Blockwise Analysis of Health Indicators of Gadchiroli District using Composite Index: An application of GKG Algorithm.

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Background:

Gadchiroli district is a part of Vidarbha, Traibal district away from 200 KM from sub capital of Maharashtra, Nagpur, Gadchiroli is well known tribal district of vidarbha. Total forest cover of the district is around 78% of total geographic area. District has 12 blocks with 6 revenue division. It is a notified tribal district having 8.61%–81.50% tribal population in different blocks and block-wise urbanization varies from 0.00% to 37.10%.

Objective:

Objective of present research paper is to device tool to rank the blocks of the district according to community health status exist in blocks and accordingly assess community health status at block level in Gadchiroli district.

Methods: The author has used available secondary data sources including Census, Survey of Cause of Death scheme, health management information system, Directorate of Economics and Statistics, and Maharashtra Medical Council. Ten indicators were selected to evolve comprehensive health index. Blocks having best statistic in each indicator were given100 marks, marks were calculated according to index as the mean of variable is one, Index can easily converted into percentages.

Introduction:

A composite indicator is an aggregated index comprising individual performance indicators. It is an index of relative attainment since It reflects the relative values of the underlying performance indicators. Composite indicators are increasingly being used to measure the performance of and to rank organization, districts, blocks and institutions in economic, social and policy areas [Freudenberg, 2003]. Ghai (2003) opined that there is rarely one single measure of the desired outcome and a combination of several indicators may give a more accurate measure of a specified objective. Saisana, Tarantoobarhshola and Saltelli (2005), argued that composite indices can be used to summaries complex or multi-dimensional issues and facilitate ranking of countries on complex issues etc.

To measure development needs the statistical tool, best way to measure development and rank the blocks using composite index, In this paper author develop composite index using Gotmare-Khot-Gotmare algorithm here onwards called GKG algorithm, algorithm has nice property of measuring development in health quantitatively and across the blocks of the district. Another property of algorithm is through which one can compare the development across the blocks, composite index is standardized as it measures development from mean which is unity, it can be easily converted into percentage terms. Simple measure of statistics is used which is sums of square of variation and total sums of square of variation and weights are based on using these statistical tools. We can define composite index as a mathematical combination of several indicators or measures in order to form a single number. This single index can be used to describe an entire set of indicators, and allows for an examination of differences between health. In other words a composite index rolls several related measures (indicators) into a single score that provides a summary of how the health system is performing in certain areas. In this paper ten health indicators were included to form the index namely, Infant Mortality Rate, Birth Rate, Sickle cell carrier rate, Annual Parasite incidence of Malaria, Doctor population Ratio, Nurse population Ratio, Bed Population Ratio, Use of Latrine (by subtracting the proportion of open air defection), Use of non-fire wood fuel for cooking., Institutional deliveries. Purpose of the present paper is to demonstrate methodology to

compute composite index, this composite index GKG algorithm can be used in Ranking the development in the area of agriculture, Psychology if scale is used, education etc. Data in this paper is taken from the published paper.

Material and Methods:

The population of Gadchiroli district is 10,72,942 and area is 10.72 km2, implying population density of 74/km2. There are12 blocks having population ranging from 36,325 to 1,45,963. It is a notified tribal district having 38.7% (block-wise range:8.61% to 81.50%) of tribal population. Gond, Bada Madia,and Rajgond are main scheduled tribes in the district. Theurban population is 11% (block-wise range: 0%–37.10%). The map of district is depicted in Figure 1. Per capita net district domestic product (2013–2014) is Rs. 58,603. Literacy rate is 74.4%. Population sex ratio is 982 and child sex ratio is 961.There are 376 sub centers, 45 primary health centers, and 11 community health centers.

Selected Indicators

Health Outcomes:

1. Infant Mortality Rate
2. Birth Rate
3. Sickle cell carrier rate
4. Annual Parasite incidence of Malaria

Health System:

1. Doctor population Ratio
2. Nurse population Ratio
3. Bed Population Ratio

Other Health Determinants:

1. Use of Latrine (by substracting the proportion of open air defection)
2. Use of nonfire wood fuel for cooking.

Health Care Utilization

1. Institutional deliveries

Data Sources (Specific Indicators)

To construct composite Index data is taken from the published paper entitled block-wise Comprehensive Health Index in Gadchiroli: A Tribal District in Maharashtra by P.P.Doke

1. Census 2011 (use of Latrine and Fuel for cooking)[8]
2. Survey of Causes of Death Scheme (Rural) .(Average of three calendar years 2012-2014) for Infant Mortality and Birth rate[9]
3. HMIS, 2013-2014 (Infant Mortality Rate, Birth Rate, Annual Parasite incidence, Proportion of Sickle Cell Anemia Carriers and Proportion of Institutional Deliveries)[10]
4. Annual District Socio Economic Survey Report of Directorate of Economics and Statistics, Government of Maharashtra for 2013-2014 (Doctor population Ratio, Nurse population Ratio)[11]
5. Maharashtra Medical Council (List of MBBS doctors for calculation of doctor population ratio)[12]
6. Management Information system of Women and Child Development Departments (Malnutrition in children)
7. Interaction with key informants (Morbidity and mortality experiences, functioning of public and private health sectors and traditions and culture factors seeking health care)
8. Special Survey conducted (preferred health care providers drug addiction)
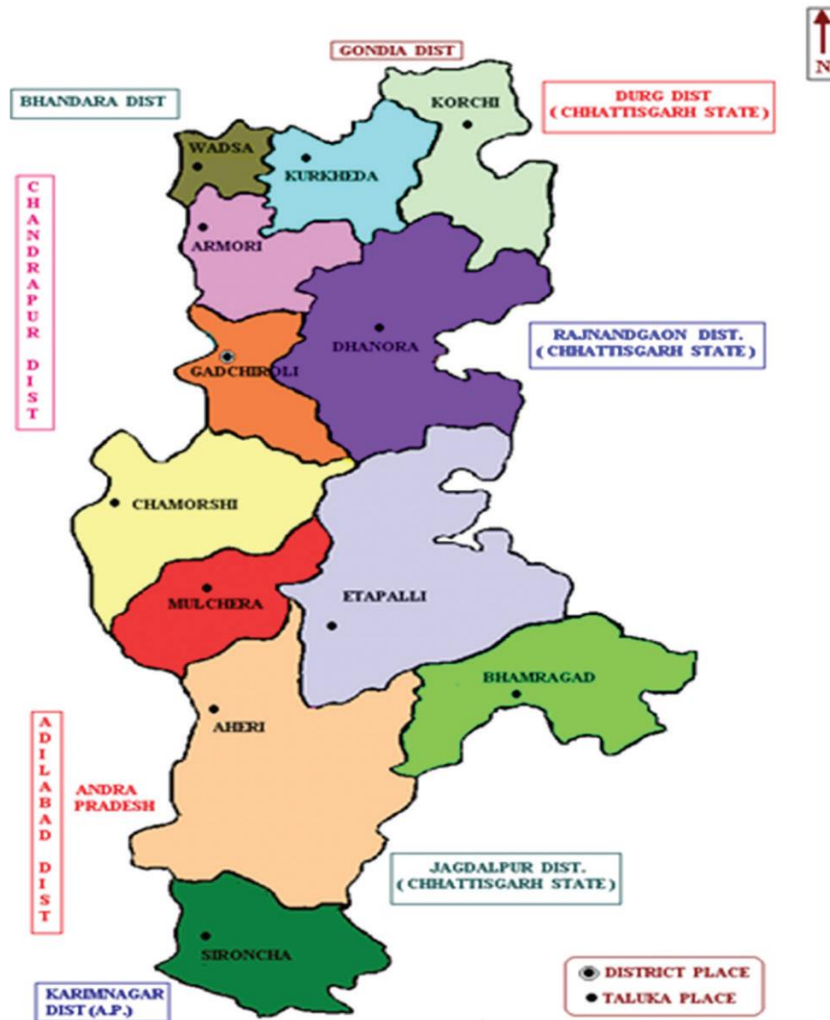
Gadchiroli Map

Methodology:

In this paper m algorithm is suggested to compute composite Index of Health called GKG Algorithm, In this algorithm following steps are suggested to compute final Index

1. At very first step variable is unities by dividing it by mean value and allowed only variation to vary.

2. At second step sums of squares as a measure of variation is computed for each variable.

Sums of Square = $\sum (X_i-\bar{x})^2$ Summation is ranging for i=1 to no. of talukas, Value of $\bar{x}$ is taken as unity that is 1.

3. At third step Total Sums of square is computed as

Total sums of suare = $\sum (SS_i)$, Summation is ranging for j=1 to no. of variables).

4. At fourth step weights for each variable is computed

Weights(W_i)= SS_i/TSS, i ranging for 1 to no of Variables

5. Final Index is computed as

Index= $W_1*I_1+W_2*I_2.........+W_i*I_i$,i ranging for no of variables

Ranking of blocks are based on value of Index so obtained.

Table 1: Indicators

Taluka	Mean IMR	Mean BR	API	Sickle cell anemia carrier(%)	Doctor /10000	Nurse / 10000	Bed/ 10000	Latrine	Clean fuel use (%)	Institutional Deliveries (%)
Aheri	43	15	8	2.22	1.79	4.53	6.84	22	17	75
Armori	27	14	13	1.71	1.85	4.84	7.62	37	17	89
Bhamragad	42	13	44	0.63	3.85	7.43	13.21	15	7	65
Chamorshi	27	19	6	2.17	1.23	4.02	5.36	22	14	86
Wadsa	15	14	5	2.73	3.35	2.63	7.54	47	23	92
Dhanora	34	16	23	1.16	2.3	6.05	7.26	19	7	74
Etapalli	21	26	16	1.28	2.08	5.38	5.87	16	8	43
Gadchiroli	68	26	2	2.85	4.86	7.81	18.77	42	35	96
Korchi	27	17	3	1.25	2.8	6.31	9.81	18	6	73
Kurkheda	21	15	16	1.45	2.09	5.46	7.9	38	11	92
Mulchera	22	16	20	0.55	1.97	4.8	10.48	24	7	75
Sironcha	25	14	14	1.53	2.68	6.02	8.03	13	10	81
Mean	31	17.08	14.17	1.6275	2.570833	5.44	9.0575	26.083	13.5	78.41667

Table 2: Standardized table after dividing the unit value by mean

Taluka	Mean IMR (I1)	Mean BR (I2)	API(I3)	Sickle cell anemia carrier(%) (I4)	Doctor /10000 (I5)	Nurse/ 10000 (I6)	Bed/ 10000 (I7)	Latrine (I8)	Clean fuel use (%) (I9)	Institutional Deliveries (%) (I10)	INDEX (I) ∑Wi*Ii
Aheri	1.3871	0.878	0.565	1.36406	0.6963	0.8327	0.75518	0.84345	1.25926	0.95643	0.9769
Armori	0.871	0.8195	0.918	1.05069	0.7196	0.8897	0.84129	1.41853	1.25926	1.13496	1.047
Bhamragad	1.3548	0.761	3.106	0.3871	1.4976	1.3658	1.45846	0.57508	0.51852	0.82891	1.2355
Chamorshi	0.871	1.1122	0.424	1.33333	0.4784	0.739	0.59177	0.84345	1.03704	1.09671	0.914
Wadsa	0.4839	0.8195	0.353	1.67742	1.3031	0.4835	0.83246	1.80192	1.7037	1.17322	1.1824

Dhanora	1.0968	0.9366	1.624	0.71275	0.8947	1.1121	0.80155	0.72843	0.51852	0.94368	0.9555
Etapalli	0.6774	1.522	1.129	0.78648	0.8091	0.989	0.64808	0.61342	0.59259	0.54835	0.7879
Gadchiroli	2.1935	1.522	0.141	1.75115	1.8904	1.4357	2.07232	1.61022	2.59259	1.22423	1.4354
Korchi	0.871	0.9951	0.212	0.76805	1.0891	1.1599	1.08308	0.6901	0.44444	0.93092	0.6894
Kurkheda	0.6774	0.878	1.129	0.89094	0.813	1.0037	0.87221	1.45687	0.81481	1.17322	1.0148
Mulchera	0.7097	0.9366	1.412	0.33794	0.7663	0.8824	1.15705	0.92013	0.51852	0.95643	0.8455
Sironcha	0.8065	0.8195	0.988	0.94009	1.0425	1.1066	0.88656	0.4984	0.74074	1.03294	0.9157
Mean	1	1	1	1	1	1	1	1	1	1	

Results:

In this paper algorithm is devised called GKG algorithm to compute index and rank the blocks according to community health status. There were 10 indicators selected, data were sought from the published paper [1], Composite index shows that Gadchiroli district stood first in development of health as per selected indicators. Development is 43% higher than district development of 100. Followed by Bhamragad (23%), Wadsa (18%). Few talukas namely armori, kurkheda are below 5%. Rest of the talukas found to be below district development of 100. Minimum development in health sector is found in Chamorshi, Dhanora, Etapalli,Korchi, Mulchera and Sironcha Block.

Conclusion:

Reasonably reliable and valid block-wise data are available to carry out community health assessment and develop comprehensive health index. The index is useful for comparison among blocks In present research paper author used GKG algorithm to compute composite Index in health. Taluka wise inequalities were found in the index.GKG algorithm has nice properties of standardization, Development can be measure quantitatively that is development can be measurable. GKG algorithm can be applied to study inequality and development in Education, Agriculture, Psychology, economic sector, environment.etc. based on composite index score policies can be made.

References:

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Annexure: 1

Index values of Indiacator

Taluka	Mean IMR	Mean BR	API	Sickle cell anemia carrier(%)	Doctor /10000	Nurse / 10000	Bed/ 10000	Latrine	Clean fuel use (%)	Institutional Deliveries (%)	
Aheri	0.1498	0.0149	0.189	0.13254	0.0923	0.028	0.05994	0.02451	0.06722	0.0019	
Armori	0.0166	0.0326	0.007	0.00257	0.0786	0.0122	0.02519	0.17517	0.06722	0.01821	
Bhamragad	0.1259	0.0571	4.435	0.37565	0.2476	0.1338	0.21019	0.18056	0.23182	0.02927	
Chamorshi	0.0166	0.0126	0.332	0.11111	0.2721	0.0681	0.16665	0.02451	0.00137	0.00935	
WAdsa	0.2664	0.0326	0.419	0.4589	0.0919	0.2668	0.02807	0.64307	0.4952	0.03001	
Dhanora	0.0094	0.004	0.389	0.08251	0.0111	0.0126	0.03938	0.07375	0.23182	0.00317	
Etapalli	0.1041	0.2724	0.017	0.04559	0.0365	0.0001	0.12385	0.14945	0.16598	0.20399	
Gadchiroli	1.4246	0.2724	0.738	0.56423	0.7929	0.1898	1.14986	0.37237	2.53635	0.05028	
Korchi	0.0166	2E-05	0.621	0.0538	0.0079	0.0256	0.0069	0.09604	0.30864	0.00477	
Kurkheda	0.1041	0.0149	0.017	0.01189	0.035	1E-05	0.01633	0.20873	0.03429	0.03001	
Mulchera	0.0843	0.004	0.17	0.43832	0.0546	0.0138	0.02467	0.00638	0.23182	0.0019	
Sironcha	0.0375	0.0326	1E-04	0.00359	0.0018	0.0114	0.01287	0.2516	0.06722	0.00109	
Sums of squares (SS)	0.3624	0.7501	7.333	8.44544	1.7221	0.7622	2.48431	2.20613	4.43896	6.64508	
Weights	0.0103	0.0213	0.209	0.24027	0.049	0.0217	0.07068	0.06276	0.12629	0.18905	1
Weights %	1.0311	2.1341	20.86	24.0271	4.8993	2.1685	7.06782	6.27688	12.6287	18.9051	

TSS=∑Ssi   35.15