Inter-District Disparities in Health in Haryana

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Abstract

In this research paper, an attempt was made to assess the extent of inter-district disparities in Haryana in terms of health indicators. The health status was measured by various indicators covering three aspects of health, that is, health outcome, health infrastructure, and access to and uses of health facilities. The paper found wide inter-district disparities in various health indicators. The range and standard deviation of various health indicators clearly showed wide dispersion in health indicators. The extraction of factor scores and their district-wise ranking revealed some interesting results. Some of the districts scored very low on health infrastructure, but scored very high on access to and uses of health facilities. This indicated that either the residents of these districts were making better use of available public health facilities, or they were availing private health facilities. Again, it was observed that some districts that scored high on health infrastructure performed poorly on uses of health facilities. This indicated that the public, at large, was not availing the available public health infrastructure. The reason could either be the attitudes of the public health staff or inhibiting cultural factors. Hence, it can be concluded that having public infrastructure in place does not ensure proper maternal and child health care; the emphasis should be on their proper and efficient uses.

Keywords: **health status, health indicators, factor analysis, mortality rates, composite health indicator**

JEL Classification: I100, I140, I120

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The role of human capital is almost universally regarded as being indispensable to the engine of economic growth (Meier, 1984). Right upto 1990s, human capital was mainly linked to education, but after the work of Barro and Sala (1995) and Barro (1996), the link between health and economic growth gained importance. The studies by Arora (2001), Ruger, Dean, and Bloom (2001), Mayer (2001), Sachs (2003), Fogel (2004), Bloom and Canning (2005), Ashraf, Lester, and Weil (2008), and Bloom and Fink (2013) reported a strong positive relationship between health & economic growth and prosperity. The economic value to current and future generations of 10% reduction in heart disease mortality is estimated to be more than $3 trillion and of 1% reduction in cancer mortality is estimated to be more than $400 billion (Murphy & Topel, 2003). According to the World Bank (2005), 50% of economic growth differentials between developed and developing nations are attributed to ill-health and low life expectancy.

Bloom, Canning, and Graham (2003) reported that a 10-year increase in life span is associated with an increase of 4.5% points in savings rates as healthier individuals with increased longevity are more concerned with future financial needs. Finlay (2007) illuminated that health does play a role in economic development as healthier individuals live longer, and are encouraged to invest more in education, as returns to education can be enjoyed in the form of higher skilled wages. Baldacci (2004) explored the role played by health expenditures and found that spending on health within a period of time affected growth within that same period of time. Nordhaus (2002) found that half of the overall economic growth in the U.S. during the last century was associated with improvements in the population's health. Bloom et al. (2004) focused on the labour productivity effects of health on economic growth, where improvements in health will lead to an increase in per capita income. Their main

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result was that health has a positive and significant effect on economic development. Bloom (2004) argued that the initial beneficiaries of health improvements are often children. Lower infant mortality initially creates a "baby boom" cohort and often leads to a subsequent reduction in the birth rate as families choose to have fewer children in the new low-mortality regime. It affects the economy as it enters education, then finds jobs, saves for retirement, and, finally, leaves the labor market. Mechanisms through which health improvements can contribute to economic development are: (a) improved productivity, (b) improved learning and education, (c) reduced family size, (d) health and investment, (e) reduced treatment burden, and (f) lifespan and life cycle behavior.

With impressive economic growth, one of the highest per capita income index, sound industrial infrastructure, strong manufacturing base, advanced agriculture sector, and a vibrant service sector, Haryana is one of the highly economically flourishing and industrialized states of India. Today, it enjoys the unique distinction of having provided electricity, metalled roads, and potable drinking water to all its villages. Haryana has also done very well in terms of development, but its health and education indicators are less than satisfactory, specifically in view of its economic prosperity. Moreover, there are a wide range of intra-state regional disparities or inter-district imbalances in economic and social indicators as well in the sectors of agriculture, industries, education, health, water supply, sanitation, and social services. There exist wide inter-district disparities in terms of per capita income as the ratio of richest district per capita income to the poorest district per capita income is 6.97, implying high income inequalities. The ratio of income of the three richest districts to the three poorest districts is 4.38, which confirms the prevalence of significant inter-district disparities in the state (Narayan, 2011).

Improvement in the health status of the population has been one of the major thrust areas in social development programmes of the State. At present, health services in Haryana are being provided through a network of 57 hospitals, 112 community health centers, 485 primary health centers, 2,630 sub-centers, 7 trauma centers, 37 urban and rural dispensaries, 90 urban RCH centers, and 473 delivery huts. In addition, 11 polyclinics, 4 dispensaries, and 11 urban health centers have been operationalized (Government of Haryana, 2015b). But the delivery of the services is not uniform across regions and districts. Not only there are inter-district disparities in delivery of health services, there are disparities in health outcomes also. Given this background, it is interesting to analyze health indicators and inter-district variations in health indicators in Haryana.

The main objectives of the paper are to undertake a comparative analysis of inter-district disparities in health infrastructure by comparing availability of health staff, hospitals, and services delivery by health staff. Health is not the sole responsibility of the state, and the public, in general, uses both public and private health services. The private health care has grown significantly. Hence, the paper also compared health outcome by comparing infant mortality rates and child mortality rate (CMR) across the districts of the state.

Data and Methodology

The data for the study were obtained/compiled from 'Statistical Abstract of Haryana-2013-14' (Government of Haryana, 2015a) and 'District Level Household and Facility Survey-2007-08: Haryana'. The paper also used data from Sample Registration System (Government of India, 2014), Bulletin and Civil Registration System (Government of India, 2015a), and Report published by Vital Statistics Division of Registrar General, India. The infrastructure related health statistics were also used from Rural Health Statistics (Government of India, 2013a) Bulletin published by Ministry of Health & Family Welfare, Government of India. Collated data from Planning Commission (Government of India, 2015b) table for Chairman were also used for the purpose. The data were examined at the district level and the latest available data were used. The data is represented through tables.

Principal component analysis has been used to group the district with similar characteristics. Principal component analysis is a multivariate technique for transforming a set of related (correlated) variables into a set of unrelated (uncorrelated) variables that account for decreasing proportions of the variation of the original observations. The rationale behind the method is an attempt to reduce the complexity of the data by decreasing the

number of variables that need to be considered. If the first few of the derived variables (the principal components) account for a large proportion of the total variance of the observed variables, they can be used both to provide a convenient summary of the data and to simplify subsequent analyses (Landou & Everiit, 2004). The study conducts principal component analysis using SPSS 19.0 with varimax rotation with 10 variables. The KMO-statistic is 0.699 and Barlett's test is also significant, indicating that the variables are correlated high enough to undertake principal component analysis. The component scores of extracted factors are combined using their explaining power to form a weighted composite health indicator.

Inter-District Disparities in Health Status

Health is a multi-dimensional concept; hence, there is no single standard measurement of health status for population groups. Judgments regarding the level of health of a particular population are usually made by comparing one population to another, or by studying the trends in a health indicator within a population over time. Due to simplicity, and easy availability of data, mortality rates are usually used as measures of health. Key health indicator based on mortality rates are (a) Life Expectancy and Health-adjusted Life Expectancy [HALE], (b) Maternal Mortality Ratio [MMR], (c) Infant Mortality Rate [IMR], (d) Neo-natal Mortality Rate [NMR], (e)

Table 1. Infant Mortality Rate (IMR) in Districts of Haryana

Group / District	Total(Rural+Urban)			Rural			Urban		
	T	M	F	T	M	F	T	M	F
Ambala	32	34	31	36	46	34	23	20	27
Bhiwani	44	43	45	46	45	47	24	22	27
Faridabad	37	35	40	44	39	49	31	30	33
Fatehabad	50	49	51	54	51	56	32	33	31
Gurgaon	47	45	50	52	48	56	36	42	30
Hisar	41	39	43	45	43	48	27	24	31
Jhajjar	42	39	44	44	41	48	33	31	35
Jind	48	46	50	51	49	54	34	32	36
Kaithal	48	43	54	51	46	57	40	42	36
Karnal	39	38	41	42	40	45	28	27	30
Kurukshetra	44	45	42	47	46	49	23	25	21
Mahendergarh	45	42	48	47	45	51	30	26	33
Panchkula	34	32	36	36	33	40	30	28	32
Panipat	45	41	50	49	44	55	37	38	36
Rewari	42	43	41	44	44	43	32	34	31
Rohtak	38	36	41	43	40	47	29	27	31
Sirsa	41	40	43	45	44	47	40	38	43
Sonipat	35	38	30	36	39	33	27	26	28
Yamunanagar	35	32	39	45	37	52	28	27	30
HARYANA	40	41	39	45	43	47	30	29	31
Range	**32-50**	**32-49**	**30-54**	**36-54**	**33-51**	**33-57**	**23-40**	**20-42**	**21-43**
Std. Dev.	**5.11**	**4.67**	**6.40**	**5.06**	**4.31**	**6.64**	**4.97**	**6.22**	**4.77**

Source: Rajan, Nair, Sheela, Jagatdeb, & Mishra (2008)

Table 2. Child Mortality Rate (CMR) in Districts of Haryana

Group /District	Total(Rural+Urban)			Rural			Urban		
	T	M	F	T	M	F	T	M	F
Ambala	29	26	32	31	28	35	24	21	28
Bhiwani	48	48	50	51	51	54	36	35	38
Faridabad	43	41	45	54	50	57	34	33	35
Fatehabad	53	51	55	57	54	60	33	34	32
Gurgaon	52	52	59	57	57	63	29	29	31
Hisar	45	42	49	51	51	56	29	29	33
Jhajjar	45	45	48	48	48	53	35	35	38
Jind	54	46	58	59	54	64	37	34	41
Kaithal	50	46	54	54	49	59	52	48	37
Karnal	41	39	44	45	42	49	31	30	34
Kurukshetra	35	36	35	40	40	40	24	26	22
Mahendergarh	54	52	56	57	55	59	37	35	39
Panchkula	35	33	37	38	34	42	31	30	33
Panipat	43	42	44	48	44	52	29	27	32
Rewari	47	47	47	50	50	50	33	33	33
Rohtak	43	41	44	47	47	52	30	30	32
Sirsa	43	42	45	47	45	49	31	29	34
Sonipat	43	40	46	48	44	52	29	27	32
Yamuna nagar	36	35	38	41	38	45	29	28	31
HARYANA	44	44	42	49	46	53	31	30	33
Range	**29-54**	**26-52**	**32-59**	**31-59**	**28-57**	**35-64**	**24-52**	**21-48**	**22-41**
Std. Dev.	**6.78**	**6.57**	**7.52**	**7.12**	**7.31**	**7.52**	**5.9**	**5.35**	**4.15**

Source: Rajan et. al.(2008)

Child Mortality Rate [CMR]. District level secondary data was only available on IMR and CMR ; hence, I could include these two indicators only. There exist wide inter-district disparities in health in Haryana. The inter-district health disparities can be measured by three dimensions of health, that is, *Health Outcome Indicators, Morbidity Indicator, and Health Infrastructure Indicators*.

(1) Disparities in Mortality Indicators : The data presented in the Table 1 shows that Fatehabad (50) tops the list of districts with higher IMR followed by Kaithal (48) and Jind (48) ; whereas, Ambala (32) has least IMR followed by Panchkula (34) and Yamunanagar (35). Kaithal (54) has highest female IMR and Sonipat (30) has least. Another important indicator of health outcome is Child Mortality Rate(CMR). The data presented in the Table 2 shows that Jind (54), Mahendergarh (54), and Fatehabad (53) have higher CMR among districts of Haryana ; whereas, Ambala (29), Kurukshetra (35), and Panchkula (35) have low CMR.

(2)Disparities in Morbidity Cases : The inter-district differences in morbidity are presented in the Table 3. The data reveals that diarrhoeal diseases (Cholera/gastroenteritis) have highest incidence in Kurukshetra (4906) followed by Kaithal (722), Panipat(675), Mewat (643), and Bhiwani (625) ; whereas, Rohtak has only four indoor patients due to the disease. Other districts with low incidence of diarrhoeal disease are Gurgaon (53), Rewari (70), and Palwal (71). Rewari (719) has the highest number of Malaria and Typhoid cases followed by Kaithal (516)

Table 3. District Wise Distribution of Indoor Patient of Diarrhoeal Diseases

	Tuberculosis	Malaria and Typhoid	Diarrhoeal diseases (Cholera/gastroenteritis)	Total(including other diseases)
Ambala	339	110	404	855
Bhiwani	77	303	625	1015
Faridabad	171	357	500	1028
Fatehabad	83	185	283	551
Gurgaon	75	25	53	153
Hisar	438	259	426	1123
Jhajjar	87	59	231	384
Jind	204	191	300	695
Kaithal	2265	516	722	3527
Karnal	16	78	96	190
Kurukshetra	292	237	4906	5440
Mahendragarh	28	144	406	578
Mewat	93	167	643	903
Palwal	10	242	71	327
Panchkula	192	134	246	572
Panipat	90	197	675	962
Rewari	210	719	70	1000
Rohtak	34	104	05	143
Sirsa	255	129	322	707
Sonipat	73	47	152	272
Yamunanagar	30	65	205	307
HARYANA	**5062**	**4268**	**11341**	**20732**

Source: Statistical Abstract of Haryana 2013-14.

and Faridabad (357) ; whereas, Gurgaon has only 25 cases of Malaria and Typhoid. In case of Tuberculosis, Kaithal (2265) has the highest number of cases, followed by Hisar (438) and Ambala (339) ; whereas, Palwal has only 10 indoor cases of Tuberculosis and Karnal has 16 cases. Overall, Kurukshetra and Kaithal have higher incidences of these select diseases and Rohtak has least.

(3) Disparities in Health Infrastructure and Access to Health Facilities : Disparities in health infrastructure among districts of Haryana are appended in the Table 4. The column-3 of the Table shows number of medical institutions in the districts. Bhiwani (283) has the highest number of institutes followed by Hisar (265), Sonipat (212), and Jind (203) ; whereas, the lowest number of institutes are in Panchkula (77) followed by Gurgaon (98), and Palwal (98). The number of institutes gives us a rough idea of health infrastructure available in various districts of Haryana. But to remove the effect of population size, number of institutions per lakh of population can be a better approximation of health infrastructure. Figures in column 4 indicate that Bhiwani (17) has highest number of institutions per lakh of population preceded by Kaithal, Jhajhhar, and Rewari (15 each) ; whereas, Faridabad (06), Gurgaon (09), and Palwal (10) have the lowest number of institutions per lakh of population.

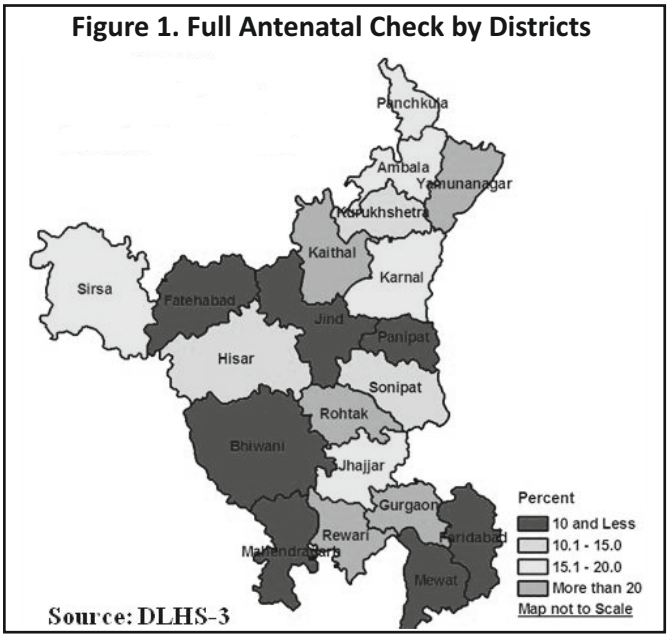
Number of beds per lakh of population is another indicator of health infrastructure in districts. Rohtak (159) has the highest number of beds per lakh of population ; whereas, Mewat (16) has the least number of beds. The other districts ranked higher on this parameter are Bhiwani (59), Panchkula (55), and Hisar (45) ; whereas, districts ranked lower are Gurgaon (20), Palwal (21), and Panipat (26). As far as disparities in human health resources are concerned (Col.8&9), Bhiwani (1229), Mahendergarh (1032), and Hisar (984) enjoy more staff as

Table 4. Select Indicators of Health Infrastructure

Sl. No.	District	Total Institution	Institutions per lakh of population	Indor Patient Treated	Bed per lakh	Medical Officers	Total Medical Staff
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Ambala	132	11	44240	47	64	770
2	Bhiwani	283	17	59060	59	145	1229
3	Faridabad	101	6	60166	33	42	374
4	Fatehabad	132	14	34738	28	78	485
5	Gurgaon	98	9	43077	20	69	583
6	Hisar	265	14	47277	45	121	984
7	Jhajjar	157	15	24756	35	72	761
8	Jind	203	14	32084	37	46	897
9	Kaithal	174	15	26718	28	53	445
10	Karnal	185	12	47514	31	95	715
11	Kurukshetra	137	14	31418	32	58	506
12	Mahendragarh	135	14	32490	35	56	1032
13	Mewat	105	11	25152	16	48	449
14	Palwal	98	10	21158	21	...	...
15	Panchkula	77	14	39045	55	138	664
16	Panipat	116	10	25277	26	62	383
17	Rewari	135	15	26428	38	32	84
18	Rohtak	160	14	116965	159	80	642
19	Sirsa	188	14	32497	28	83	527
20	Sonipat	212	14	31607	27	101	745
21	Yamunanagar	147	13	40481	35	95	662
	HARYANA	**3240**	**13**	**842148**	**40**	**1538**	**12937**

Source: Compiled from Statistical Abstract of Haryana

Figure 1. Full Antenatal Check by Districts



compared to Rewari (104), Faridabad(374), and Panipat(383).

DLHS-3's (International Institute for Population Sciences, 2010) [1] report pertaining to Haryana shows access to health facilities and their utilization. The spatial distribution of health facilities based on the report are depicted in the Figures 1,2 and 3. Maternal health care is an important component of health. One of the goals of population and reproductive health policy is to ensure safe motherhood and reduce reproductive health system related morbidity and mortality. Data related to access of health facilities for child and maternal health care are presented in the Table 5.

The column 3 of the Table 5 shows that 55.0% of the pregnant women went for antenatal check up in the first trimester of pregnancy. The Figure ranges from 17.4% in Mewat to 72.5% in Yamunanagar. Districts of Mewat, Faridabad (45.5%), Bhiwani (48.9%), Fatehabad (51.2%), and Jhajjar (54.5%) have lower average than Haryana as a whole. Yamunanagar, Sonipat (69.6%), Rewari (68.4%), and Panchkula (68.2%) performed better on this indicator.

Table 5. Access to Health Facilities (In %)

Sl. No.	District	Antenatal check in the first trimester	Full Antenatal Check up	Institutional Delivery	Safe Delivery	Delivery at Home	Full Immunization	Female Sterilization
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Ambala	59.5	17.4	55.4	62.9	43.7	79.1	36.7
2	Bhiwani	48.9	8.9	35.7	44.8	64.6	58.4	52.4
3	Faridabad	45.5	9.3	39.1	42.7	60.6	46.4	28.2
4	Fatehabad	51.2	9.5	48.6	58.1	51.1	62.8	46.3
5	Gurgaon	56.1	27.5	52.3	56.8	47.5	70.5	37.7
6	Hisar	56.0	10.4	48.6	54.5	50.7	55.8	50.6
7	Jhajjar	54.5	16.2	48.0	57.9	51.6	64.8	41.5
8	Jind	58.0	9.7	42.1	48.3	56.9	55.4	45.1
9	Kaithal	65.3	21.1	48.0	57.4	52.0	72.5	38.3
10	Karnal	61.9	16.6	51.3	57.1	47.8	75.2	33.2
11	Kurukshetra	65.9	11.8	64.2	67.8	35.5	67.8	33.0
12	Mahendragarh	55.0	9.1	56.8	65.1	43.1	67.7	53.1
13	Mewat	17.4	1.9	14.8	16.3	84.5	11.0	12.7
14	Panchkula	68.2	19.1	64.3	67.8	35.4	78.1	29.8
15	Panipat	65.3	6.2	39.0	48.4	60.4	57.0	29.5
16	Rewari	68.4	20.6	65.0	73.5	35.1	67.3	49.4
17	Rohtak	66.7	27.5	52.8	58.9	46.4	75.7	37.0
18	Sirsa	58.1	17.8	53.5	69.5	46.4	61.3	45.3
19	Sonipat	69.6	14.9	53.7	61	45.4	73.0	33.3
20	Yamunanagar	72.5	20.8	52.3	58.4	47.5	70.0	33.6
	HARYANA	**55.0**	**13.2**	**46.8**	**53.2**	**52.7**	**59.6**	**38.5**
	Range	**17.4-72.5**	**1.9-27.5**	**14.8-65.0**	**16.3-73.5**	**35.1-84.5**	**11.0-79.1**	**12.7-53.1**
	Std. Dev.	**11.8**	**6.87**	**11.19**	**12.15**	**11.14**	**14.7**	**9.68**

Source: Compiled from DLHS-3

[1] The survey was funded by the Union Ministry of Health and Family Welfare, United Nations Population Fund (UNFPA), and United Nations Children's Fund (UNICEF). This is the third round of the district level household survey which was conducted during December 2007 to December 2008.

Figure 2. District Wise Distribution by Full Immunization Coverage of Children Aged 12-13 Months

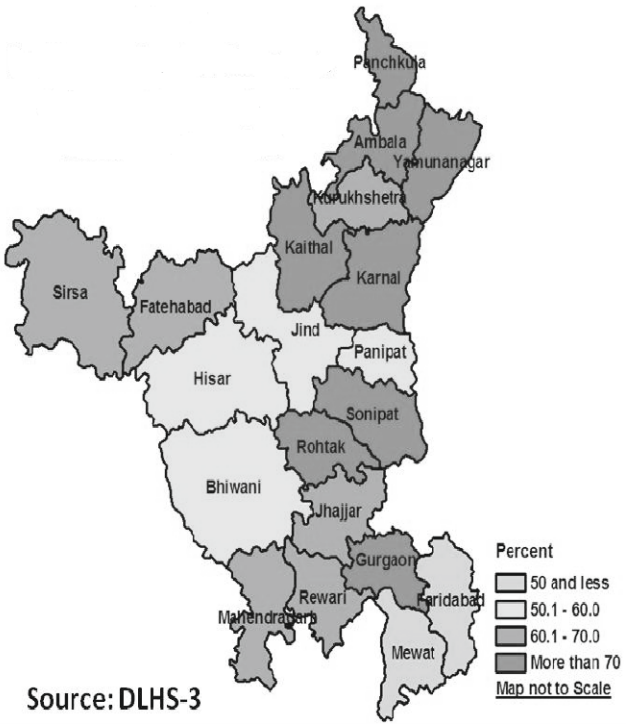
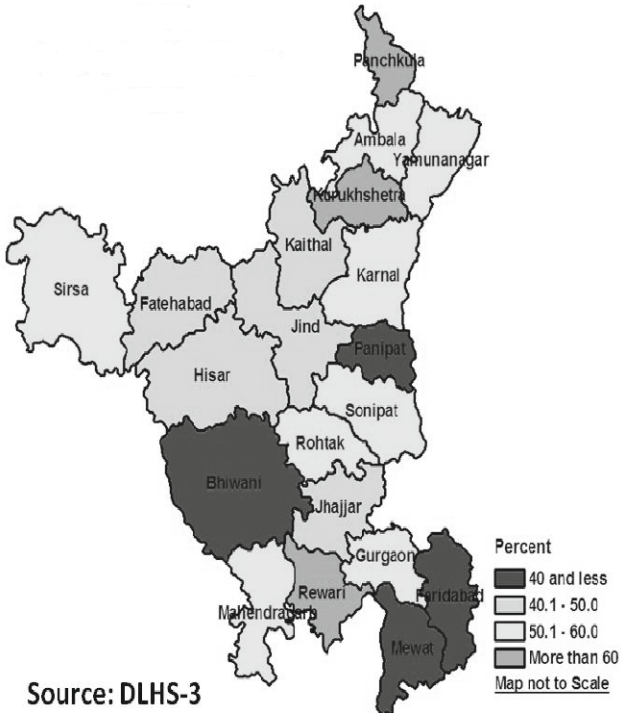


Figure 3. Institutional Delivery by Districts



DLHS's survey revealed that among the women who had their last live/still birth in the three years period preceding the survey, 87.2% received at least one antenatal check up ; 45.7% from a government health facility, 45.8% from a private health facility, and 3.8% from community-based services. All check-ups and examinations recommended for Antenatal Care(ANC) [2] were not availed by women during pregnancy. Full ANC coverage shows significant inter-district disparities as shown in the Figure 1 and column-4 of Table-5. Full ANC was availed only by 1.9% pregnant women in Mewat, 6.2% in Panipat, 8.9% in Bhiwani, and 9.1% in Mahendergarh. Rohtak and Gurgaon top the list on this indicator, where 27.5% pregnant women availed full ANC followed by Kaithal (21.1 %) and Yamunanagar (20.8%).

Child healthcare and immunization is an important aspect of health facilities. The coverage of full immunization was decreased from DLHS-1 to DLHS-2 (66% to 59 %) and increased only by 1% point in DLHS-3. Full immunization [3] coverage differs significantly across districts as depicted in the Figure 2 and column-8 of Table 5. The coverage of full immunization of children was below 50% in two districts of Haryana - Mewat (11%) and Faridabad (46.4%), and it was more than 70% in Yamunanagar (70%), Gurgaon (70.5 %), Kaithal (72.5%), Sonipat (73%), Karnal (75.2%), Rohtak (75.7%), Panchkula (78.1%), and Ambala (79.1 %).

Column 5 and 6 of the Table 5 show maternal and child care provided at the time of birth in terms of institutional deliveries and safe deliveries. The percentage of institutional delivery ranged from 14.8% in Mewat to 65% in Rewari as presented in the Figure 3. It was higher in the districts of Rewari, Panchkula (64.3%), Kurukshetra (64.2%), and Mahendragarh (65.1%), and lower in the districts of Mewat, Bhiwani (35.7%), Panipat (39%), and Faridabad (39.1%). Percentage of safe delivery was 73.5% in Rewari and 16.3% in Mewat districts,

[2], [3] Full ANC consists of at least three visits for antenatal check-up, at least one TT injection received, and 100+ IFA tablets/ syrup consumed.

Table 6. Comparative View of District Wise Performance on Health Parameters

Sl. No.	Districts	IMR	CMR	IPL	BLP	ANC in the first trimester	Full a.n. check	Institutional Delivery	Full Immunisation
1	Ambala	A.Ag	A.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag
2	Bhiwani	B.Ag	B.Ag	A.Ag	A.Ag	A.Ag	B.Ag	B.Ag	B.Ag
3	Faridabad	A.Ag	A.Ag	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag
4	Fatehabad	B.Ag	B.Ag	A.Ag	B.Ag	B.Ag	B.Ag	A.Ag	A.Ag
5	Gurgaon	B.Ag	B.Ag	B.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag
6	Hisar	B.Ag	B.Ag	A.Ag	A.Ag	A.Ag	B.Ag	A.Ag	B.Ag
7	Jhajjar	B.Ag	B.Ag	A.Ag	B.Ag	B.Ag	B.Ag	A.Ag	A.Ag
8	Jind	B.Ag	B.Ag	A.Ag	B.Ag	A.Ag	A.Ag	B.Ag	B.Ag
9	Kaithal	B.Ag	B.Ag	A.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag
10	Karnal	A.Ag	A.Ag	B.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag
11	Kurukshetra	B.Ag	A.Ag	A.Ag	B.Ag	A.Ag	B.Ag	A.Ag	A.Ag
12	Mahendergarh	B.Ag	B.Ag	A.Ag	B.Ag	A.Ag	B.Ag	A.Ag	A.Ag
13	Mewat	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag
14	Palwal	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag	B.Ag	A.Ag	A.Ag
15	Panchkula	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag
16	Panipat	B.Ag	A.Ag	B.Ag	B.Ag	A.Ag	B.Ag	B.Ag	B.Ag
17	Rewari	B.Ag	B.Ag	A.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag
18	Rohtak	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag	A.Ag
19	Sirsa	B.Ag	A.Ag	A.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag
20	Sonipat	A.Ag	A.Ag	A.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag
21	Yamunanagar	A.Ag	A.Ag	B.Ag	B.Ag	A.Ag	A.Ag	A.Ag	A.Ag

Source: Based on data presented in Table-1 to Table-5.

Note: 1. A. Ag- Performance Better than State Average for the Indicator.
2. B. Avg - Performance Worse than State Average for the Indicator.
3. IPL - Health Institutions per lakh of population
4. BLP - Beds per lakh of population

Table 7. Classification of Districts

S. No	Rank	Criteria	Districts
01	Low	Above Average Scores on less than 03 indicators	Mewat, Palwal, Faridabad, Bhiwani, Fatehabad, Jhajjar, Jind, and Panipat.
02	Medium	Above Average Scores x Hisar, Kaithal, and Mahendragarh.	Kurukshetra, Rewari, Gurgaon, Hisar, Kaithal, and Mahendragarh.
03	High	Above Average Scores on more than 05 indicators	Panchkula, Rohtak, Sonipat, Sirsa, Yamunanagar, Ambala, Karnal.

Source: Based on Table-6.

and in Sonipat, Ambala, Mahendragarh, Kurukshetra, Panchkula, and Sirsa, it ranged from 61% to 69.5%. In Hisar, Gurgaon, Karnal, Kaithal, Jhajjar, Fatehabad, Yamunanagar, and Rohtak districts of Haryana, safe delivery was more than 50%. As per DLHS-3, 52.7 % of the deliveries in Haryana were performed at home. Mewat performed poor with 84.5% of the deliveries taking place at home, followed by Bhiwani (64.6%), Faridabad

Table 8. Total Variance Explained

Components	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.84	38.41	38.41	3.30	32.99	32.99
2	2.07	20.68	59.08	2.29	22.94	55.93
3	1.87	18.71	77.79	2.19	21.86	77.79
4	.943	9.44	87.22			
5	.569	5.69	92.91			
6	.348	3.48	96.39			
7	.187	1.88	98.26			
8	.122	1.22	99.48			
9	.041	0.41	99.88			
10	.012	0.12	100.00			

(60.6%), Panipat (60.4%), and Jind (56.9%). Rewari has the least number of deliveries at home (35.1%) followed by Panchkula (35.4 %), Kurukshetra (35.5%), and Mahendergarh (43.1%). Desai and Wu (2010) in their study of maternal health care disparities also found significant regional variations across the states of India.

A cursory look at the Table 6 reveals that Panchkula and Rohtak scored above average on all the indicators ; whereas, Mewat scored below average on all the indicators. Based on the Table, we can ascertain that the health status was comparatively low in Mewat, Palwal, Faridabad, Bhiwani, Fatehabad, Jhajjar, Jind, and Panipat ; whereas, it was comparatively high in Panchkula, Rohtak, Sonipat, Sirsa, Yamunanagar, Ambala, and Karnal.

The classification of districts based on the criteria given in the Table 6 and Table 7 gives us only a rough approximation as it suffers from many limitations. It gives equal weight to all the parameters and ignores the actual value and distance from average value. Hence, the paper used more sophisticated technique of principal component analysis (PCA). The results of PCA analysis are presented and discussed in subsequent paragraphs.

The method of principal component is a special case of the more general method of factor analysis. The aim of the method of principal component analysis is the construction of a set of variables P_i, called principal component ($I = 1,2,\ldots\ldots k$) out of a set of variables, $1,2,3\ldots\ldots k$). Each principal component is a linear combination of the X's;

$$P_1 = a_{11}x_1 + a_{12}x_2 + \ldots\ldots\ldots\ldots + a_{1k}x_k$$
$$P_2 = a_{21}x_1 + a_{22}x_2 + \ldots\ldots\ldots\ldots + a_{2k}x_k \ldots$$
$$\ldots$$
$$P_k = a_{k1}x_1 + a_{k2}x_2 + \ldots\ldots\ldots\ldots + a_{kk}x_k$$

The method of principal component can be applied by using the original values of the X_j 's or the standardized variables Z_j defined by :

$$Z_j = (X_j - X) / \sigma x_j$$

The coefficients *aij*'s are called loading of the principal component which are so chosen that the newly created variables, called principal components, satisfy the following two conditions : (a) Principal components are orthogonal (uncorrelated), (b) the first principal component has a larger variance as possible. The second principal component is then chosen in such a way that it absorbs the maximum of the remaining variations in X's after allowing for the variation accounted by the first principal component and so on. In this procedure, the data matrix is transformed into a new set of uncorrelated principal components which accounts as much of the

Table 9. Rotated Component Matrix

	Extraction Method: Principal Component Analysis Rotation Method: Varimax with Kaiser Normalization.			
	Component			Communality
	1	2	3	
Percentage of Safe Delivery	0.973	--	--	0.924
Percentage Full Immunization	0.966	--	--	0.905
Percentage Institutional Delivery	0.905	--	--	0.813
Infant Mortality Rate	-0.679	--	--	0.739
Number of Indoor Patients Treated	--	0.934	--	0.905
Beds per Lakh of Population	--	0.859	--	0.813
Institutions per lakh of Population	--	--	0.776	0.671
Number of Doctors	--	--	0.722	0.657
Total Medical Staff	--	--	0.720	0.621
Area Covered per Institute in Sq Km	--	--	0.691	0.630
Variance Explained	32.99	22.94	21.86	

Note: 1. Rotation converged in 5 iterations.
2. Factor Loadings < 0.5 are omitted.

variation as possible in descending order. The analysis was performed with a view to construct a composite index of health for the districts of Haryana.

The principal component analysis was conducted using SPSS 19.0 with varimax rotation including 10 variables namely (a) Percentage of children having full immunization, (b) Percentage of institutional delivery, (c) Percentage of safe delivery, (d) Beds per lakh of population, (e) Child mortality rate, (f) Infant mortality rate, (g) Area covered per institute in sq km, (h) Institutions per lakh of population, (i) Number of doctors, and (j) Total medical staff. As explained in the methodology, three components have been extracted and they explained 77.8% of the total variance. The eigen values and cumulative variance are presented in the Table 8.

The plotting of the component score in Figure 4 reveals considerable inter-district variations. The Table 9 presents the loadings of each of the three components on the selected variables in the original data sets. It is observed that the first factor has high positive correlation with percentage of children having full immunization, percentage of institutional delivery, percentage of safe delivery, and infant mortality rate. All these indicators represent uses of health facilities, hence the factor can be named as Access to Health Infrastructure. This factor explains 33.0 % of the variance. The second factor is highly correlated with number of indoor patients treated and beds per lakh of population. This component thus relates to Incidence of Health Indicators. The second factor explains 25.56 % of the variance. The third factor is highly correlated with area covered per institute in sq km, number of doctors available, strength of medical staff in the district, and institutions per lakh of population. These indicators can be renamed as a factor - Health Infrastructure Indicator.

The Table 10 depicts scores of each component with overall scores for the 21 observations. The scores of individual components indicate the direction and extent to which an observation is associated with the respective components. In some cases, the scores work out to be positive, while in the remaining others, they are negative. A high and positive score indicates that a particular district is more developed than others with lower scores. The data presented in the Table 10 reveals that on the first component representing 'uses of and access to the health facilities,' the highest score is attained by Rewari (1.325) followed by Panchkula (1.226), Kurukshetra (0.924), and Ambala (0.885) ; while, the lowest score is of Mewat (-3.283) followed Bhiwani (-1.098), Faridabad

Figure 4. Plotting of Component Scores

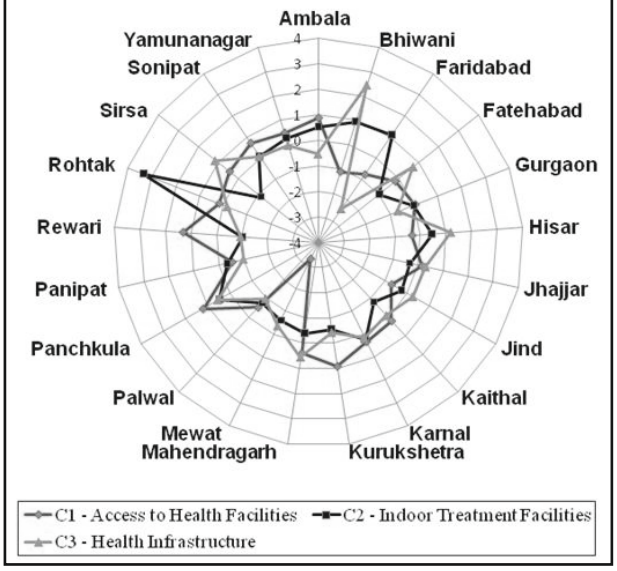


Table 10. Component Score

District	Component Score			Composite Score
	C1	C2	C3	
Ambala	0.885 (4)	0.539 (4)	-0.533 (16)	0.384 (4)
Bhiwani	-1.098 (20)	0.961 (3)	2.467 (1)	0.511 (3)
Faridabad	-0.780 (19)	1.088 (2)	-2.405 (21)	-0.687 (19)
Fatehabad	-0.156 (14)	-0.962 (19)	0.763 (4)	-0.135 (14)
Gurgaon	0.068 (13)	-0.233 (10)	-0.644 (17)	-0.221 (16)
Hisar	-0.323 (15)	0.452 (6)	1.213 (2)	0.338 (6)
Jhajjar	0.153 (12)	-0.336 (13)	0.310 (7)	0.053(12)
Jind	-0.696 (18)	-0.249 (11)	0.273 (8)	-0.292 (17)
Kaithal	0.209 (10)	-0.823 (18)	-0.069 (12)	-0.173 (15)
Karnal	0.331 (9)	0.217 (8)	0.186 (9)	0.256 (8)
Kurukshetra	0.924 (3)	-0.582 (15)	-0.416 (15)	0.104 (11)
Mahendragarh	0.399 (8)	-0.416 (14)	0.568 (5)	0.207 (9)
Mewat	-3.283 (21)	-0.608 (16)	-0.349 (14)	-1.670 (21)
Palwal	-0.515 (16)	-0.783 (17)	-0.980 (19)	-0.725 (20)
Panchkula	1.226 (2)	0.475 (5)	0.535 (6)	0.810 (2)
Panipat	-0.531 (17)	-0.330 (12)	-1.004 (20)	-0.605 (18)
Rewari	1.325 (1)	-1.014 (20)	-0.965 (18)	-0.008 (13)
Rohtak	0.183 (11)	3.363 (1)	-0.181 (13)	1.017 (1)
Sirsa	0.456 (7)	-1.129 (21)	1.153 (3)	0.186 (10)
Sonipat	0.719 (5)	0.097 (9)	0.087 (10)	0.358 (5)
Yamunanagar	0.503 (6)	0.271 (7)	-0.010 (11)	0.290 (7)

Note: 1. Figures in parenthesis are their respective rank.

2. The three intermediate composites (*C1, C2,* and *C3*) are aggregated by assigning a weight to each one of them equal to the proportion of the explained variance in the data set. That is 0.424 for *C1*[3.3/(3.3+2.29+2.19], 0.294 for *C2* [2.29/ (3.3+2.29+2.19] and 0.281 for *C3*[[2.19/(3.3+2.29+2.19], refer OECD (2008) for methodology.

Table 11. Classification of Districts According to Composite Score

Category	No. of Districts	Name of Districts (in order of decreasing score)
Very High (above 0.5)	03	Rohtak, Panchkula, and Bhiwani
High (0.25 to 0.50)	05	Ambala, Sonipat, Hisar, Yamunanagar, and Karnal
Medium (0.0 to 0.25)	04	Mahendragarh, Sirsa, Kurukshetra, and Jhajjar
Low (-0.5 to 0.0)	05	Rewari, Fatehabad, Kaithal, Gurgaon, and Jind
Very Low (Below -0.5)	04	Panipat, Faridabad, Palwal, and Mewat

Source: Compiled from Table-10

(-0.780), Jind (-0.696), and Panipat (-0.36). On the second component representing morbidity related aspects of health, Rohtak, Faridabad, Bhiwani, and Ambala scored higher as these districts have higher number of treatment facilities available in these districts ; whereas, Sirsa, Rewari, Fatehabad, Kaithal, and Palwal scored lower in this parameter. Regarding the third component representing health infrastructure facilities, Bhiwani (2.467) scored highest and Faridabad (-2.405) scored lowest. Along with Bhiwani, Sirsa, Hisar, and Fatehabad (0.763) performed better on this component, whereas Panipat, Palwal, and Rewari performed lower in this component. Component scores are plotted and presented in the Figure 4, which reveals significant differences in the scores obtained by the districts on three factors.

The composite health indicator using factor analysis is constructed and presented in the Table 10. The last column of the table depicts that Rohtak stands first, Panchkula second, and Bhiwani third on Composite Health Indicator ; whereas, Mewat ranked last followed by Palwal, Faridabad, and Panipat. Classification of districts based on the composite health indicator are presented in the Table 11. On the basis of overall score, the districts are regionalized in five categories listed in the Table 11.

To the best of my knowledge, no such study at the district level has been conducted in Haryana, though studies have compared health status across states of India and inter-state comparisons have also been made. Minnery, Soto, Firth, Nguyen, and Hodge (2013) using pooled data for two new states - Jharkhand and Chhattisgarh undertook both direct and indirect estimations and evaluated inter-population disparities, mortality data stratification of rural - urban location, ethnicity, health, and districts. They found wide inter-district disparities in health and concluded that these disparities may in part be associated with geographical access, traditional practices, and district-level health resource allocation. Islam(2013) also found that awareness and cultural factors played an important role in access to health facilities in Bangladesh. The present paper also reached similar conclusions based on analysis of inter-district disparities in Haryana. The findings of the present study support the findings of Agnihotri (2012), indicating significant regional variations in access to health services in India.

Summary and Policy Implications

In this paper, an attempt has been made to assess the extent of inter district disparities in Haryana in terms of health indicators. The health status was measured by various indicators covering three aspects of health, that is, health outcome indicators, health infrastructure indicators, and access to and uses of health facilities. The paper found wide inter-district disparities in various health indicators. For example, the highest rate of IMR found is 56.2% more than the lowest IMR, and in case of urban female IMR, it was more than 104%. In case of full antenatal check up, the percentage coverage ranged from 1.9% to 27.5%. The range and standard deviation of various health indicators clearly shows wide dispersion in health indicators. The composite score by PCA showed similarities based on the geographical location of the districts.

The extraction of factor scores and their district-wise ranking revealed some interesting results. Some of the

districts scored very low on health infrastructure and scored very high on access to and uses of health facilities. For example, Rewari ranked first in access to and uses of health facilities and ranked 18th on the public health infrastructure indicator. Same is the case with Kurukshetra and Ambala. This indicates that either the residents of these districts are making better use of available public health facilities, or they are availing private healthcare facilities. Again, I found that some districts scoring high on health infrastructure performed poorly on uses of health facilities. For example, Bhiwani scored highest on availability of health infrastructure, but ranked last but one on access to and uses of health facilities. Same is the case with Hisar, scoring high on public health infrastructure indicator and poor on uses of public health facilities. This indicates that the public, at large, was not availing the available public health care infrastructure. The reason could either be the attitude of public health staff or cultural factors. Hence, we can safely conclude that merely having public infrastructure in place does not ensure proper maternal and child health care; the emphasis should be on its proper, efficient, and moreover, compassionate use. The lack of general health awareness may be an obstacle in using the facilities ; in particular, maternal health care and reproductive & child health care facilities. The results drawn from this study can help policy makers to target health resource allocation more effectively. The analysis also provides information on impact of state initiatives.

Limitations of the Study and Scope for Further Research

The study used only CMR and IMR for analyzing health status at the district level due to limitations of availability of data. Life expectancy and health-adjusted life expectancy [HALE] and neo-natal mortality rate [NMR] as an indicator of health status could not be used due to non-availability of data. Secondly, there is a considerable time gap between data collected and reported at the district level. Thirdly, the access and availability of health infrastructure could have been better understood by incorporating public attitude towards public health services and difficulties faced by them in accessing these facilities. In view of the limitations of the study, further research can be carried out to analyze attitudinal differences towards health facilities across regions of the state. Furthermore, as indicated by the findings, cultural and social taboos towards maternal and reproductive & child health care should be explored for explaining inter-district differences.

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