in health sector, it remains crucial area of concern for government and society. To achieve healthy society, Indian government has established Sustainable Development Goals target for various health indicators to be achieved by year 2030. To reach SDG target by 2030 we need to assess improvement in health outcomes and take necessary steps to accelerate the process. So in this paper we will see improvement of various health indicators of 10 talukas of Bhavnagar district by comparing health indicators and its composite health index for period of 3 years with base year 2015-16 and reference year 2018-19. For comparison we have used primary data provided by health department of Bhavnagar District Panchayat. According to guideline of NITI Aayog, first scaled value of indicators is calculated by formulas and then health indicators are divided in domain and sub-domain to give them weight according to their importance and then composite health index number for base year and reference year is calculated. We can now compare each taluka's health index number for base and reference year to see progress and give suggestions to accelerate the same. Health ranking of each taluka is given on basis of composite index number for base year and reference year respectively. Comparison of individual indicators of each taluka for base year and reference year is done and suggestion is given on the basis of progress of each indicator.

Keywords: Neonatal Mortality Rate, Under-Five Mortality Rate, Proportion of Low Birth Weight Among New-Born, Sex Ratio, Malaria Treatment, Tuberculosis Treatment, Maternal Death, Infant Death, Anemia Test in Pregnancy, HIV Screening, Negative Indicators, Positive Indicators, Base Year Reference Year, Scaled value, Composite health index, Rank.

Introduction

Accompanying the rapid economic growth, Bhavnagar district has made significant improvements in health. Health system and health outcomes have also significantly improved.

To inspire Talukas within Bhavnagar district in order to make progress in population health facilities, we have used the report of National Institution for Transforming India (NITI) Aayog to measure the performance of talukas of district on Health Index. Health Index (referred to as Health Index-2019) examined the overall performance and incremental improvement in the Bhavnagar district for the period 2015-16 (Base Year) to 2018-19 (Reference Year), i.e., a three-year period. The details of the Health Index and indicators can be found in below Tables.

Methodology

Talukas will enter basic data for each indicator for a base year and a reference year which will be specified based on the availability of data. This data is compiled by health department of Bhavnagar district panchayat, which we have used as secondary data.

Computation of Index Scores and Ranks

After validation of data by the health department of Bhavnagar district panchayat data submitted by the Talukas and pre-filled from established sources were used for the Health Index score calculations. Each indicator value was scaled, based on its importance. For positive indicators, where higher value indicates better performance (e.g. sex

ratio at birth), the scaled value (S_i) for the i^{th} indicator, with data value as X_i was calculated as follows:

Scaled Value (S_i) for Positive Indicators

$$= \frac{X_i - \text{Minimum Value}}{\text{Maximum Value} - \text{Minimum Value}} \times 100$$

Similarly, for negative indicators where lower value indicates better performance [e.g. Neonatal Mortality Rate (NMR), Proportion of low birth weight among new-born (LWB)], and the scaled value was calculated as follows:

Scaled Value (S_i) for Negative Indicators

$$= \frac{\text{Maximum Value} - X_i}{\text{Maximum Value} - \text{Minimum Value}} \times 100$$

The minimum and maximum values of each indicator were ascertained based on the values for that indicator across Talukas within the grouping of Talukas for that year.

The scaled value for each indicator lies between the ranges of 0 to 100. Thus, for a positive indicator such as institutional deliveries, the Taluka with the lowest institutional deliveries will get a scaled value of 0, while the Taluka with the highest institutional deliveries will get a scaled value of 100. Similarly, for a negative indicator such as NMR, the Taluka with the highest NMR will

get a scaled value of 0, while the Taluka with the lowest NMR will get a scaled value of 100. Accordingly, the scaled value for other Taluka will lie between 0 and 100 in both cases.

Based on the above scaled values (S_i), a composite Index score was then calculated for the Base Year and Reference Year after application of the weights using the following formula:

$$\text{Composite Index} = \frac{\sum w_i s_i}{\sum w_i}$$

Where w_i is the weight for i^{th} indicator.

The Health Index score – List of indicators with their respective weights.

The Health Index is a weighted composite Index based on 24 indicators and 27 indicators for 2015-16 and 2018-19 respectively grouped into the domains of Health Outcomes, Governance and Information, and Key Inputs/Processes.

Each domain had been allotted weights based on its importance. Within a domain or sub-domain, the weight has been equally distributed among the indicators in that domain or sub-domain. Table 1 provides a detail of the number of indicators in each domain and sub-domain along with weights.

Table 1
Domain, Sub-domain and Indicators

Domain	Sub –domain	Sr. No	Indicators	Weight
1. Health Outcomes (14)	1.1. Key Outcomes (4)	1.1.1	Neonatal Mortality Rate (NMR)	500
		1.1.2	Under-five Mortality Rate (U5MR)	
		1.1.3	Proportion of low birth weight among new-born	
		1.1.4	Sex ratio at birth (number of girls born per 1000 boys born)	
	1.2. Intermediate outcomes (13)	1.2.1	Full immunization coverage (%)	250
		1.2.2	Proportion of institutional deliveries	
		1.2.3	Total Case NOTIFICATION Rate of TB(TBN)	
		1.2.4	TREATMENT Success Rate of TB Cases (TR. TB)	
		1.2.5	Proportion of people living with HIV (PLHIV) on antiretroviral therapy (ART)	
		1.2.6	Malaria Parasitic Incident	
		1.2.7	Malaria Treatment Rate	
		1.2.8	Malaria Blood Examination Rate	
		1.2.9	Severe Anemia	
		1.2.10	Maternal Death	
		1.2.11	Infant death	
		1.2.12	SAM children identified and treated	
		1.2.13	Successful discharge rate from NRC/CMTC	
2. Governance and information (1)	2.1. Health monitoring data integrity (1) and Governance	2.1.1	Data integrity measure: (Institutional deliveries, ANC registered within first trimester)	130
3. Key inputs/ processes (11)	3.1. Health Systems/Service Delivery (9)	3.1.1	CCU	200
		3.1.2	Live birth	
		3.1.3	Proportion of public health facilities with accreditation certificates by a standard quality assurance programme (NQAS /NABH/ISO/AHPI etc.)	
		3.1.4	Early ANC	
		3.1.5	HIV Screening	
		3.1.6	Anemia test	
		3.1.7	HRMI	
		3.1.8	HBNC	

		3.1.9	NCD Screening of the 30yrs+ population against estimate	
--	--	-------	---	--

Taluka -wise Performance on Indicators

This section provides insights about the overall, incremental and domain-specific performance. This section presents a detail of Taluka -wise performance on all indicators included in the Index. This can help the Bhavnagar district to easily identify specific areas requiring attention through a horizontal comparison. The tables present data for Base Year (BY) and Reference Year (RY) of each indicator for all Talukas of Bhavnagar. The direction as well as the magnitude of incremental change in the value of indicators from the Base Year to Reference Year is depicted by categorization ('Most Improved', 'Improved', 'No Change', 'Deteriorated', 'Most Deteriorated', 'Not Applicable') and is visually identifiable by respective color coding (dark green, light green, yellow, orange and red respectively) as follows:

Incremental change in performance for an indicator is calculated by subtracting Base Year value from Reference Year value. For indicators, such as NMR, U5MR, and LWB, a negative change from Base to Reference Year denotes improvement, while a positive change denotes deterioration. In the case of Indicators such as those that reflect service coverage, a positive change denotes improvement, while a negative change denotes deterioration. The range of improvement is calculated by subtracting the minimum value of change from the maximum value of change. This range is then divided into two equal parts and for indicators such as service

coverage the half towards maximum value of change is termed as 'Most Improved' (dark green) and the half towards the minimum value of change is termed as 'Improved' (light green).

Similarly, the range of deterioration is calculated by subtracting the minimum value of change from the maximum value of change. This range is then divided into two equal parts and the half towards maximum value of change is termed as 'Deteriorated' (orange) and the other half towards minimum value of change is termed as 'Most Deteriorated' (red) respectively. The yellow color denotes that the indicator value is stagnant and there has been no incremental change from Base to Reference Year.

The grey color indicates 'Not Applicable' (NA) category. For a Taluka, the incremental performance on an indicator is classified as NA in instances such as:

1. Data Integrity Measure indicator wherein the same data has been used for Base and Reference Year due to non-availability of updated NFHS data;
2. Health indicators with 100 percent values in both Base and Reference Year;
3. The data value for a particular indicator is NA in Base or Reference Year or both.

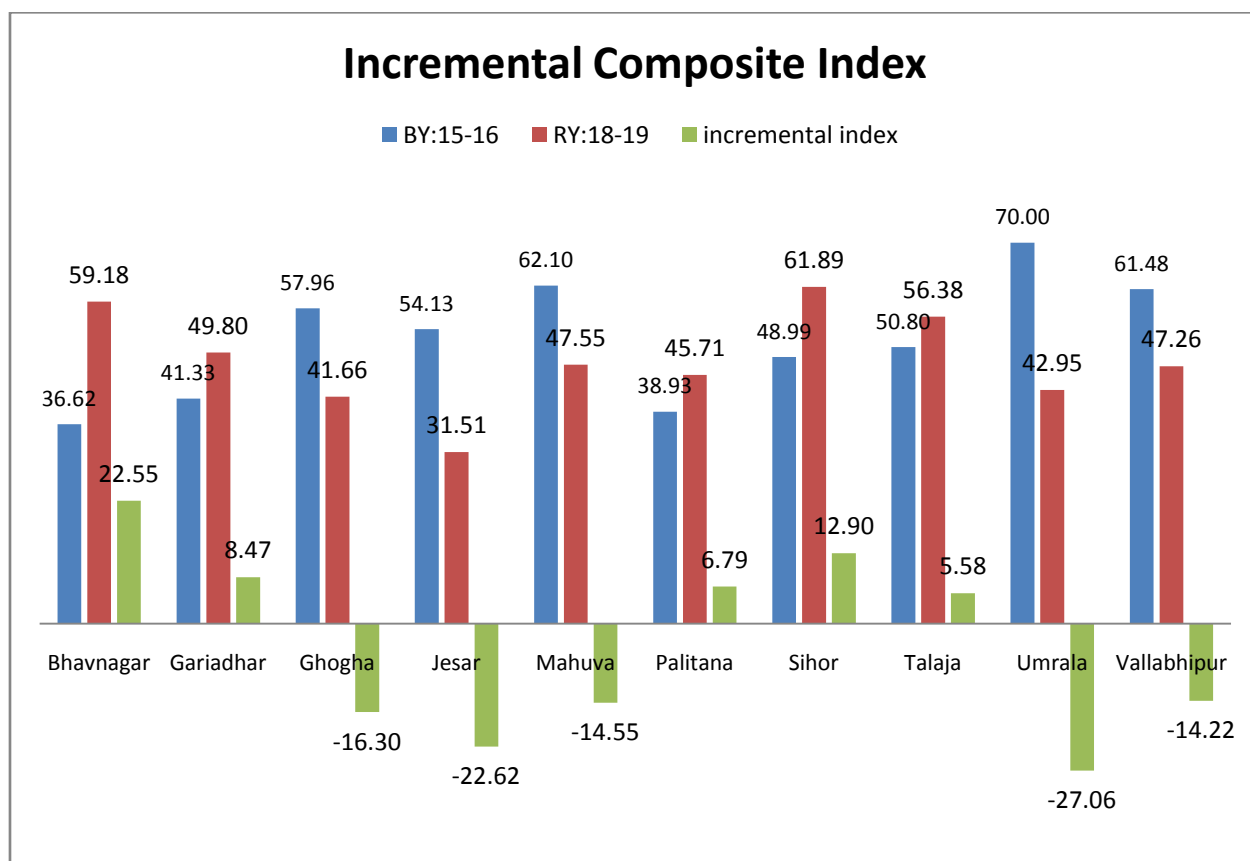
Computation of Composite Health Index

Computation of Composite Health Index of 10 Talukas for Base Year 2015-16 and Reference Year 2018-19.

$$\text{Composite Health Index} = \frac{\sum S_i W_i}{\sum W_i}$$

Table 2 Composite Health Index

TALUKA	Y ₀ BY:15-16		Y ₁ RY:18-19		Incremental index (Y ₁ - Y ₀)	Remarks	Incremental Rank (Y ₁ - Y ₀)
	Composite Health Index	Rank	Composite Health Index	Rank			
Bhavnagar	36.62	10	59.18	2	22.55	most improved	1
Gariadhar	41.33	8	49.80	4	8.47	most improved	3
Ghogha	57.96	4	41.66	9	-16.30	not improved	8
Jesar	54.13	5	31.51	10	-22.62	not improved	9
Mahuva	62.10	2	47.55	5	-14.55	not improved	7
Palitana	38.93	9	45.71	7	6.79	most improved	4
Sihor	48.99	7	61.89	1	12.90	most improved	2
Talaja	50.80	6	56.38	3	5.58	most improved	5
Umrala	70.00	1	42.95	8	-27.06	not improved	10
Vallabhipur	61.48	3	47.26	6	-14.22	not improved	6



Incremental performance from Base Year (2015-16) to Reference Year (2018-19) – Indicator wise

Table 3: Incremental performance from Base Year (2015-16) to Reference Year (2018-19) – Indicator wise

	NMR		Diff	UFR		Diff	LBW		Diff	Sex Ratio		Diff
	15-16	18-19		15-16	18-19		15-16	18-19		15-16	18-19	
Bhavnagar	10.22	4.37	-5.86	13.243	5.29	-7.96	23.00	0.65	-22.35	894.086	891.93	-2.15
Gariadhar	9.58	6.74	-2.83	12.906	8.99	-3.92	5.00	0.28	-4.71	846.995	858.04	11.04
Ghogha	7.16	10.53	3.37	9.839	12.53	2.69	1.97	3.34	1.37	981.395	889.20	-92.19
Jesar	6.14	21.68	15.54	8.5942	29.81	21.22	2.64	1.60	-1.04	1014.49	921.88	-92.62
Mahuva	5.66	5.07	-0.59	8.8713	6.73	-2.15	2.31	1.37	-0.94	886.56	894.32	7.76
Palitana	9.95	8.17	-1.77	13.266	10.90	-2.37	8.27	2.13	-6.14	934.698	912.88	-21.82
Sihor	10.18	9.30	-0.88	13.012	10.02	-2.99	8.41	1.14	-7.27	903.653	912.86	9.21
Talaja	7.69	7.63	-0.06	11.006	11.26	0.25	3.84	1.27	-2.57	1004.36	1005.83	1.47
Umrالا	5.61	13.32	7.71	8.4175	16.18	7.76	2.08	0.39	-1.69	912.371	870.11	-42.26
Vallabhipur	8.34	11.83	3.49	10.006	12.74	2.73	2.00	1.34	-0.66	890.625	825.58	-65.04

	Full immu		Diff	Institutional deliveries		Diff	TB_notification rate		Diff	TB_treatment success rate		Diff
	15-16	18-19		15-16	18-19		15-16	18-19		15-16	18-19	
Bhavnagar	74.78	104.58	29.80	175.86	322.81	146.96	99.02	62.92	-36.10	99.02	63.23	-35.79
Gariadhar	92.19	74.46	-17.73	84.33	76.09	-8.23	27.32	126.61	99.29	27.32	76.19	48.87
Ghogha	80.85	77.88	-2.97	84.79	62.93	-21.86	12.42	90.63	78.21	12.42	89.01	76.59
Jesar	52.43	74.73	22.30	16.50	29.05	12.55	9.15	103.53	94.37	9.15	94.12	84.96
Mahuva	84.30	108.69	24.39	96.42	107.90	11.48	59.27	96.15	36.88	59.27	82.78	23.51

Palitana	84.99	96.59	11.59	94.94	57.02	-37.92	45.16	102.73	57.57	45.16	82.92	37.76
Sihor	86.67	71.17	-15.50	109.74	78.19	-31.55	52.29	101.56	49.28	52.29	86.16	33.87
Talaja	68.86	85.12	16.26	20.28	81.26	60.98	37.11	107.41	70.30	37.11	85.85	48.74
Umrالا	82.12	82.79	0.67	107.50	70.10	-37.39	19.05	146.43	127.38	19.05	84.69	65.65
Vallabhipur	82.72	89.81	7.09	87.15	65.56	-21.59	46.71	113.75	67.04	46.71	93.85	47.14

	HIV(ART)		Diff	Malaria_PI		Diff	Malaria treatment success rate		Diff	Malaria blood Examination		Diff
	15-16	18-19		15-16	18-19		15-16	18-19		15-16	18-19	
Bhavnagar	85.75	95.00	9.25	0.27	0.03	-0.24	100	100	0	23.19	25.80	2.614608
Gariadhar	75.51	0.00	-75.51	0.032	0.02	-0.01	100	100	0	18.96	17.56	-1.40164
Ghogha	91.36	0.00	-91.36	0.26	0.04	-0.22	100	100	0	19.5	23.64	4.139946
Jesar	88.64	0.00	-88.64	0	0.06	0.06	0	100	100	0	23.28	23.28
Mahuva	81.90	93.00	11.10	0.38	0.12	-0.26	100	98.21	-1.79	16.17	20.33	4.16
Palitana	88.27	100.00	11.73	0.062	0.02	-0.04	100	100	0	17.79	17.6	-0.19
Sihor	87.63	96.00	8.37	0.053	0.01	-0.04	100	100	0	19.16	18.88	-0.28
Talaja	90.05	90.00	-0.05	0.042	0.02	-0.02	100	100	0	22.17	25.79	3.62
Umrالا	81.25	100.00	18.75	0.043	0.03	-0.01	100	100	0	15.91	17.5	1.59
Vallabhipur	89.71	86.00	-3.71	0.088	0.1	0.01	100	100	0	30.16	29.84	-0.32

	Severe anemia		Diff	Maternal Death		Diff	Infant Death		Diff
	15-16	18-19		15-16	18-19		15-16	18-19	
Bhavnagar	8.89	48.10	39.20735	140.85	86.98173384	-53.86333659	1.32	5.286749	3.962399
Gariadhar	7.33	11.11	3.781919	0.00	85.76329331	85.76329331	1.29	8.988764	7.698173
Ghogha	1.93	49.52	47.59331	0.00	0	0	0.98	12.53133	11.54743
Jesar	3.61	23.08	19.46247	304.88	0	-304.8780488	0.86	29.8103	28.95088
Mahuva	1.03	58.01	56.9841	330.21	109.6357656	-220.5788739	0.89	6.725469	5.838337
Palitana	0.07	21.62	21.55448	218.10	22.85714286	-195.2453653	1.33	10.89918	9.572629
Sihor	2.44	54.55	52.10643	341.30	65.84723442	-275.4496939	1.30	10.01669	8.715544
Talaja	0.88	35.84	34.95604	642.40	73.67839381	-568.7198931	1.10	11.26044	10.15989
Umrالا	0.13	0.00	-0.13298	0.00	176.2632197	176.2632197	0.84	16.17507	15.33332
Vallabhipur	4.95	47.17	42.22022	0.00	59.34718101	59.34718101	1.00	12.73885	11.7383

Remarking An Analisation

	ANC			CCU			Live birth			NAQS			Early ANC		
	15-16	18-19	Diff	15-16	18-19	Diff	15-16	18-19	Diff	15-16	18-19	Diff	15-16	18-19	Diff
Bhavnagar	91.59	111.20	19.60902	100	100	0	104.85	269.66	164.8089	12.50	37.50	25	64.29	91.71	27.41626
Gariadhar	95.70	85.45	-10.2443	0	0	0	109.43	74.73	-34.7022	0.00	50.00	50	44.78	71.56	26.77974
Ghogha	94.75	86.19	-8.55596	0	0	0	108.28	90.54	-17.7383	0.00	0.00	0	82.71	80.74	-1.96824
Jesar	83.41	108.12	24.70582	0	0	0	95.65	23.21	-72.4478	0.00	0.00	0	0.00	91.36	91.36399
Mahuva	95.00	90.08	-4.92426	0	0	0	108.80	99.46	-9.34272	0.00	0.00	0	70.77	81.56	10.79068
Palitana	91.23	87.53	-3.69684	0	0	0	104.48	55.71	-48.7721	0.00	16.67	16.66667	69.73	77.24	7.513142
Sihor	110.11	433.87	323.7547	0	0	0	126.02	96.09	-29.9341	16.67	14.29	-2.38095	78.57	426.24	347.6705
Talaja	87.30	97.85	10.55333	0	0	0	99.80	82.26	-17.5484	0.00	7.69	7.692308	67.44	82.49	15.05347
Umralla	96.53	86.84	-9.69494	0	0	0	110.41	63.26	-47.149	0.00	33.33	33.33333	83.26	82.35	-0.90991
Vallabhipur	101.24	90.39	-10.8495	0	0	0	115.62	66.67	-48.9479	25.00	25.00	0	57.06	83.94	26.87365

	HIV Screening			Anemia test			HRMI			HBNC		
	15-16	18-19	Diff	15-16	18-19	Diff	15-16	18-19	Diff	15-16	18-19	Diff
Bhavnagar	97	63.23	-33.7724	71.84	115.55	43.71425	0.64	13.17	12.52894	77.28	28.51	-48.763
Gariadhar	100	76.19	-23.8095	33.51	95.44	61.92862	0.20	8.03	7.826089	97.00	89.44	-7.5643
Ghogha	0	89.01	89.01099	23.17	227.67	204.5024	0.13	13.99	13.8589	79.61	77.09	-2.51371
Jesar	100	94.12	-5.88235	5.10	71.34	66.24277	0.56	8.95	8.383464	47.82	328.73	280.9055
Mahuva	100	82.78	-17.2165	24.94	75.75	50.81783	0.50	16.69	16.1916	71.32	63.76	-7.56357
Palitana	100	82.92	-17.0807	65.86	71.02	5.151793	0.32	11.15	10.82845	82.47	123.24	40.77123
Sihor	100	86.16	-13.8408	30.93	117.18	86.25163	0.79	12.47	11.68442	64.27	77.15	12.88689
Talaja	100	85.85	-14.1509	35.97	119.95	83.98234	0.20	18.29	18.09589	69.15	87.54	18.38664
Umralla	100	84.69	-15.3061	42.20	99.18	56.98158	0.98	11.34	10.36011	83.33	92.29	8.959721
Vallabhipur	100	93.85	-6.15385	60.64	201.60	140.9591	0.28	15.32	15.03394	74.54	122.66	48.11555

Overall Performance of RY: 2015-16**Table 4: Overall Performance of BY: 2015-16**

Overall Performance-2015-16					
Aspirants (36.62 to 47.74)		Achievers (47.75 to 58.87)		Front-runners (58.87 to 70)	
Bhavnagar	36.62	Ghogha	57.96	Mahuva	62.10
Gariyadhar	41.33	Jesar	54.13	Umralla	70.90
Palitana	38.93	Shihor	48.99	Vallabhipur	61.48
		Talaja	50.80		

The Taluka are categorized on the basis of Base Year Index score range: Front-runners: top one-third (Index score >58.87), Achievers: middle one-third (Index score between 47.75 and 58.87), Aspirants: lowest one-third (Index score <47.74).

2.4 Overall Performance of RY: 2018-19**Table 5: Overall Performance of RY: 2018-19**

Overall Performance-2018-19					
Aspirants (31.51 to 41.63)		Achievers (41.63 to 51.76)		Front-runners (51.76 to 61.89)	
Jesar	31.51	Vallabhipur	47.26	Shihor	61.89
		Gariyadhar	49.8	Bhavnagar	59.18
		Ghogha	41.66	Talaja	56.38
		Mahuva	47.55		
		Palitana	45.71		
		Umarala	42.95		

The Taluka are categorized on the basis of Reference Year Index score range: Front-runners: top one-third (Index score >51.76), Achievers: middle one-third (Index score between 41.63 and 51.76), Aspirants: lowest one-third (Index score <41.63).

Key Results (RY: 2018-19, BY: 2015-16)

- The Health Index scores for 2018-19 (Reference Year) revealed large disparities in overall performance across Taluka. Among the Taluka, the overall Health Index score of the best-performing Taluka are Bhavnagar, Sihor and Talaja and least-performing are Jesar, Ghogha and Umralla.
- Sihor championed the taluka with an overall score of 61.89, while Jesar was the least performing Taluka with an overall score of 31.51 (Table: 05)
- Among the least performing Taluka, particularly, there is an urgent need to accelerate efforts to narrow the performance gap between Taluka.
- The changes in Health Index scores from 2015-16 to 2018-19 varied significantly across Taluka, implying Different levels of momentum to improve performance.
- Only three Talukas had an improvement in the overall score between 2015-16 and 2018-19. The degree of change in incremental performance scores Differed across the Talukas. The magnitude of change was bigger in Bhavnagar, Sihor and Gariadhar Compared to Umralla, Jesar, Ghogha. (Table no.2)
- A decline of Talukas Health Index score from Base Year to Reference Year could be due to worse performance on some indicators in the Reference Year (2018-19) that outweighs the improvements on other indicators.
- Among the Taluka , Bhavnagar, Sihor and Gariadhar are the top three Taluka in terms of incremental performance, while Sihor, Bhavnagar, Talaja and Gariadhar are the top Four Talukas in terms of overall performance.
- In terms of incremental performance in Index scores from Base Year to Reference Year, the top three ranked, most improved Taluka are Bhavnagar (up 22.55 points), Sihor (up 12.90 points) and Gariyadhar (up 8.47 points). In terms of incremental performance in Index scores from Base Year to Reference Year, the least three, not improved Taluka are Umralla (-27.06 points), Jesar (-22.62 points) and Ghogha (-16.30 points).(Table : 2).
- The decline in the overall Health Index score for Five taluka (Vallabhipur, Umralla, Jesar, Ghogha, Mahuva) between the Base Year (2015-16) and Reference Year (2018-19) is attributed to the deterioration of performance in several indicators. For instance in Umralla, the deterioration between Base Year and Reference Year was primarily due to the performance related to institutional deliveries severe anaemia, maternal death and ANC, while in the case of Jesar the performance related to NMR, UFR, Sex ratio, HIV ART, Malaria PI, infant death, live birth are accounted for the deterioration. Similarly, Mahuva had a decrease in Health Index score mainly because of the

deterioration in malaria treatment rate and HIV screening rate. (Table: 3).

10. It was observed that though Severe anaemia, TB notification rate, TB success rate have improved in most Talukas, most key outcome indicators have improved such as LBW. Institutional delivery is intermediate outcome indicator that needs significant improvement. Jesar is most deteriorate taluka because in case of NMR and UFR, Jesar is outlier (Difference in NMR=15.54 and UFR =21.22).
11. Sihor, increase in overall Health Index score, maintained its ranking as the top performing among talukas of Bhavnagar District. However, Gariyadhar lifted from ninth position to fourth position, while Palitana dropped from fourth position to seventh. (Table 2).

Reference

- Aiming higher: Results from a scorecard on state health system performance, 2014-the commonwealth fund, Washington, DC.; 2014*
- Brown, D.L., Champion, T., Coombes, M., and Wyner, C. (2015) *The migration commuting nexus in rural England: A longitudinal analysis. Journal of rural studies 41:118-128.*
- "Everybody's business: Strengthening Health Systems To Improve Health Outcomes:*

WHO's Framework For Action- World Health Organization, Geneva ; 2007

"Healthy states progressive India, report on the ranks of states and union territories", Health Index June-2019, NITI Aayog and Ministry of Health and Family Welfare.

Measuring the health of nations: updating an earlier analysis.- Health Aff (Milwood); 2008

Measuring performance on the healthcare Access and quality Index for 195 countries and territories and selected sub-national locations: a systematic analysis from the global burden of disease study 2016- GBD 2016 Healthcare access and quality collaborators-May 23; 2018.

Transforming our world: the 2030 Agenda for Sustainable development- united nation, new York; 2015

"The world health report 2010- Health Systems Financing: Path to Universal Coverage."- World Health Organization, Geneva ; 2010

"The world health report 2000- Health systems: Improving performance"- World Health Organization, Geneva;2000

Variation in amenable mortality-trends in 16 high-income nations.- Health policy; 2011