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TREND, DIFFERENTIAL AND DETERMINANTS OF REPRODUCTIVE HEALTH IN INDIA AT THE DISAGGREGATE LEVEL: WHAT DO WE KNOW FROM NFHS DATA?

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Abstract: The present paper seeks to explore the movement of inequality of the deprivation of reproductive health status of 15 major states in India from 1992-93 to 2019-21. It is found that inequality in overall reproductive health status is rising over time, but parameter specific inequality study gives us mixed results. High as well as rising trend of regional inequality in respect of reproductive health is expected to have long-term social and economic consequences. Panel data regression confirms that female literacy rate and female labor force participation are the two demand side variables affecting deprivation of reproductive health status whereas two supply side factors like health infrastructural gap and social sector spending appear as significant predictors of deprivation of reproductive health. Our central authority should take a serious note on this issue to reduce regional imbalance towards ensuring social justice and equity; otherwise future development path of India may be jeopardized due to poor reproductive health at sub-national level.

Keywords: Reproductive and Child Health, Deprivation Index, Health Infrastructure

JEL Classification*:* C43, D63, I

INTRODUCTION

Reproductive and child health is the most important yardstick in assessing the status and standard of living of the population of an economy. Future

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"Demographic Dividend" which is expected to be enjoyed by India after 2025 largely depends on the quality of future human resources along with fertility decline of the country. Only the number of the working age cohort cannot guarantee to generate sufficient income of an economy if quality of the working force remains poor. This quality can be achieved through effective human capital formation. Being a fundamental component of human capital, health affects economic growth directly through labor productivity and the economic burden of illness, for example. Healthy and well nourished children perform better in school and better performance in school positively affects their future income. Proper childhood development depends to a large extent on adequate prenatal care for the mother so that child births can take place under adequate medical supervision, and on the suitable and proper preventive and curative medical attention be provided during childhood. There is an important linkage between improvement in maternal health and development process as poor maternal health negatively affects child health, reduces women's productive capacity, lowers participation in economic activities, sabotages the poverty alleviation programme and the process of effective human capital formation (Nanda, Switlick and Lule 2005). But major health challenges posed by specific phases of the demographic transition that India is going through is related to infant mortality and reproductive health. This is inevitable given the fact that the proportion of women in the reproductive age-group is projected to remain at a peak of nearly 55% or around that level for the next few years upto 2026 (Population Reference Bureau 2007). But the increase in this proportion requires increased efforts to reduce maternal mortality and the number of infant and child deaths. Among developing countries, India contributes largest sum of births per year (27 million) in the world and alone accounts for the 20% of global maternal deaths (WHO, 2018).

The 2010 United Nations Summit on the Millennium Development Goals (MDGs) concluded with the adoption of a global action plan to achieve the eight anti-poverty goals by their 2015 target date and the announcement of major new commitments for women's and children's health and other initiatives against poverty, hunger and disease (United Nations, 2011-12). The outcome document of the three-day Summit sets out a concrete action agenda for achieving the Goals by 2015. The Global Strategy for Women's and Children's Health initiated by United Nations has the potential of saving

the lives of more than 16 million women and children, preventing 33 million unwanted pregnancies, protecting 120 million children from pneumonia and 88 million children from stunting due to malnutrition, advancing the control of deadly diseases such as malaria and HIV/AIDS, and ensuring access for women and children to quality health facilities and skilled health workers. Women's reproductive and sexual health had for decades been a neglected area of international research (Graham and Campbell (1990); Koblinsky, Campbell and Harlow (1993); Pachauri (1994), Sen and Snow(1994)). Now these issues feature more prominently in policy and programme development of government and non-governmental organizations. Concern with sexual and reproductive health gained momentum with the 1994 International Conference on Population and Development in Cairo(United Nations 1994; Germain, Kyte 1994; Germain 1997). The emerging inter-national consensus on a definition of reproductive health, for women and men, is contained in the report of the Cairo conference itself:

> *"Reproductive health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and its functions and process. (ICPD, 1994)".*

With respect to women's health, the 1994 International Conference on Population and Development (ICPD) and the 1995 Beijing Platform for Action were instrumental in shifting the traditional focus from a population-centric approach to one that envisioned an expansive developmental agenda that enshrined gender equality and sexual and reproductive health and rights (SRHR) as critical aspects. Many of the strides made in this direction were, however, undone when the Millennium Development Goals (MDGs) failed to adopt a broad reference to sexual and reproductive health and rights but limited the goal to reduction of maternal mortality (MDG 5). Reducing maternal deaths by 75% between 1990 and 2015 is one of the main goals of Millennium Development Goal (MDG) 5 (goal 5a). While progress towards this goal has been substantial, it has been too slow to hope for its achievement by 2015 (Ooms, Mulumba, Hammonds, Latif, Waris, Forman 2013). For example, according to the WHO World Health Statistics 2013 report, an estimated 287,000 maternal deaths occurred in 2010 worldwide, a decline of 47% from 1990 (World Health Organization 2013). All regions have made

progress but accelerated interventions are required in order to meet the target. The maternal mortality ratio in developing regions is still 15 times higher than that of the developed regions. India is no exception. For India decline in MMR estimates in 2007-09 over 2004-06 was 212 from 254, a fall of about 17% (Sample Registration System 2004, 2007). It is definitely a progress but there is no room for complacency. The target of MDG5, laid down by United Nations was to reduce MMR to 109 by 2015. Now The prime objective of sustainable development goals (SDGs) is to ensure global justice, equity and transform our planet where everyone can live in peace with good health, prosperity, and human dignity by 2030. The major constraints in achieving the SDGs in respect of health and well-being are the LDCs scattered around mostly in Sub-Saharan Africa and South Asia. All these economies are more or less characterized by higher fertility (TFR), higher infant, child and maternal mortality due to poor reproductive and child health (RCH) in one hand and inadequate infrastructure on the other hand. The Economic Community of West African States (ECOWAS) countries have a realistic chance to likely reach the SDG targets in 2030 with a delay of less than 4 years regarding maternal, neonatal, and under-five-mortality (Mikanovic, Broniatowski, Byepu, Laaser 2018). In the context of getting real benefit of demographic dividend in near future, we must know about the present health status of the mothers and to explore the regional variation of Reproductive Health Status of India so that appropriate measures can be undertaken at the disaggregate level towards alleviation of this kind of short falls of reproductive health with a view to ensure social justice, equity and inclusive growth.

ROOT OF RCH PROGRAMME IN INDIA

India has a long history of action on population and development and was the first country in the world to introduce a national family planning programme (FPP) in the 1950s. The programme was introduced in 1951 with a view to stabilize population at a level consistent with the requirement of our national economy ignoring the health of the population in general and reproductive and child health in particular. Over the years, the Govt. had adopted 3 Health Policies and 2 Population Policies. Paradigm shift has taken place in India's population policies from the earlier methods mix target approach to the target free approach (TFA) in April 1996 subsequently renamed as the community's

need assessment (CNA) approach at late 1997. These shifts have duly emphasized the reproductive and child health (RCH) quality services package which is geared towards an improvement in the quality of life having implicit implications for a reduction in infant and maternal mortality. The immediate objective of National Population Policy (NPP)-2000 is to address the unmet needs for contraception, healthcare infrastructure and health personnel and to provide an integrated service delivery for basic reproductive and child health care (MHFW 2000). The availability and accessibility to the reproductive and child health package of quality services would facilitate a reduction in infant and maternal mortality and would improve not only the quality of life but also lead to a faster reduction in the wanted fertility component of the total fertility. Meeting this immediate objective is essential in order to attain the medium term objective of bringing down fertility to replacement level and population stabilization by 2045.

Through the decades, family planning programmes have adopted a number of approaches, some involving serious challenges to human rights in general and reproductive rights in particular, most notoriously during the period of the so-called 'Emergency' in the mid-1970s. Maternal and child health and nutrition were integrated with family planning programme during Fifth Five Year Plan (1974-1979). In the year 1992-1993, programme was renamed as child survival and safe motherhood programme (CSSM) with a view to improve quality and utilization of MCH services. In the year 1997, the programme was again renovated and renamed as Reproductive and Child Health (RCH) which incorporates all components of CSSM and some additional components like reproductive tract infections and sexually transmitted diseases. Broadly, the programme aims to universalize immunization, antenatal care, skilled attendance during delivery as well as for common childhood elements.

The 1994 ICPD had an impact on many countries, and India was no exception. It energized both civil society and the government, and as a result, the Central Ministry of Health and Family Welfare introduced a new population policy in 2000, marking a shift from demographic targets per se to an approach more sensitive to human rights and development. Along with the objective of population control through family planning targets, incentives and disincentives, some key aspects of reproductive health have begun to receive attention. The introduction of the Reproductive and Child Health Program followed by the

National Rural Health Mission has meant that, in the past 15 years or so, safe motherhood – a long neglected subject – and infant health have become central to policies and programs (National Rural Health Mission 2009). Reproductive and child health (RCH) has a multidimensional sphere which generally includes pregnancy, child birth and post partum care, maternal and infant nutrition, breast feeding, sexual behaviours, STDs and HIV/AIDS, reproductive rights, freedom, women's status and empowerment. Under these circumstances there has been an increasing thinking in the scientific community about the need to give stress on maternal health in essence of their reproductive health problems (Pachauri, S. 1995). Utilization of reproductive health (RH) services and their linkages with basic demographic parameters and socioeconomic development factors have often been argued and highlighted in the theoretical and empirical literature. The National Population Policy-2000 affirms the provision of quality RH services and an informed choice of contraception along with women empowerment characterized by improvements in women's educational standards, working conditions and autonomy (National Population Policy: 2000). These improvements are expected to bring about changes in their quality of life standards of living and to facilitate a faster control and an early stabilization of population. Broadly, the RCH programme aims to universalize immunization, antenatal care, skilled attendance during delivery as well as for common childhood elements. A step further of new endeavor of Govt. of India, National Rural Health Mission (NRHM 2009) outlines its objectives to promote 'equity, efficiency, quality and accountability of public health services through community driven approaches, decentralization and improving local governance to rural population, particularly among poor, underserved women and children(National Rural Health Mission 2009). Despite of all the programmes and efforts taken by the Government, some studies have revealed that reproductive and child health situation in India is quite alarming, especially in Northern states. In some major states (viz. Uttar Pradesh, Madhya Pradesh, Bihar and Rajasthan), the utilization of Govt. health facilities for delivery was poor that is only 5 to 16 percent, whereas home deliveries were widely prevalent and largely attended by untrained birth attendants that is 80 to 92 percent with greater probability of high risk of maternal morbidity and mortality (Raju 2002). Some Southern states performed well in Child immunization Programme (Lakshmana 2010).

With this overall scenario, an urge is felt to explore the inter-state variation in Reproductive Health (RH) indicators of India. This study is thus aimed to examine the variation in the reproductive health status among the 15 major states of India in five points of time viz. 1992-93, 1998-99, 2005-06, 2015-16 and 2019-21 using NFHS Survey results. An attempt here is made to explore the plausible causes of such inter-state disparities of RH status in India.

OBJECTIVES / MAJOR RESEARCH QUESTIONS ADDRESSED

Keeping in mind the importance of health in general and reproductive health in particular in social development paradigm, the following are the research objectives:

- Since reproductive health has a multidimensional sphere including a number of variables, therefore, my first objective is to estimate an appropriate index namely RH deprivation index (RH-DI) in order to determine the relative positions of the 15 major states of India in respect of the overall RH status at five different time pont.
- Secondly I have tried to examine whether the states are converging or diverging in respect of deprivation indices (and its RH components) over time using two inequality measures like Generalized Entropy and Atkinson Index.
- To find out what are the possible reasons of low performance of some states in respect of selected RH parameters. Is it due to supply side factors or demand side factors or both?
- To explore the role of rural public healthcare infrastructure in determining the differential RH outcome and to find out the status of 3-tier rural healthcare infrastructure among the states of India. Is the inequality of rural healthcare infrastructure rising over time?

DATA AND METHODOLOGY

5 round dataset of National Family Health Survey (NFHS: ROUND I-1992-93, Round-II: 1997-98 and Round-III: 2005-06, Round-IV: 2015-16, Round-V: 2019-21) conducted by Ministry of Health and Family Welfare, Government of India have been used in this paper to carryout my study. In my analysis I have considered 15 major states of India and have chosen 5 key

reproductive health (RH) indicators which are found to be commonly available in five points of time for my present study. These are:

(i) Percentage of less than 2nd and higher order births reported (X_1)

(ii) Percentage of institutional delivery (X_2)

(iii) Percentage of pregnant women who had at least 3 antenatal care visits during last pregnancy (X_3)

(iv) Percentage of women who are current users of any family planning method (X_4)

(v) Percentage of women not suffering from anemia (X_5)

CONSTRUCTION OF REPRODUCTIVE HEALTH DEPRIVATION INDICES

Different indices may be computed to study the pattern of reproductive health status of the states in India. One can estimate the RH achievement index using Range Equalization Formula or simple Relative Distance Methodology, generally used in the construction of human development index (HDI) but if someone tries to understand how far and to what extent the states are deprived from the above cited key RH parameters, the Human Poverty Index formula developed by Anand and Sen (1997) is assumed to be much more relevant towards formulation of policy prescription.

It is to be mentioned here that a state with higher achievement (AI) generally manifests lower deprivation but it may always not hold good because of the power of the average (α). Thus, in order to find out the Deprivation Index in respect of the RH parameter, I subtract each parameter from 100, since all are positive developmental parameters given in percentage terms. Thus, following Anand and Sen (1997), I have considered the following function:

$$\text{RH-DI}(\alpha)=[\sum\omega_i.P_i^{\alpha}/\sum\omega_i]^{1/\alpha} \qquad (1)$$

where, $P_i=(100-X_i)$, α stands for the order of the average, ω_i be the weights attached to $(100-X_i)$ parameter, i=1,2…5.

Equation (1) does follow some important properties of a good index. It is to be mentioned here that the RH-DI(α) does also suffer from the problem of the choice of the dimensions, aggregation, overlapping and multicollinearity (Alkire 2007, Krishnaji 1997, Rippin 2009, Roy and Haldar 2010). Moreover, the arbitrary weightage scheme is unscientific. In order to overcome this

problem, I have employed the Principal Component Analysis (PCA) through which one can reduce the number of variables in one hand and take care of the weights of the PCs on the other[1]. Here, the weights are not arbitrarily given; it is determined endogenously from the data matrix (Raychaudhuri and Haldar 2010, Bhattacharya and Haldar 2012). It is assumed, the weights of the PCs are the corresponding Eigen Values (λ). Thus, I can have two DI(α) –one can be estimated using equation (1) where $\omega_1 = \omega_2 = \ldots = \omega_7 = 1$ and the other one can be estimated using PCA (using the same logic of eqn. 1) which is termed as weighted reproductive health deprivation index (WRHDI) of order α as given in equation (2). Here, in my study, WRHDI has beed estimated using PCA assuming α=3.

$$WRHDI_j(\alpha) = [\ \omega_1 * \{(PC_1)_j\}^{\alpha} + \omega_2 * \{(PC_2)_j\}^{\alpha}]^{1/\alpha} \quad (2)$$

where, $\omega_1 = \lambda_1/(\lambda_1 + \lambda_2)$ and $\omega_2 = \lambda_2/(\lambda_1 + \lambda_2)$. PC_1=first principal component and PC_2=second principal component. In this paper, at most two PCs have been extracted based on Kaiser Normalization and Scree Tests criteria.

METHODS TO STUDY THE INEQUALITY OF THE INDICES AND THE SELECTED RH PARAMETERS

The inequalities are analyzed using two different inequality measures. These are:

- Generalized Entropy Class of measure (GE)
- Atkinson Class of measures

The Lorenz Class like Gini Coefficient is not applied here because of non-monetary values of the RH parameters. The GEM and Atkinson inequality measures give different implications for the distribution to be analyzed. The Generalized Entropy class of measures, for example, GE(0) or mean log deviation is more sensitive to the changes in the lower tail of the distribution. GE(1) or Theil index applies equal weights to entire distribution. GE(2) is ½ of the squared coefficient of variation(CV) which is more sensitive to the upper tail of the distribution.

The Atkinson measure (AT) is originated from the social welfare point of view. Inequality aversion parameter (ε) ranges from zero to infinity, with 0 representing no preference for equality. This index is a measurement of inequality that explicitly incorporates normative judgement about social welfare.

$$GE(0)=Theil(0) = \frac{1}{n}\left[\sum_{i=1}^{n}\log\frac{\bar{y}}{y_i}\right] \quad (3)$$

$$GE(1)=Theil(1)=\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}.\log\frac{y_i}{\bar{y}}\right) \quad (4)$$

$$GE(2)= (½)*CV^2 \quad (5)$$

$$AT= 1-\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{1-\epsilon}\right]^{\frac{1}{1-\epsilon}} \quad (6)$$

Here, n=number of states=15, $y_i=P_i$=RH parameter/indicator, ε=inequality aversion parameter. In my analysis, I have used α=0, 1 and 2 for calculation of GEM; while the Atkinson Index is estimated for different values (viz. 0.5, 1 and 2) of the inequality aversion parameter (ε).

Selection of the Variables, Model Specification in Panel Data Regression towards Determining RH deprivation index across the 15 major states in India: In order to find out the determinants of RH-DI across 15 major states of India a panel data regression has been carried out using the following socio-economic and infrastructural variables . These are: Female Literacy Rate, Female Labor Force Participation, Income measured by Per Capita state domestic product (PCSDP), Per capita Social Sector Expenditure (PCSSE) comprising education and healthcare lagged by 5 years (since human capital investment (viz. SSE) does not give instantaneous return), Rural Public Healthcare Infrastructure measured[2] by Gap of Community Health Centre (CHC), Primary Health Centre (PHC) where the gaps have been calculated by the difference between actual and required number of CHC, PHC in each state on the basis of the 1983 Health Policy. Initially, I have incorporated other variables like proportion of backward community (viz. SC and ST) and Minority but finally, all are dropped from the model because of very marginal and insignificant explanatory power of the variables. Data on Female Literacy Rate and Female Labor Force Participation Rate are estimated from the decadal values given in different Census Reports, Govt. of India. SDP (Per Capita) is drawn from CSO, GoI. Data on rural

healthcare infrastructure are collected from Rural Health Statistics, Ministry of Health and Family Welfare, Govt of India. Per Capita Social Sector Expenditure (PCSSE) is collected from Statistical Abstract-Central Statistical Organization, Govt. of India. We have 15 states and 5 time points; WRH-DI has been considered as dependent variable in the model. therefore, we consider the following panel data regression model:

$$WDI_{it}=\beta_1.(FLR_{it})^{\beta 2}.(FLFPP_{it})^{\beta 3}.(PCSDP_{it})^{\beta 4}.(PCSSE_{it-5})^{\beta 5}.(PCSSE_{it-10}{}^{\beta 6}.(GCHC_{it})^{\beta 7}.(GPHC_{it})^{\beta 8}(e)^{uit} \quad (7)$$

Where, i=1,2,3…15; t=1,2,…,5; WDI=weighted deprivation index, FLR=female literacy rate, PCSDP=per capita state domestic product, GCHC=gap of community health centre, GPHC=gap of primary health centre, $PCSSE_{it-5}$= per capita social sector expenditure lagged by 5 years, $PCSSE_{it-10}$= per capita social sector expenditure lagged by 10 years , u_{it} be the error term.

We apply the unrestricted or unconstrained regression, this is because the dependent variable is composed of many variables and it is artificially created, does not exactly reflect any specific variable.

FINDINGS

Following the above cited methodology the weighted reproductive health deprivation index (RHDI) has been estimated for 15 major states at five points of time as given in the following Table 1:

Table 1: RHDI in the 15 States of India: 1992-93, 1997-98, 2005-06, 2015-16 and 2019-21

States	*RHDI(1992-93)*	*RHDI(1997-98)*	*RHDI(2005-06)*	*RHDI(2015-16)*	*RHDI(2019-21)*
Andhra Pradesh	185.15(12)	143.85(13)	128.97(13)	108.25(13)	61.65(13)
Assam	293.34(02)	258.99(03)	258.74(03)	234.66(03)	163.40(03)
Bihar	296.29(01)	290.02(01)	290.13(01)	288.25(01)	184.77(02)
Gujrat	196.63(09)	172.04(09)	172.92(08)	155.63(09)	107.89(08)
Haryana	229.72(07)	198.91(06)	190.68(07)	166.20(07)	93.68(10)
Karnataka	192.90(10)	156.45(11)	136.91(12)	127.01(11)	79.67(11)
Kerala	94.85(15)	82.41(15)	69.14(15)	75.22(15)	52.79(15)

States	*RHDI(1992-93)*	*RHDI(1997-98)*	*RHDI(2005-06)*	*RHDI(2015-16)*	*RHDI(2019-21)*
Madhya Pradesh	271.54(5)	193.49(07)	223.70(05)	195.81(05)	139.87(04)
Maharastra	180.97(13)	153.39(12)	147.99(11)	121.71(12)	74.98(12)
Orissa	258.77(06)	217.45(05)	201.74(06)	183.29(06)	124.0(06)
Punjab	191.52(11)	162.76(10)	170.87(09)	139.44(10)	95.09(09)
Rajasthan	285.63(04)	244.58(04)	230.80(04)	208.47(04)	139.41(05)
Tamil Nadu	159.22(14)	124.13(14)	98.79(14)	89.16(14)	53.45(14)
Uttar Pradesh	291.44(03)	281.29(02)	262.32(02)	242.32(02)	188.77(01)
West Bengal	225.13(08)	184.66(08)	167.80(10)	162.28(08)	109.83(07)

Note: Values in parentheses represents rank. Higher values mean lower rank[4].

It has been found that there exists wide range differential across the states of India in terms of overall reproductive health deprivation and utilization of reproductive health services. Four laggard states (Bihar, Uttar Pradesh, Rajasthan and Madhya Pradesh), which are collectively known as BIMARU states are relatively more deprived compared to others in all the selected 5 time points.

Study of Inequality across the states in respect of RH –WDI and all five Key Parameters for five points of time in India: The extent of inequality of RH –WDI and its five components is given in Table 2.The results show that the Weighted Deprivation Index is found to be rising over time. Does it mean that all the states are diverging in all the five deprivation parameters? Since, WDI is composed of all the five parameters; I felt need to estimate the inequality of all the parameters in 5 points of time.

Although inequality in overall reproductive health status is rising over time, parameter specific inequality study gives mixed results. It has been observed that regional inequality is more pronounced in case of institutional delivery of the mothers and higher order births. It is to be noted that Govt. of India(UPA Govt.) enacted Janani Suraksha Yojona (Safe Motherhood Programme) in 2005 to encourage institutional delivery by providing some cash incentive to pregnant women if they deliver in medical facilities; but till date many states as well as districts fail to achieve 100 percent safe delivery.

Table 2: Inequality Measurement of the WDI and Five Deprivation Parameters

Parameters	*Year*	*GE(0)*	*GE(1)*	*GE(2)*	*AT(0.5)*	*AT(1)*	*AT(2)*
	1992-93	.0391	.0349	.0349	.0183	.0384	.0845
Weighted Deprivation Index(WDI)	1997-98	.0486	.0454	.0475	.0232	.0474	.0989
	2005-06	.0633	.0569	.0580	.0295	.0614	.1312
	2015-16	.0638	.0606	.0647	.0306	.0618	.1239
	2019-21	.0793	.0754	.0808	.0380	.0762	.1498
Parameter 1	1992-93	.3037	.2278	.2296	.1227	.2619	.5428
	1997-98	.3002	.2635	.3034	.1318	.2594	.4755
	2005-06	.3233	.2788	.3273	.1397	.2762	.5086
	2015-16	.3411	.2821	.4044	.1423	.2833	.5161
	2019-21	.3217	.2765	.3721	.1388	.2801	.5173
Parameter 2	1992-93	.0931	.0618	.0516	.0367	.0889	.2612
	1997-98	.1378	.0889	.0748	.0529	.1288	.3673
	2005-06	.1807	.1203	.0934	.0602	.1653	.5054
	2015-16	.2035	.1456	.1245	.0741	.1892	.6021
	2019-21	.2317	.1592	.1558	.0923	.2004	.5697
Parameter 3	1992-93	.0169	.0171	.0187	.0084	.0167	.0326
	1997-98	.0256	.0266	.0300	.0130	.0253	.0478
	2005-06	.0272	.0313	.0337	.0130	.0268	.0520
	2015-16	.0291	..0382	.0786	.0211	.0307	.0655
	2019-21	.0322	.0402	.0448	.0303	.0356	.0587
Parameter 4	1992-93	.0197	.0182	.0185	.0094	.0195	.0417
	1997-98	.0338	.0334	.0364	.0166	.0332	.0659
	2005-06	.0430	.0331	.0392	.0229	.0421	.0809
	2015-16	.0524	.0408	.0579	.0317	.0552	.0909
	2019-21	.0592	.0506	.0691	.0366	.0729	.0833
Parameter 5	1992-93	.0279	.0255	.0258	.0132	.0275	.0596
	1997-98	.0293	.0243	.0226	.0132	.0289	.0697
	2005-06	.1102	.0569	.0516	.0456	.1043	.3156
	2015-16	.1533	.0721	.0158	.0656	.1456	.3582
	2019-21	.1755	.0922	.0275	.0537	.1722	.3244

Source: Authors estimation.

Determinants of Deprivation Index of Reproductive Health Parameters: A Panel Data Regression

Table 3 Results of the Random Effects Model of Equation (7)

Dependent Variable=lnDI_RH

Exogeneous Variables ↓	*Coefficient*	*Standard Error*	*t value*	*P[|Z|>z*
Constant	8.8660	0.7181	12.334	0.0000
lnPCNSDP	-0.0738	0.0578	-1.227	0.2016
lnFLFPR	-0.2119	0.1184	-1.788	0.0737
lnFLR	-0.4934	0.1142	-4.319	0.0000
lnGCHC	0.0765	0.0849	0.9010	0.3670
lnGPHC	0.0950	0.0461	2.0670	0.0450
lnPCSSE(-5)	-0.2783	0.0651	-4.2710	0.0000
lnPCSSE(-10)	-0.1477	0.0813	-1.8171	0.0693
Regression Diagnostic R^2=0.6814				
LM Test (Pooling Vs. Panel)=32.71 (p=0.000 at 1d.f)				
Hausman Test(Fixed Vs. Random) =10.81 (p=0.1469 at 7d.f)				
N=75				

LM test suggests panel over pooling; Hausman test suggests random effect model.

From the panel data regression model, it is found that the panel is more appropriate than pooling (or CLRM). Moreover, the Hausman tests suggest the random effect rather than fixed effects. It is observed that female literacy, female labor force participation rate appear to be an important predictors in reducing the WRHDI and this result is quite obvious; the PCSDP[3] is found to be in expected direction but insignificant. PCSSE comprising education and health care both lagged by 5 and 10 years are found to be significant predictors

for reducinf reproductive health deprivation. In 3-tier rural public healthcare infrastructure, only the gap of PHC is revealed to be significant but the other healthcare infrastructure does not show any significant impact on WRHDI. The above model may suffer from multicollinearity problem but the VIF do not show any severity of multicollinearity problem.

RURAL HEALTHCARE INFRASTRUCTURE IN THE 15 MAJOR STATES OF INDIA

All the states have been experiencing a wide range of gap in respect of 3-tier rural healthcare infrastructure. This gap is estimated from the required number (as laid down in 1983 Health Policy) and existing number of healthcare infrastructure (viz. CHC, PHC and SC). I am not reporting here the gap of Community Health Centre (CHC), Primary Health Centre (PHC) and Sub-Centre (SC) across the states over time but I mention here the inequality (viz. GE (2)) among the states in 3-tire rural healthcare in five reference points of time as given in the following Table-4.

Table 4: Inequality of the Gap of Rural Healthcare Infrastructure across the 15 major states of India over time

Year	Gap of CHC	Gap of PHC	Gap of SC
1992-93	0.1553	0.2904	0.2187
1998-99	0.1551	0.2863	0.2163
2005-06	0.1567	0.2726	0.2019
2015-16	0.1545	0.2547	0.2175
2019-21	0.1504	0.2471	0.3015

Note: Inequality is measured by GE (2). Gap is the difference between required number (as laid down in 1983 Health Policy) and existing or actual number. Source: Data on CHC, PHC and SC and Medical Bed per lakh population are drawn from Rural Health Statistics, Ministry of Health and Family Welfare, Govt of India.

My present study also reveals the fact that all the 15 major states in India are suffering from inadequate health care facilities in all the 3 categories of 3-tier rural healthcare infrastructure. From the above Table-4, it is clear that the gap of inequality is found maximum in PHC and SC, whereas it is found the least in the gap of CHC. The inequality of the gap of PHC and CHC is found falling but it is rising in respect of SC. Sub-Centre plays an important role in

rural public health infrastructure and a rising trend of the gap of inequality is a great concern for the Govt. from the social welfare point of view.

Moreover inequality of the shortfalls in these 3 categories is also widening over time. Except Female Literacy Rate, the inequality of the variables included in this study show a rising trend- this implies that Indian economy has not been experiencing inclusive growth in respect of social sector development.

CONCLUDING OBSERVATIONS AND POLICY IMPLICATIONS:

The policy basis of "Health for All" enshrined in WHO's constitution defines the objective of the organizations as "the attainment by all peoples of the highest possible level of health". The goal of health for all by the year 2000 embodied that objective. The strategy of health for all emphasizes that there will be an even distribution among the population of whatever resources for health are available. It does mean that essential health care will be accessible to all individuals and families, in an acceptable and affordable way, and with their full involvement.

Our present study has elicited RH deprivation status indices for all the 15 major states of India. Different absolute values of the indices show that by and large states like Bihar, UP, MP, Rajasthan are found to be comparatively more deprived in terms of overall RH status and utilization of RH services. The broad idea of this paper has also been to capture the inequality in access to and utilization of various RH services viz. ante natal care, safe delivery for maternal care and higher order birth. The results of inequality measurement of various deprivation indices are suggestive enough to the clear pattern of unequal utilization of RH services emerging from this analysis. Inequality in utilization of maternal health care services is more pronounced in the case of higher order birth and safe delivery of the mother. Panel study reports that important predictor like women's literacy has significant impact on the RH status. Women's education and employment help towards fertility reduction, higher contraceptive usage, higher utilization of reproductive health care. Social sector expenditure has been appeared as important predictor of the panel data regression model.

Nevertheless, it is an accepted view that for preventive services, that for maternal healthcare, there is enormous dependence on public sector. The international conference on primary healthcare, held in Alma-Ata in 1978,

issued the declaration of Alma-Ata which stated that primary healthcare is the key to attaining 'Health for All'. The National Health Policy (2002) for rural area is based on a combination of preventive, promotive and curative services. The rural healthcare structure is vertical in nature comprising three tiers: community health centre (CHC), primary health centre (PHC), and sub centres (SC). Our present study also establishes the fact that the gap of PHC is revealed to play a significant role for widening the RH deprivation in the states of India. Therefore, in this respect a substantial rise in the expenditure related to reproductive health of the women and adequate investment in public healthcare infrastructure can be suggested to ensure better and safer RH facilities. In this respect, Central Govt. can take an initiative to remove reproductive health deprivation by disbursing some kind of development grants for better utilization of RH services with a view to alleviate the regional variation.

Government of India has already identified some backward regions based on selected education and health parameters which are quite arbitrary. Allocation of fund disbursement should be formulated on the basis of degree of deprivation in each state and in this context the reproductive deprivation index estimated in my study can be considered for the measurement of the degree or intensity of reproductive health deprivation . A proportional and scientific rule of disbursement of fund by the Central Govt. is suggested to the states in such a way that states with higher deprivation of RH status should get more and states with least deprivation should get minimum amount. This is to be done with a view to ensure social justice and for attaining inclusive growth. Lastly, a close co-ordination between our health policies and our poverty eradication programmes is required for getting desired health outcomes although in-depth study pertaining to empirical verification of "Health- Poverty" nexus in reproductive health dimension is beyond the scope of our present study. Public Healthcare expenditure is about 1 percent of National Income of India, therefore, how the Central Govt. will reach "Health for All" programme? It seems to be an elusive and distant dream! Since, health sector is absolutely state's responsibility; the backward states are facing a deep rooted problem towards improving the health status of the general mass and reproductive health in particular. If we do not seriously address this issue, our future real demographic dividend will become bleak and uncertain.

Notes

1. Following Pett et al (2003), Johnson et al(2006) and Raychaudhuri and Haldar (2009), we can say that the method of PCA is the construction out of a set of variables, P_i(i=1, 2, 3…..n) of new variables (PC_j) called principal components, which are linear combinations of the P's and these are artificial as well as orthogonal in nature:

$PC_1=a_{11}P_1 + a_{12}P_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots+a_{1n}P_n\ldots\ldots\ldots\ldots(1a)$

$PC_2=a_{21}P_1 + a_{22}P_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots+a_{2n}P_n\ldots\ldots\ldots\ldots(1b)$

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$PC_n=a_{n1}P_1 + a_{n2}P_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots+a_{nn}P_n\ldots\ldots\ldots\ldots(1n)$

Where, PC_j=Principal Component of j-th indicator, j=1,2..,n; $P_i=(100-X_i)$=RCH Deprivation Parameter, $a_{ij}=r(PC_i,P_j)$=Factor Loading of the j-th original variable/ parameter in the i-th PC. This represents the correlation between PC and the original variable/parameter (viz. P_i). The square of this term represents the proportion of variance captured by P_j indicator in the i-th Principal Component.

$r(PC_j, PC_i)=0$ $i\neq j$

It is to be mentioned here that the PCA is applied to the standardized values of the original P's. The a's, called factor loading, are chosen in such a way that the constructed PCs satisfy two conditions:

(i) The PCs are uncorrelated i.e., orthogonal and

(ii) the first PC i.e., PC_1 absorbs and accounts for the maximum possible proportion of the total variation in the set of all P's, the 2nd PC (i.e., PC_2) absorbs the maximum of the remaining variation in the P's (after allowing for the variation accounted for by the first PC) and so on.

Following Kaiser's criterion, principal components (PCs) having latent root (i.e., Eigen value) greater than one are considered as essential and should be retained in the analysis. Cattell's Scree Test is also applied for selection of the optimum number of PCs. In 'Scree Test', we plot the latent roots against the order of extraction of the PCs and we use the shape of the resulting curve to judge how many PCs to retain in the analysis. The decision rule is to retain the PCs up to the point where the resulting curve gets some curvature and reject the PCs for which the curve becomes a straight line.

2. There exits a standard national norm regarding rural health infrastructure in 1983 National Health Policy. This is laid down as follows for plain area:

   There should be one Community Health Centre(CHC) or Rural Hospital(RH) per100000-120000 population

   There should be one Primary Health Centre(PHC) per 30,000 population

   There should be one Sub-Centre (SC) per 5000 population.

3. PCSDP has been calculated at 2004-05 constant price

4. For the state level analysis in this paper I have incorporated only the reproductive health (RH) parameters since child health parameters were not available consistently in all five time poins we have considered for each of the 15 major states of India

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