Child Health Among Himalayan States of India

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Contents:

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Abstract

This study is based on the factor analysis approach. By initiating factor exploratory approach of five Himalayan states Jammu and Kashmir (JK), Uttarakhand (UK), Himachal Pradesh (HP), Assam (AS) and Arunachal Pradesh (AP). The data of the five states has been extracted from the National Family Health Survey (NFHS-4) 2015-2016 Survey. Those variables which are directly related with health of children in the age group 2 months to 36 month and that of pregnant women between the ages fifteen and forty-nine years are selected. Two imperative tests, KMO and Bartlett's Test, are performed to check the sample adequacy and correlation among variables, and then with the help Factor Analysis, factor loading on each variable is calculated. The entire study is divided into two parts; the first one analyses child health after birth, and the second one is concerned with the preborn stage. We found that JK and AP have the highest nutrition rate and children's physical growth (mean height to age as category 1) whereas UK and AS have a high significance in pre-born checkups among pregnant women and better delivery conditions.

.**Key Words:** Nutrition, Child growth, Child care, preborn checkups, Delivery condition and Vaccinations.

JEL: C87, C82, L1, Y10, O10

Introduction

Inequalities exist in many areas and can be measured using various indicators. Until recently, development goals and agendas have lacked a systematic focus on the reduction of within-country inequality. The MDGs adopted in the year 2000 called for improvement in national averages but did not address how the goals might address within-country inequality. In the absence of inequality monitoring, it remains unknown whether countries have narrowed or widened the gap between the advantaged and disadvantaged. The post-2015 sustainable development agenda, which was adopted by the United Nations summit in September 2015, cited equity as a central principle of the renewed development goals and targets. The health of the world's population is in a state of inequality. Infancy, childhood and women's childbearing years are widely recognised as critical junctures for lifelong health, and by extension, thriving and productive populations. Inequities associated with reproductive, maternal, newborn and child health interventions and outcomes warrant action. (World Health Organisation, 2015)

Talking of pregnancy, ultrasound scans have become an almost universal feature of pregnancy care in countries with developed health services. As part of a larger study of the evidence about the clinical and economic impact of pregnancy ultrasound, we carried out a systematic review of studies about women's views of ultrasound use in pregnancy. Because another recent review has explored the impact of ultrasound on psychological variables like anxiety or attachment to the baby, this topic is not addressed by the study reported here **(Jo Garcia MSc 2002).**

The infant mortality rate has frequently been used as a social indicator. For example, Sir Arthur News Holme in Britain wrote in 1910: "Infant Mortality is the most sensitive index we possess of social welfare and of sanitary administration, especially under urban conditions (Haines 2010)**.** In 1998, about 2.5 million under 5-year olds died in India, the highest total of any country. Child mortality trends, differentials, and determinants in India have been the subject of many studies. A study concluded that a substantial decline in infant mortality rate is possible even without significant economic development, even though the relative importance of determinants could not be assessed. It made a case for increased access to a minimum package of essential services that would significantly reduce high infant mortality rates: reproductive health services; perinatal care;

improved breastfeeding practices; immunization; home-based treatment of diarrhoea; and timely introduction of supplementary foods. (Claeson, et al., 2000)

Polio, yaws, guinea worm and maternal and neonatal tetanus have been eliminated in India. However, India has a high burden of communicable, including NTDs, maternal and neonatal conditions and a rising burden of NCDs, mental health and injuries. While the country recorded an impressive 70% reduction in maternal deaths and 66% reduction in deaths of children underfive years of age between 1990 and 2015, the maternal mortality ratio (MMR) of 167 and infant mortality rate (IMR) of 43 is still high. (World Health Organisation, 2018)

Undernutrition in young children is conventionally determined through measurement of height, weight, skin fold thickness (or subcutaneous fat) and age. The most common indices derived from these measurements are stunting (indicating chronic under nutrition, the result of prolonged food deprivation and/or disease or illness), wasting (indicating acute under nutrition from more recent food deprivation) and underweight (a composite indicator for both kinds of under nutrition). In 2002, UNICEF estimated that among children less than 5 years old in India, prevalence of stunting, underweight and wasting was 45%, 47% and 16% respectively. (Nandy, et al., 2005) Wide health inequality exists within and among states. For example, MMR in Kerala was 61 compared to 300 in Assam (2013), and girls in India have a higher prevalence of undernourishment than boys. (World Health Organisation, 2018) In India, during the mid-nineties the Union Government had initiated the Mid-Day Meal scheme in schools to promote primary education on one hand, and to reduce malnutrition on the other. However, Tamil Nadu had launched this program several decades before; during the regime of Mr. Kumarasami Kamraj (1954-1963) **(Palanisamy Navaneethan 2011).**

Diarrhoea is a major concern when it comes to child health. The clinical scientific discovery underlying the development of oral rehydration therapy occurred in the early 1960's with the discovery of the coupled sodium and glucose transport **(DM Kadam 2012).** Glucose given orally enhances the intestinal absorption of salt and water and is capable of correcting the electrolyte and water deficit. This process continues to function normally during secretory diarrhoea whereas the other pathways of intestinal absorption of sodium are impaired **(Park K 2005)**. A Study conducted in rural Maharashtra found that 90.7% of mothers were aware of Oral rehydration therapy but only 60% correctly practiced it (Singh HR 2003).

Economic growth underpins multisector progress, but it alone is not sufficient. The Success Factor econometric analysis by Bishai et al indicates gross domestic product (GDP) per capita accounted for only 12% of the reduction in child mortality in LMICs between 1990 and 2010. Further, the relationship between economic growth and health outcomes varies across countries. Many LMICs (e.g. India, Nigeria) experienced fast economic growth, but did not make commensurate progress on maternal and child health. Others (e.g. Bangladesh, China and Rwanda) made good progress while following diverse economic strategies.

Health sector investments accounted for around half the mortality reduction in children under five years between 1990 and 2010. High-impact interventions and system strengthening were important; e.g. for immunisation and other child health interventions, skilled birth attendance, and maternal and newborn care, and family planning. The remaining gains resulted from health enhancing investments in other sectors; e.g. from improved levels of education, women's political and socioeconomic participation and environmental management (e.g. access to clean water), reduced levels of fertility and poverty. Income inequalities within countries had a negative impact on child mortality.

Two factor identified as key enablers across the qualitative and quantitative findings in the Success Factors studies are good governance and women's political and socioeconomic participation. (Kuruvilla & al, 2014)

Data

The entire data is taken from National Family Health Survey (NFHS-4) of five Himalayan states which are Uttarakhand, Assam, Jammu Kashmir, Arunachal Pradesh and Himachal Pradesh which was conducted from 2015-2016 and collected households information on various aspect like crime, children health, population, HIV etc. We have chosen variables which are directly related to children's health, which include nutrition in children, their physical growth, caretaking practices with respect to them, diarrhoea (**as category 1**), and preborn checkups gotten by the mother before delivery, delivery conditions, and vaccinations for the infant (**as category 2**). Children from the age group one and thirty-five months are taken under consideration and women from the age group fifteen to forty-nine are taken under consideration.

Methodology

To understand better we have constructed one sample as an example for factor analysis. Table A, shows the matrix comprising of of (a,b,c) 1...5. Each variable comprises different variation on the factor A1. To observe their influence and analyse this, we have used factor analysis technique as follows:

A1	a	b	c
1	.1	.2	.3
2	.3	.4	.2
3	.6	.7	.8
4	.8	.9	.4
5	.1	.2	.4

First we have find out the N values by Σ columns a, b and c respectively, and add them to get the grand total (GT). We then compute N × GT for F1, which are called first factor loadings for each variable and their sum as Eigen value. The Eigen value helps us determine the number of factors (F1, F2.......Fn) to analyse factor relation within variables 1 to 5.
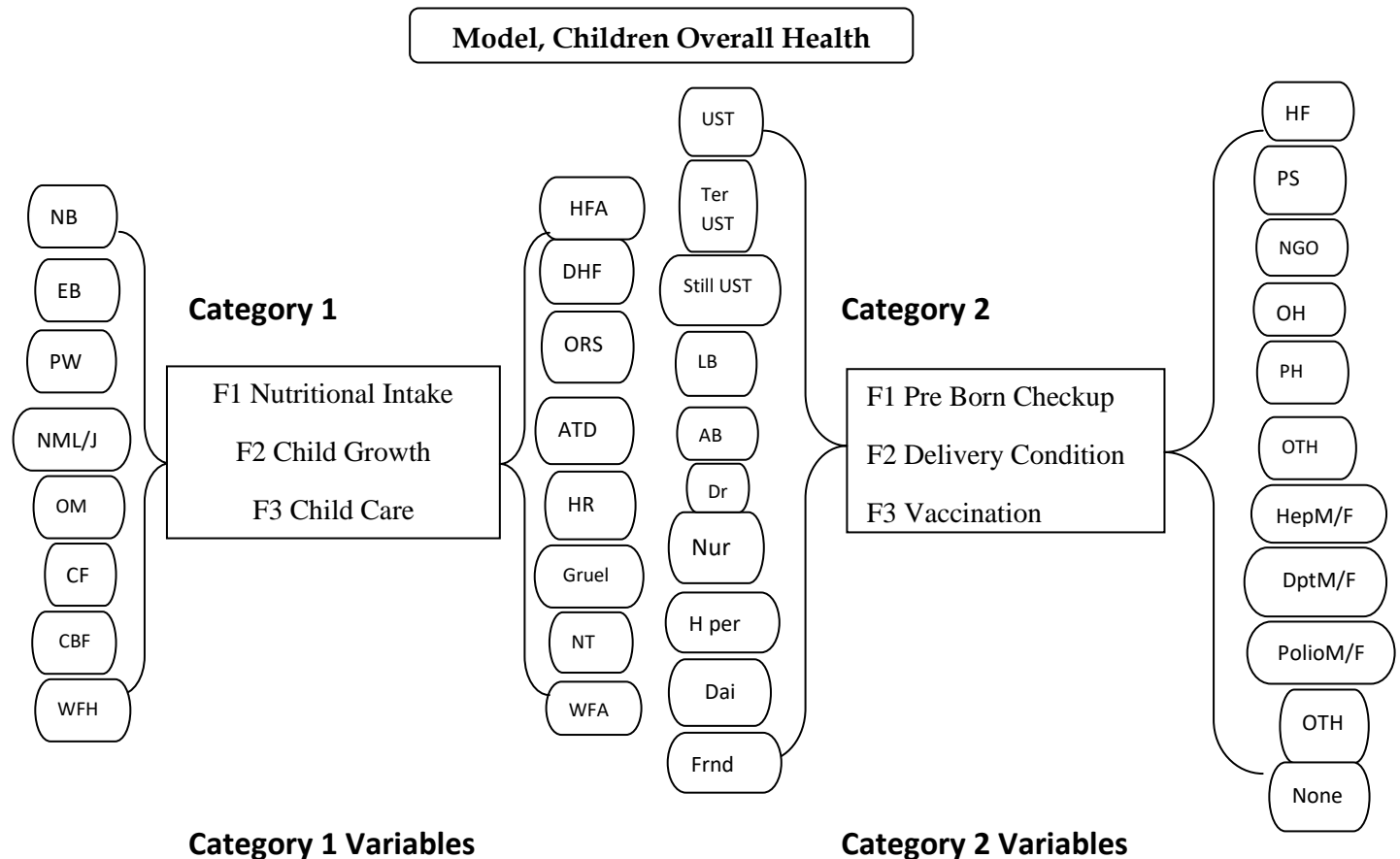
$$N = 1/\sqrt{GT}$$

Later in the study, we compare the overall variance between a, b, c by using score plots to observe each performance on the score chart.

The F1 value can only suggest variable relation up to a certain limit, therefore we calculate F2 value for which factor residual matrix is required. We multiply corresponding rows & columns to obtain the across product matrix (L_i) as $1 \times a \dots 1 \times c \ and \ 1 \times b \dots 1 \times c$ similarly. For each variable the summation of 1 to 5 is called L_{ij}. We subtract (a – L_{ij} values) which are second factor loadings F2. Similarly for the whole matrix, while calculating $L_{ij,}$ each value should remain positive. After obtaining factor loading it is important to select the number of factors. The selection process involves different methods. Scree plot method is used, which suggests factors considering more than one Eigen values. After selection of factors with the help of factor loading, its values are presented in chart form so to comparatively analyse

factor 1 and factor 2 performances. Therefore, later the cumulative impact of all the factors loading are presented state-wise so as to analyse each state's performance on the single chart for both the categories with the help of score plots chats.

Model Formation

Model, Children Overall Health

Category 1

F1 Nutritional Intake

F2 Child Growth

F3 Child Care

Category 2

F1 Pre Born Checkup

F2 Delivery Condition

F3 Vaccination

Category 1 Variables

(Nutrition status, Height, Weight, Age and child care while diarrhoea)

1. No Breastfeed (NB)
2. Exclusive Breastfeeding (EB)
3. Plain Water (PW)
4. No milk/ juice (NML/J)
5. Other milk (OM)
6. Complementary Food (CF)
7. Currently Feeding (CBF)
8. Height for age (HFA)
9. Weight for height (WFH)
10. Weight for age (WFA)
11. Child diarrhea (C Dia)
12. Health facility (DHF)
13. Taken ORS (ORS), Gruel
14. Given antibiotic drug (ATD)
15. Given home remedy (HR)
16. Given no treatment (NT)

Category 2 Variables

(Pre Born checkups, Delivery Condition and after Born Vaccination)

1. Ultra Sound Male / Female Child (UST)
2. Termination after Ultra sound (Ter UST)
3. Still Pregnant Ultrasounds   (Still UST)
4. Health Facility while delivery (HF)
5. Delivery in Public Hospitals (PS)
6. Delivery by NGO's (NGO)
7. Delivery in Private Hospitals (PH)
8. Delivery by Other health personals (OTH)
9. Delivery in own home (OH)
10. Delivery by Doctor present (DR)
11. Delivery by Nurse present (Nur)
12. Delivery by Dai (Dai)
13. Delivery by friend (Frnd)
14. Delivery by none (None)
15. Delivery by other (H per)
16. Hepatitis Male/ Female (Hep)
17. DPT Male/Female (Dpt)
18. Polio Male / Female (polio)

Results and Discussion

| KMO and Bartlett's Test		Category 1	Category 2
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.826	0.817
Bartlett's Test of Sphericity	Approx. Chi-Square	128.453	224.672
	df	10	10
	Sig P value.	0.000	0.000

- KMO and Bartlett's test check correlation and samples adequacy. As the results shows that p value is zero in both the category and KMO values are greater than .5 therefore both test satisfy basic guidelines for factor analysis.

  Null H_o: No Correlation Exists

  P value: Both Category = 0.000

  Hence: Strong Correlation among all variables

- **Scree Plot Outcome**

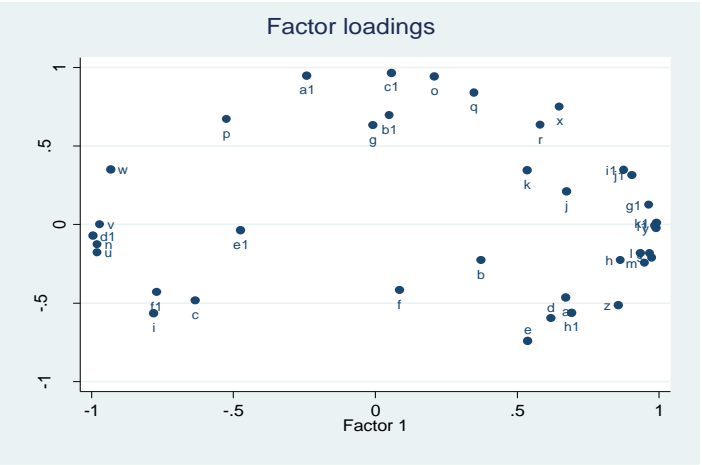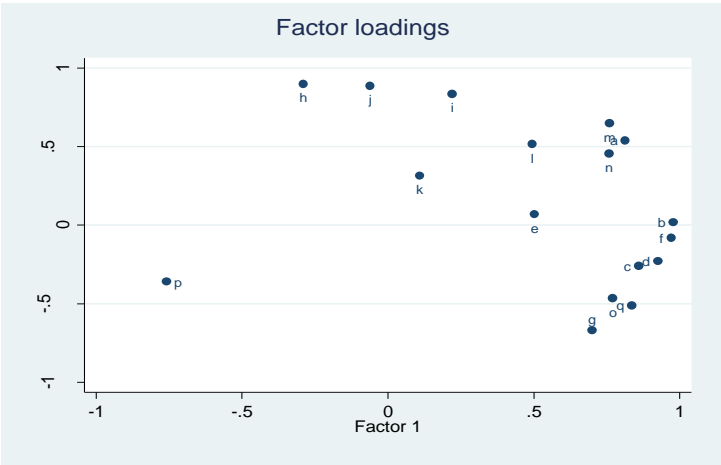Category 1   Category 2
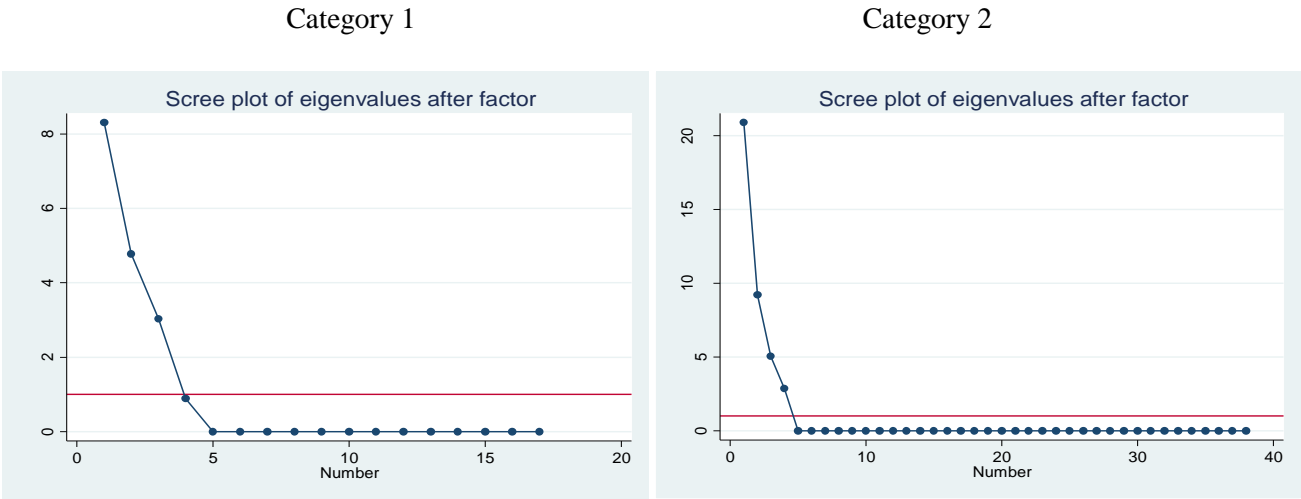
To analyse factor performance it is important to determine the number of factors. As we have already mention that factor loadings are the summations of Eigen values, thus, to determine the number factors, Scree Plot method is used, which involves drawing a line at one on Y axis and the factor values which are less than one are not considered further. In the above case, category 1 Scree plot suggests four factors but we have analysed three factors for the simplicity. The category 2 Scree plot suggests three factors and hence three of them are taken under consideration.

- **Loading Pots Outcomes**

L1   L2

Factor loadings

Factor loadings

Category 1				
Code	Variable	Factor1	Factor2	Factor3
a	NB	**0.8131**	0.5401	0.1903
b	EB	**0.9774**	0.0189	-0.2013
c	PW	**0.8598**	-0.2581	0.3244
d	NML/J	**0.9244**	-0.2299	-0.2950
e	OM	**0.5015**	0.0697	0.8620
f	CF	**0.9714**	-0.0789	-0.1255
g	BF	**0.6990**	-0.6705	-0.2224
h	HageZ	-0.2891	**0.9006**	-0.3170
i	WheiZ	0.2203	**0.8373**	-0.4453
j	WageZ	-0.0610	**0.8894**	-0.4464
k	Child Dia	0.1094	0.3151	**0.9395**
l	Child DiaHF	0.4944	0.5171	**0.4558**
m	Fluid ORS	0.7585	0.6501	**-0.0170**
n	Gruel	0.7582	0.4561	**0.2937**
o	Anti drug	0.7695	-0.4636	**-0.3250**
p	Home rmdy	-0.7581	-0.3589	**0.3813**
q	Not treat	0.8355	-0.5109	**-0.1659**

Category 2				
Code	Variable	Factor1	Factor2	Factor3
d1	Frnd	-0.9952	**-0.0701**	-0.0664
e1	Othr	-0.4745	**-0.0356**	0.7802
f1	None	-0.7704	**-0.4311**	0.1493
g1	Hep M	0.9634	0.1272	**0.2241**
h1	Hep F	0.6924	-0.5613	**0.0938**
i1	Dpt M	0.8761	0.3493	**0.2576**
j1	Dpt F	0.9047	0.3141	**0.2571**
k1	Polio M	0.9900	0.0113	**0.1199**
l1	Polio F	0.9852	-0.0064	**0.1217**

Category 2				
Code	Variable	Factor1	Factor2	Factor3
a	Preg UST	**0.6704**	-0.4645	0.5120
b	Termi UST	**0.3725**	-0.2274	-0.6786
c	Still UST	**-0.6349**	-0.4839	-0.5098
d	Preg USTU	**0.6194**	-0.5974	0.4904
e	Termi USTU	**0.5373**	-0.7420	-0.2409
f	Still USTU	**0.0849**	-0.4168	0.7439
g	Preg USTR	**-0.0090**	0.6327	0.7204
h	Termi USTR	**0.8640**	-0.2263	0.3007
i	Still USTR	**-0.7805**	-0.5648	-0.0322
j	LB	**0.6741**	0.2110	-0.6574
k	AB	**0.5344**	0.3456	-0.7652
l	HF	**0.9338**	-0.1838	-0.1652
m	PS	0.9489	-0.2441	-0.0508
n	NGO	-0.9796	**-0.1264**	0.0773
o	PrS	0.2086	**0.9438**	-0.2542
p	ATH	-0.5245	**0.6720**	0.2851
q	OWNH	0.3482	**0.8419**	0.2030
r	PH	0.5810	**0.6356**	0.3460
s	HFR	0.9740	**-0.2099**	0.0055
t	PSR	0.9668	**-0.1837**	-0.1218
u	NGOR	-0.9803	**-0.1772**	0.0385
v	Pr SR	-0.9701	**0.0005**	0.1992
w	ATHR	-0.9323	**0.3513**	-0.0260
x	OWNHR	0.6489	**0.7514**	-0.1128
y	PHR	0.9888	**-0.0213**	0.0304
z	Dr	0.8559	**-0.5142**	-0.0349
a1	Nur	-0.2411	**0.9506**	0.0814
b1	Hper	0.0499	**0.6974**	-0.5311
c1	Dai	0.0572	**0.9674**	0.1843

Discussion

Category 1 Table

The factor loading is the correlation and co-variation between factors, three factor values are consider by highlighting those value which have close relationship with the factors as mentioned in the model chart; F1 nutrition intake of infants, F2 Child growth height, weight and F3 child care while diarrhoea.

The F1 values have shown high degree of correlation with the factor of nutrition, but alarmingly, there is **still a high percentage** of infants who do not rely on mother's milk (NB) for nutrition. It is also verified by the other milk figure, which states that **more than fifty percent infants depends on OM** overall all the figures have shown positive result of nutrition intake of children in some form or the other.

F2 suggests positive relation for child growth among three variables, **height according to age dominates** overall children growth followed by weight for height and weight for age.

F3 represents the most common health issue endured by infant in their initial months, "Diarrhoea (D)". The government should ensure that at least infants do not die because of diarrhoea. Result suggests that a large number of children are highly infected by the D, and alarmingly, fifty percent children do not get health facility to take care of D. The ORS, Antidrug and No treatment value remain negative, which suggest that still majority of children do not get treatment and basic remedy to cure D which may lead to death, and the remaining two variables suggest that children are given more of gruel (ORS is more preferable in D) and home remedy, is **inappropriate over Doctor prescription.**

Category 2 Table

The highlighted variables are F1 Preborn checkups of pregnant women, F2 Delivery condition of pregnant women F3 Infant vaccination, this category clubs both mother and child information.

The F1 values are divided in two categories: rural and urban pregnant women. It is observed that urban women have done more Ultrasounds as compare to rural, but the number of infant terminations are more in rural, even though infant termination after Ultra sound was found more than fifty percent in urban (the high correlation between abortion and the F1 is observed due to its value more than fifty percent) **it seems that infant termination may be due to gender expectations, belief, honour killing and unsafe sexual intercourse**, and overall termination is not more than forty percent with more than fifty percent Ultra sounds.

F2 value deals with women's delivery conditions. This section is also divided into two parts with delivery conditions in rural and urban. The amount of health facility provided in urban and rural remains negative and similarly for NGO's but delivery condition observe positive in case of public (negative in rural)/private hospital (negligible in rural) with positive figure in case of at home, own home and parent home delivery (PH remain negative in case of rural). This implies that public sector hospitals are **not able to perform satisfactory contribution in rural India**, and the same goes for private hospitals. Therefore while during the delivery, the number of doctors remain in fewer amounts in case of both rural and urban, but number of nurses and other health personnels remain in positive; assistance like friends, other and none show negative figure despite of "dais" which implies that all five states have significant shortage of **obstetricians and gynaecologists**.

F3 deals in infant vaccinations (like that for **Hepatitis B** which can cause serious problems including liver failure, persistent infection, cirrhosis, and liver cancer, afor **DPT**, which is a class of combination vaccines against three infectious diseases of the human body diphtheria, pertussis (whooping cough), and tetanus, and for **polio virus**, which can infect person's brain and spinal cord, causing paralysis). Results suggests that all three vaccinations led to positive values, but more males are immunized for Hep B that females. Polio and DPT vaccination are given almost equally to male and female. Despite of this, we have observed that all three vaccinations are **not more than fifty percent children are immunized with all three vaccinations** in the overall population in five states.

- **Score Plot Outcomes**

Sc1
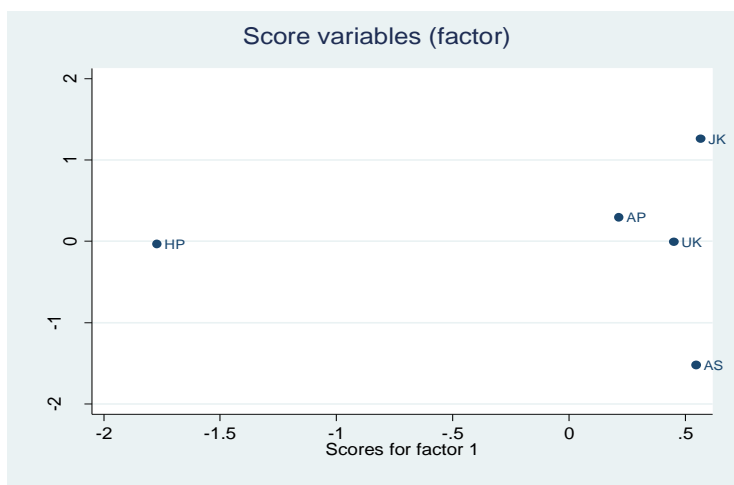
Sc2
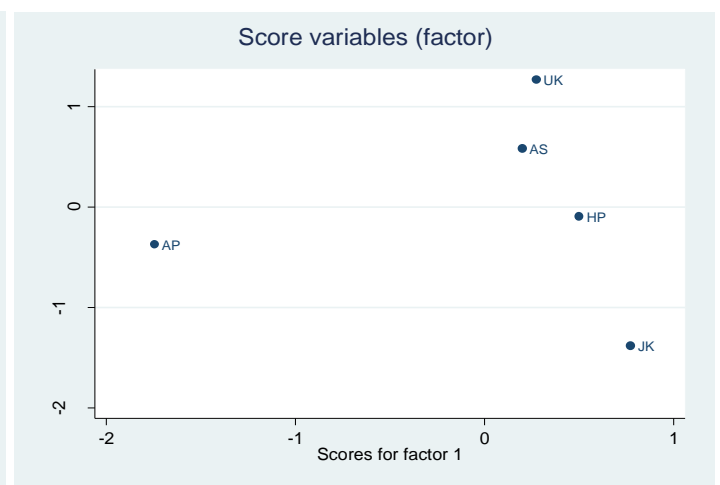
It is slightly difficult to compare six factors for five states simultaneously, and therefore we have used two factors on each category. To represent the comparative assessment of five states we have used score plot method starting with Sc1 for category 1 study and Sc 2 for category 2 studies.

Sc1

The Sc 1 represent Nutrition on X axis and Child growth on Y axis. Observing that nutrition among children remains positive in four states, and the highest in Jammu and Kashmir JK and lowest in Assam AS, Arunachal Pradesh AP above Uttarakhand UK. It is negative in case of Himachal Pradesh HP. F2 child growth is observed to be negative in case of AS and equal in case of HP and UK, whereas JK and AP remain highest.

We can conclude that in both cases JK and AP have highest child nutrition and child growth among the five states.

Sc2

The Sc 2 represents preborn check up of mother on X axis and delivery condition of mother on Y axis. Observing that UK followed by AS and HP have highest values in preborn checkups of pregnant women, and it is lowest in case of JK and negative in case of AP.

F2 Delivery conditions JK and AP have shown negative results, whereas HP remains close to zero and UK and AS have highest values.

We can conclude that in both cases UK and AS are better off in case of pregnant women's preborn checkups and mothers' delivery condition among the five states.

Conclusions

As aforementioned states JK, AP and UK, AS lead in two different categories of overall child health which are analysed in this paper. It can be concluded that Himachal Pradesh is lacking in all parameters of child health like nutrition, child growth, vaccinations, preborn checkups and children's growth. It can also be concluded that there is a large proportion of infants which is still not breastfed (this might be due to medical issues with mother), among height to age is found significant in children physical growth, still number of Doctors (mainly ob-gyns, is few) that may have reason why people prefer home remedy to cure child diarrhea. It is also found that Hepatitis B vaccination is more injected in male child rather female child. For the policy perspective, HP should be most strongly taken care of while dealing with child health.

Limitation:

We wished to include Sikkim in our study along with the five Himalayan states, but due to unavailability of data with NFHS, we were unable to do so. This study was also unable to cover anaemia, a major health concern for all age groups of people, including children.

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