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Dr. Jyoti S. Hallad, Professor & Director and Dr. Shriprasad H., Associate Professor/Joint director attended Annual Work Plan and Review meeting of PRCs organized by Deputy Director General, Ministry of Health and Family Welfare New Delhi ,GoI on 08.05.2020 through Webex.

As a part of capacity building, 8 sta□ members attended online workshop on Exploring Analytics Using R during 21-24 May, 2020 organized by Population Research Centre/Institute of Economic Growth (IEG) New Delhi.

Following 3 papers presented in the 4th Knowledge Dissemination Workshop of Population Research Centers held on 16 and 17 January, 2020 at Population Research Centre, Patna University, Patna, hosted by Ministry of Health and Family Welfare (MoHFW), GoI, New Delhi.

i) Dr. Shriprasad H., 'Social Dynamics of Hypertension and Diabetes: An Empirical Study in Rural Areas of Haveri District, North Karnataka
ii) Mrs. Manjula G. Hadagalimath "An Assessment of Knowledge and Performance of ASHAs on Home Based Newborn Care"
iii) Mr. Javeed A. Golandaj "Di□erentials and Determinants of Anemia Prevalence among Pregnant and Non-pregnant Women in Karnataka"

Publications

1. Pradeep S. Salve, S. R. Vatavati and J. S. Hallad (2020), "Clustering the Envenoming of Snake Bite in India: The district level analysis using Health Management Information System data", Clinical Epidemiology and Global Health, https:\\doi.org/10.1016/j.cegh.2020.01.011.
2. B.M. Ramesh, Arin Kar, J. Krishnamoorthy, J. S. Hallad et.al. (2020), "Potential Contributions of an on sight Nurse Mentoring Programme on Neonatal Mortality Reductions in Rural Karnataka, South India: Evidence from Repeat Community Cross-sectional surveys." BMC Pregnancy and Child Birth (2020) 20:242 https:\\doi.org/10.1186/s12884-020-02942-8
3. Golandaj J.A, and Hallad J.S. (2019). "Levels, Trends and Socio-Economic Correlates of Caesarean Section Deliveries: District Level Analysis in Karnataka, India", Journal of Health Research Vol. 33, Issue 4.
5. Shriprasad H. Edited Book '*Banking and Developmental Challenges in India*: Issues, Magnitude and Remedies', Spring Leaf Publications, Mysore. ISBN 978-81-927970-9-0.

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ARTICLES

Role of Socioeconomic Factors during Demographic Transition and Transformation in India

K N M Raju[1]

Abstract

An attempt is made in the study to identify significant socioeconomic factors influencing fertility and motility transition by using 'transition and transformation' as an analytical framework. Socioeconomic factors are computed from the Census 2011, and fertility and mortality estimates are collected from the SRS reports for the year 2011. The language is observed to be the best suitable population trait to measure ethnicity than religion or caste. Since, both religion and caste groups include different ethnic identities from various states. Therefore, the percentage of population speaking two languages is used to measure ethnicity. The ethic character of the population decreases with increase in the percentage of population speaking two languages. The percentage of population speaking two languages is like any other socioeconomic factors subjected to wide variations among states and would change concomitant to socioeconomic development of states.

Of all factors, only percentages of literates and population speaking two languages are able to explain significant variation in the CBR in the total, rural and urban areas across states. Many factors like the percentages of literates, population speaking two languages, Muslims, Christians, the SCs, workers to the total population and non-migrants are able to explain significant variation in the CDR among population sub-groups of males or females, and in rural or urban populations. Some of the factors like the percentages of literates, population speaking two languages and Christians are able to explain significant variation in the IMR among males or female, and in rural or urban populations. However, the study found that the percentage of population speaking two languages or the ethnicity is a most significant factor influencing fertility and mortality. The vital rates like CBR, CDR and IMR vary positively with the ethnicity. Or as the ethnic character of population increases, the fertility and mortality tends to increase. Secondly, the language seems to a better proxy to measure ethnicity than religion of caste as religion. Thirdly, fairly detailed data on languages is available in each census to carry out cross section or temporal analysis.

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Introduction

The terms transition and transformation can provide an analytical framework to describe and interpret fundamental changes in society. Transition and transformation are not mutually exclusive. The difference between these two terms might have been the result from their historical development of words and their meaning. They largely stem from different research communities concerned with either transition or transformation. The review found that these two terms have been enriched in research and analysis (Hölscher, Wittmayer, Loorbach, 2017).

In the context of demographic change, the term transition is used as a process of change from one state or level to another, and the term transformation is a state of being transformed (WikiDiff, DNK). In other words, while the transition describes a process, transformation describes the outcome. Or transition is considered as 'changing' and transformation as 'changed' (Jordan Oliver, 2018). For example, when death and birth rates decline during the demographic transition, population age structure transforms, (WikipediA, DNK).

In the study, an attempt is made to assess the role of socioeconomic factors in influencing fertility and mortality transition. To elaborate further, significant differentials in fertility and mortality would emerge among socioeconomic groups of population because of varying timings of onset of fertility and mortality transition in these groups.

The study aims to identify the significant socioeconomic factors influencing fertility and mortality transition. Ethnicity is an important population trait. It has been ignored and is seldom used in the demographic research despite availability of data on ethnicity for many decades. The study has made an attempt to include ethnicity as one of the socioeconomic factors influencing fertility and mortality transition. The aims of the study are three fold:

1. To use the transition and transformation as an analytical framework,
2. To identify significant socioeconomic factors influencing fertility and motility transition, and
3. To assess significance of ethnicity in demographic research.

Data and Sources

The socioeconomic factors considered in the study are computed from the census of 2011. The fertility and mortality estimates have been taken from the published reports by the Sample Registration System (SRS) for the year 2011. The annual estimate of fertility measured by the crude birth rate (CBR); and the annual estimates of mortality measured by crude death rates (CDR) and infant mortality rate (IMR) are used in the study. The SRS also presented 3-year moving averages of the CBR, CDR. and IMR. The moving averages are better estimates because random fluctuations in the annual estimates will be minimized. But, the analytical results are found to be similar between annual estimates and moving averages. Therefore, the study considered the annual estimate of fertility and mortality.

Methodology

Literature Review on Ethnicity: It is felt necessary to review the literature on ethnicity and its measurement. The ethnicity is some form of common kinship ties and specific cultural practices such as language and religion for each population group (Australian Council for Educational Research, 2000). The ethnicity is a group of people who identify with each other, usually on the basis of common language, ancestry, history, society, culture or nationality (WikipediA, DNK). While describing the difference between race and ethnicity, it is acknowledged that race refers to a person's physical characteristics, such as bone structure and skin, hair, or eye color; ethnicity refers to factors like nationality, regional culture, ancestry, and language (Diffe, DNK). Census of India described that language is an important attribute of a population, and has great relevance and significance in a pluri-lingual and pluri-ethnic land like India. The data on language is useful in the country having diverse people since no separate question is asked on their ethnicity except in respect of the scheduled tribes (Registrar General and Census Commissioner, 2011). The religion and language are the important characteristics of ethnicity. Caste is also another characteristic of ethnicity, particularly, in India (Wikipedia, DNK).

Language as a Measure of Ethnicity: The review has clearly implied that religion, caste and language are three important traits of ethnicity. In many studies, religion is considered as a set of beliefs and faith commonly agreed upon than as a measure of ethnicity (Wikipedia, DNK). The caste is used as relative degrees of ritual purity or pollution and social status (Sociology Group, 2017). Also, the religion and caste are used to measure socially and economically disadvantaged sections of population. Therefore,

language is the only important ethnic trait that can be used to measure the ethnicity. A detailed data on languages are available from census. Therefore, the data on languages can be used to measure ethnicity.

Percentage of Population speaking Two Languages: The percentage of population speaking only mother tongue would have been a better measure of ethnicity. But, such data are not directly available. Census presented data on the population speaking two languages and three languages in addition to their mother tongue. Therefore, the percentage of population speaking two languages or the percentage of population speaking three languages can be sued to measure ethnicity. The statistical results using the percentage of population speaking two languages and the percentage of population speaking three languages are similar. Therefore, the percentage of population speaking two languages is used in the study. The population speaking many languages is considered to be progressive in their attitudes and behavior because they have been interacting and assimilating with other ethnic groups of different cultures. The ethnic character of the population decreases with increase in the percentage of population speaking two or three languages. Thus, the percentage of population speaking two languages is expected to change with other socioeconomic factors and would directly or indirectly influence the fertility and mortality transition and transformation.

Statistical Methods used

Correlation matrix is computed for all socioeconomic factors, and fertility and mortality estimates. It is observed that many factors in the study are correlated among themselves. The multicollinearity is a problem to use multivariate analysis and it is a common problem in social sciences (Frost, DNK). Of all the multiple regression methods, stepwise regression is found use full as it minimizes the multicollinearity among socioeconomic factors. In stepwise regression, each factor having high correlation and ability in explaining significant variation in the dependent variable is included in the analysis one after the other. In other words, the procedure adds the most significant factor or removes the least significant factor in the model. The technique produces a single regression model when the algorithm ends (Statistical Solutions, DNK).

Two regression procedures are used in the study to explain the variation in the dependent variable - normal regression procedure employing all independent factors in model 1 and stepwise regression procedure in model 2. The difference in the percentage of variation explained in the dependent variable

between models 1 and 2 would reveal the importance of independent factors that are not included in model 2.

The state level analysis is presented among the total, male and female populations in total, rural and urban area. The state level analysis is imposed because of availability of mortality and fertility data. It is a macro study. The statistical inferences may differ between the state level macro study and the household level micro study. The reason is being that SCs of Kerala are not the same as that of SCs of Uttar Pradesh. Likewise, Muslims of Kashmir are not the same as Muslims of Tamil Nadu, and STs of Karnataka are not the same as that of STs of Nagaland. This is because that these population groups are directly or indirectly influenced by the socioeconomic development of the state.

Results

Socioeconomic Differentials

All Indian states are undergoing socioeconomic development ever since the India's independence in 1947. However, the development levels vary among states because of base level parameters differ widely. To assess relative socioeconomic development among states, wealth index presented in the National Health Survey-4 has been used. The national wealth index is calculated on the basis possession of household assets and amenities using principal component analysis and is divided into five equal categories, each with 20 per cent of de jure population (IIPS and ICF, 2017). The percentage of de jure population in the highest wealth quintile by state/union territory for the year 2015-16 by states/union territories has been presented in Table 1. The wealth index is more than 20 percent in all states/union territories excepting Andhra Pradesh in South, Dadra and Nagar Haveli in West and Rajasthan in North indicating that these regions are doing better in socioeconomic development. The wealth index is less than 20 percent in all states/union territories in East, Central and Northeast regions excepting Mizoram in Northeast indicating that these regions are doing poorly in socioeconomic development.

Table 1 Percentage of de jure population in the highest wealth quintile by state/union territory, India, 2015-16.

State/union territory	Highest wealth quintile	State/union territory	Highest wealth quintile
India	20.0		
North		**Northeast**	
Chandigarh	80.0	Meghalaya	6.3
NCT of Delhi	62.8	Mizoram	34.7
Haryana	47.1	Nagaland	11.3
Himachal Pradesh	32.3	Sikkim	11.7
Jammu and Kashmir	25.2	Tripura	6.2
Punjab	62.0	**West**	
Rajasthan	19.8	Dadra and Nagar Haveli	18.0
Uttarakhand	29.8	Daman and Diu	33.1
Central		Goa	55.9
Chhattisgarh	14.3	Gujarat	29.4
Madhya Pradesh	16.2	Maharashtra	25.9
Uttar Pradesh	15.5	**South**	
East		Andaman and Nicobar Islands	31.0
Bihar	3.3	Andhra Pradesh	17.7
Jharkhand	8.8	Karnataka	20.5
Odisha	7.3	Kerala	48.5
West Bengal	9.1	Lakshadweep	37.6
Northeast		Puducherry	36.6
Arunachal Pradesh	9.2	Kerala	22.7
Assam	6.1	Tamil Nadu	23.2
Manipur	10.4		

Source: International Institute for Population Sciences (IIPS) and ICF. 2017. National Family Health Survey (NFHS-4), 2015-16: India. Mumbai: IIPS. Table 2.5, Page 30.

Association among Socioeconomic Factors

Industrial and service sectors are normally concentrated in urban centers generating direct as well as indirect employment and thus, attracting literates and educated for employment and illiterate to eke out livelihood. This leads to structural change in increasing migrant's proportion in the population. These developments will have major impact on population redistribution and non-agriculture activities. The compounding effects will make socioeconomic factors to significantly associate among themselves.

Association among social factors: The Hindu, Muslim, and Christian populations are excusive religious groups. So, as the proportion of Hindus increases, the proportions of Muslims and Christians decrease in the total population and vice versa. Hence, the percentages of Hindus and Muslims is negatively associated (-0.377, $p<0.005$) and the percentages of Hindus and Christians is negatively associated (-0.722, $p<0.01$). The SC population is considered to be part of Hindu and therefore, the proportions Hindus and SCs should be positively associated (0.542, $p<0.01$). Many tribes adhere to their traditional tribal religions. These tribal religions are often amalgamated with one or more of the major religious traditions of Hinduism, Buddhism, Islam or Christianity, and are often under ongoing pressure of cultural assimilation (Wikipedia, DNK). Therefore, the ST population is an independent group having their own cultural identity and hence, the proportions of ST and Hindu populations should be negatively associated (-0.722, $p<0.01$). It is known that there is a long history of Christianization of the tribes in Northern, Central and Eastern India (Sarkar and Aparna, 2016) and considerable tribal populations have been converted into Christianity. Therefore, the percentages of Christians and the STs should be positively associated (0.719, $p<0.01$). The percentages of Christians and the SCs are negatively correlated (-0.574, $p<0.01$). This is because of the fact that SCs are part of Hindus and the percentages of Hindus and Christians are negatively associated.

Association among social and economic factors: The labour force participation among Muslims is very low in India. It is observed that the Muslims have the lowest labour force of about 33 per cent compared to India's average of 40 per cent (Varma, 2016). The low labour force participation among Muslims is because of very meager women's participation in labour force (Das, 2003). Therefore, the percentage of Muslim population and the labour force participation rates are negatively correlated (-0.568, $p<0.01$).

Association among economic factors: It is observed that the percentage of urban population is positively associated with percentages of literates (0.732, $p<0.01$) and workers in non-agriculture sectors (0.432, $p<0.01$). The percentage of urban population is negatively correlated with non-migrants (-0.455, $p<0.01$). That is, as the literacy rates increase, the percentage of non-migrants tends to decrease. Or as the literacy rates increase, the percentage of migrants tends to increase. This is because the literacy rates among migrants are higher than non-migrants (Bhagat, 2010). The percentage of non-migrants is negatively associated with per cent workers in non-agriculture sectors (-0.576, $p<0.01$). That means, as the percentage of non-migrants (natives) increases, the percentage of workers in non-agriculture sectors tend to decrease. This situation can be seen when different states are at varying levels of economic development.

It is found that the socioeconomic factors are influencing each other in an expected direction. The major associations are that the Hindus (including SCs), Muslims, Christens and the STs are different entities and are negatively associated. The Christians and STs are positively associated because of a long history of conversation into Christianity. The percentage of Muslims and work participation is negatively associated because females' work participation decreases with increase in Muslim population. The percentage of non-migrants is negatively associated with the percentage of workers in non-agriculture sectors. The urban population is positively associated with literacy rates and workers in non-agriculture sectors, and is negatively correlated with non-migrants.

Fertility and Mortality Differentials (CBR, CDR and IMR)

The CBR is high at around 40 births per 1000 population during the early part of the twentieth century (Kulkarni, 2014). The national family planning program initiated by the Government of India in the year 1952 (Drakshayani and Boodeppa, 2014) is successful in changing fertility attitudes form high to low through its Information, Education and Communication (IEC) activities. Thereby, the FP program is able to achieve sustained decline in the CBR over time. The onset of fertility decline is noted to be in the 1970s (Kulkarni, 2014). The CBR stands at 21.8 births in the year 2011. The fertility has declined in many states achieving replacement level fertility of 21.3 births. Fertility in some states has declined far below the replacement level fertility of 21.3 births, called as sub-replacement fertility. Some states have not achieved replacement level fertility by the year 2011 (data not presented).

Four states namely, Goa, Tripura, Manipur and Lakshadweep have achieved sub-replacement fertility of less than 15 births. This is followed by 18 states namely, Andaman and Nicobar Islands, Kerala, Tamil Nadu, Nagaland, Puducherry, Punjab, West Bengal, Himachal Pradesh, Mizoram, Maharashtra, NCT of Delhi, Andhra Pradesh, Sikkim, Jammu and Kashmir, Daman and Diu, Karnataka, Uttarakhand and Arunachal Pradesh have achieved closer to sub-replacement fertility of between 15 and 20 births. The fertility level in Odisha and Gujarat is around 21 births. The rest of the 11 states namely, Haryana, Assam, Meghalaya, Chandigarh, Jharkhand, Chhattisgarh, Dadra and Nagar Haveli, Rajasthan, Madhya Pradesh, Bihar and Uttar Pradesh have yet to achieve the replacement level fertility as the CBR is between 22 and 28 births. The rural- urban differentials in fertility are still visible. The CBR is always higher in rural than in urban areas.

The CDR is high over 40 deaths per 1000 population in the early 1900s (Kulkarni, 2014). The CDR has been declining since the 1920s and is about 7.1 deaths in the year 2011. The CDR is below 4 deaths in 6 states namely, Nagaland, Manipur, NCT of Delhi, Mizoram, Dadra and Nagar Haveli, Andaman and Nicobar Islands and Daman and Diu. It is more than 7 deaths in 12 states namely, Kerala, Karnataka, Puducherry, Tamil Nadu, Andhra Pradesh, Meghalaya, Chandigarh, Uttar Pradesh, Jharkhand, Chhattisgarh, Assam, Madhya Pradesh and Odisha. The CDR ranges between 5 and 6 deaths in the rest of the 12 states. The CDR is always marginally higher in rural than in urban areas (data nor presented).

The IMR is above 100 infant deaths per 1000 live births through the 1970s (Kulkarni, 2014) and declined to 44 infant deaths in the year 2011. The IMR is very low at 12 infant deaths in Kerala, 24 infant deaths in Tamil Nadu. It is between 30 to 40 infant deaths in 6 states namely, Maharashtra, NCT of Delhi, Punjab, West Bengal, Karnataka and Jharkhand, followed by between 30 and 40 infant deaths in 7 states namely, Jammu and Kashmir, Gujarat, Andhra Pradesh, Bihar, Haryana, Chandigarh and Chhattisgarh. The IMR is very high, more than 50 infant deaths, in 5 states namely, Rajasthan, Assam, Odisha, Uttar Pradesh and Madhya Pradesh. The IMR is always higher in rural than in urban areas. The IMR estimates are not available for 15 small states and union territories because of inadequate sample size (data not presented)

The CDR is 7.8 death among males and 6.3 deaths among females. The CDR is higher among males than among females in all states. The CDR is high among males is because males work in high risk

occupations like truck drivers and the like, and are also subjected to vices like alcohol and tobacco consumption.

The IMR is 42.7 Infant deaths among male births and 45.9 infant deaths among female births. The IMR is high among female births than among male births in all states. It is generally believed that female children suffer from discrimination against male children in Indian society; therefore, the IMR is expected to be high among female children.

Mortality transition began during the 1920s and fertility transition during the 1970s. India witnessed rapid population growth in the intervening period from the 1920s to the 1970s. The rapid population growth has transformed the age structure to become young. India launched national family planning program in the year 1952 to contain rapid population growth. Since 1952, family welfare program gained prominence. Many states have achieved replacement fertility (21.3 births) or sub-replacement level fertility of less than 21.3 births. Some states are yet to achieve replacement level fertility of 21.3 births by the year 2011. Although mortality has been declining for long period, it has also responded well to the Indian health policies and programs. It is hovering around 7 deaths in the year 2011. Although, the IMR has been declining since the 1970s, it is still high at 44 infant deaths in the year 2011. Even then, it is far from achieving the UN sustainable goal of 28 infant deaths by 2019 (United Nations, 2017).

Socioeconomic Factors Influencing Ethnicity

An attempt is made to evaluate the usefulness of population speaking two languages as a measure of ethnicity in demographic research. It is generally expected that the socioeconomic factors including population speaking two languages should change with socioeconomic development. Correspondingly, the population speaking two languages also should exhibit differentials as well as correlate with other socioeconomic factors. The same has been examined.

Differentials in Population speaking Two Languages: About 29 percentage of population in India can speak two languages. The population speaking two languages is higher among males (31.3 per cent) than females (25.9 per cent) and is higher in urban (43.9 per cent) than in rural areas (21.7 per cent). The population speaking two languages is significantly varies across states. It is low at less than 20 per cent in 8 states namely, Rajasthan, Uttar Pradesh, Chhattisgarh, Madhya Pradesh, West Bengal, Bihar,

Uttarakhand and Himachal Pradesh. It is high at more than 65 per cent in 5 states namely, Sikkim, Nagaland, Arunachal Pradesh, Andaman and Nicobar Islands and Goa and is between 20 and 65 in the rest of the states. Thus, the percentage of population speaking two languages has exhibited wide variation across states.

Association between Population speaking Two Languages and Other Socioeconomic Factors: The expected association and calculated correlation coefficient between population speaking two languages and other socioeconomic factors is presented in Table 2. The expected association and calculated coefficient between population speaking two languages and other socioeconomic factors are the same. Thus the percentage of population speaking two has exhibited wide variations across states and is correlated with other socioeconomic in expected direction. That is the percentages of population speaking two languages are like any other socioeconomic factors changing concomitant with socioeconomic development. Therefore, the percentage of population speaking two languages is a useful measure of ethnicity in demographic research.

Table 2 Expected association and calculated correlation coefficient between population speaking two language and other socioeconomic factors.

Socioeconomic factors	Expected association with population speaking two languages	Expected direction	Correlation coefficient
% Hindus	Generally Hindus speak mother tongue, especially females.	Negative	-0.297
% Muslims	Generally Muslims speak mother tongue, especially females.	Negative	-0.093
% Christians	Generally Christians speak many languages because of education and expose to church and bible.	Positive	0.266
% SCs	Generally SCs speak mother tongue, especially state language.	Negative	-0.565**
% STs	Generally STs speak mother tongue of their own and state language because some of them live in state boarders.	Positive	0.189
% urban	Urban population speaks many languages because of high literacy levels and migration from other	Positive	0.275

	states.		
% literates age 6+	Generally literates speak many languages because education policy of three languages.	Positive	0.296
% workers	Generally workers speak many languages, partly because they temporary migration for work	Positive	0.185
% workers in non-agricultural sector	Generally workers in non-agriculture occupations speak many languages, because of necessity in work place.	Positive	0.432**
% non-migrants	Generally non-migrants need not speak many languages because it is often not necessary.	Negative	-0.455**

**.Significant at the 0.01 level (2-tailed) and * Significant at the 0.05 level (2-tailed).

Association between Ethnicity, and Fertility and Mortality

The association of the population peaking two languages with the CBR, CDR and IMR is not known, but expected to be negatively correlated. That is, as the percentage of population speaking two languages varies from low to high, the ethnic character of population varies from high to low. Therefore, as the ethnic character of population decreases, the fertility and mortality tend to decrease. The correlation coefficients between the population speaking two languages, and the CBR, CDR and IMR by sex and residence are presented in Table 3. The population speaking two languages is negatively correlated with the CBR, CDR and IMR among the total, male and female populations, and in rural and urban areas. It can be observed from the data that while the population speaking two languages is negatively associated with CBR and CDR among males and females in rural areas, it is associated only with CDR in urban areas.

Table 3 Correlation coefficients between the population speaking two language, and fertility and mortality Indicators.

Reasidence	Fertility and Mortality Indicators	Total	Male	Female
Total	Birth Rate	-0.375*		
	Death Rate	-0.473**	-0.414*	-0.490**
	Infant Mortality Rate	-0.256*	-0.491**	-0.455**

Rural	Birth Rate	-0.412*		
	Death Rate	-0.412*	-0.370*	-0.435**
	Infant Mortality Rate	-0.188	-0.154	-0.016
Urban	Birth Rate	-0.171		
	Death Rate	-0.499**	-0.380*	-0.514**
	Infant Mortality Rate	-0.174	-0.041	-0.050

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Influence of Socioeconomic Factors on Fertility and Mortality

This section is intended to study the influence of socioeconomic factors, particularly, to the significance of ethnicity measured by the population speaking two languages on the CBR, CDR and IMR.

Regression results of Socioeconomic Factors on CBR: The regression results of socioeconomic factors on the CBR are presented in Table 4. The variation explained by model 2 is about 70 per cent in the total, 86 per cent in rural and 52 per cent in urban populations. The variation explained in the CBR between models 1 and 2 is very similar in rural population (2 percentage points) and is small in the total population (15 percentage points) and in urban population (20 percentage points).

According to model 2, the percentages of literates and population speaking two languages are able to explain significant variation in the CBR in the total, rural and urban populations. The 'β' coefficients are negative for both the percentages of literates and the population speaking two languages. That means, as the percentages of literates and the population speaking two languages increase, the CBR tends to decrease. In other words, as the ethnic character of the population increases, the CBR tends to increase. Similar observations have been made with regard to literacy and CBR in other studies (Kulkarni, 2014 and IIPS and ICF, 2017).

In general, fertility is high among Muslims and the SCs (Kulkarni, 2002) and is low among workers in non-agricultural sectors. On the contrary, the observed 'β' coefficients are negative for percentages of Muslims and the SCs; and positive for the workers in non-agriculture sectors (model 2). These trends are not according to expectations. But, the correlations coefficients among fertility, per cent Muslims, per

cent the SCs and per cent workers in non-agriculture sector are negligible. Therefore, these regression results are beyond explanation.

Table 4 Influence of socioeconomic factors on CBR - Beta coefficients of normal regression (Model 1) and stepwise regression (Model 2).

Socioeconomic factors	Total		Rural		Urban	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
R Square	0.851	0.698	0.882	0.859	0.724	0.517
R	0.724	0.487	0.778	0.737	0.524	0.267
Adjusted R Square	0.598	0.472	0.689	0.693	0.334	0.245
Constant	56.887	45.087	66.692	57.106	56.090	46.166
% Population speaking two languages	-0.078+		-0.159**	-0.156**	-0.031	
% Urban population	0.038					
% Hindu population	0.045		-0.030		0.128	
% Muslim population	-0.084		-0.132*	-0.067*	0.029	
% Christian population	-0.033		-0.091		0.035	
% Scheduled Caste population	-0.168		-0.278**	-0.198**	-0.152	
% Scheduled Tribe population	0.046		0.010		0.067	
% Literates age 6+	-0.423**	-0.353**	-0.397**	-0.466**	-0.477*	-0.366**
% Workers to total population	-0.181		-0.160		-0.064	
% Workers in non-agricultural sectors to total workers	0.033		0.081*	0.092**	-0.032	
% Non-migrant population	0.000		-0.003		-0.074	

** 'β' coefficient is significant at the 0.01% level (2-tailed)
* 'β' coefficient is significant at the 0.05% level (2-tailed).

Regression results of Socioeconomic Factors on CDR: The regression results of socioeconomic factors on the CDR are presented in Table 5. The variation explained in the CDR by model 2 is about 56 per cent

in the total, 73 per cent in rural and 64 per cent in urban populations. The variation explained in the CDR between models 1 and 2 is small indicating that both models are the similar.

The population speaking two languages is found to be a significant factor in explaining variation in CDR in the total, rural and urban populations. The observed 'β' coefficient is negative. Therefore, the percentage of population peaking two languages and the CDR are negatively associated or as the ethnic character of population increases, the CDR tends to increase.

The percentage of Christians in the total population, the percentages of literates and non-migrants in rural population, and the labour force participation rates in urban population are found to explain significant variation in the CDR. The percentages of Christians, literates and non-migrants, and labour force participation rates are negatively associated with the CDR as the observed 'β' coefficients are negative. Many studies have found that the CDR is negatively influenced by the factors like Christians and the non-migrants and labour force participation (Kulkarni, 2014, and IIPS and ICF, 2017).

Table 5 Influence of socioeconomic factors on CDR - Beta coefficients of normal regression (Model 1) and stepwise regression (Model 2).

Socioeconomic factors	Total		Rural		Urban	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
R Square	0.713	0.565	0.800	0.732	0.712	0.641
R	0.508	0.319	0.640	0.536	0.507	0.386
Adjusted R Square	0.283	0.278	0.497	0.492	0.310	0.346
Constant	18.151	7.706	21.287	17.717	-0.666	7.817
% Population speaking two languages	-0.030	-0.026*	-0.049**	-0.034**	-0.014	-0.028**
% Urban population	0.000					
% Hindu population	-0.007		-0.022		0.021	
% Muslim population	0.016		0.006		0.031	
% Christian population	-0.014	-0.018*	-0.028		0.027	
% Scheduled Caste population	0.015		-0.038		0.048	

% Scheduled Tribe population	0.006		0.005		-0.010	
% Literates aged 6+	-0.036		-0.070	-0.080**	0.009	
% Workers to total population	-0.037		0.031		-0.024	-0.046**
% Workers in non-agricultural sectors to total workers	-0.028		-0.023		0.033	
% Non-migrant population	-0.078*		-0.102**	-0.066**	0.018	

** 'β' coefficient is significant at the 0.01% level (2-tailed)
* 'β' coefficient is significant at the 0.05% level (2-tailed).

Males: The population speaking two languages is able to explain significant variation in the CDR in the total, rural and urban populations among males. As the ethnic character of the population increases, the CDR tends to increase because the observed 'β' coefficient is negative. The percentage of Muslims is able to explain significant variation in the CDR in urban population. As the percentage of Muslim population increases, the CDR tends to increase because the observed 'β' coefficient is positive (data not presented).

Females: The percentages of population speaking two languages and non-migrants in the total and in rural populations, and the per cent literates in the total population are able to explain significant variation in CDR. The percentage of population speaking two languages, literates and non-migrants are negatively associated with the CDR as the observed 'β' coefficients are negative. The percentages of Muslims and the SCs are significant in explaining variation in the CDR in urban population. That is, as the percentages of Muslims and the SCs increase, the CDR tends to increase because the observed 'β' coefficients are positive (data not presented).

Table 6 Influence of socioeconomic factors on IMR - Beta coefficients of normal regression (Model 1) and stepwise regression (Model 2).

Socioeconomic factors	Total		Rural		Urban	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
R Square	0.897	0.663	0.782	0.636	0.937	0.656
R	0.805	0.44	0.612	0.405	0.879	0.43
Adjusted R Square	0.566	0.41	0.223	0.374	0.757	0.4
Constant	173.332	111.218	113.579	107.624	120.976	33.721

% Population speaking two languages	-0.074		-0.115		-0.034	
% Urban population	-0.632					
% Hindu population	0.588		0.066		0.757**	
% Muslim population	0.236		-0.122		1.210**	
% Christian population	-1.082		-0.950		-0.160	-1.624**
% Scheduled Caste population	0.080		-0.361		1.942**	
% Scheduled Tribe population	0.849		0.212		2.243	
% Literates aged 6+	-1.669	1.024**	-0.836	-0.989**	-0.662	
% Workers to total population	-0.848		-0.347		-0.589	
% Workers in non-agricultural sectors to total workers	0.905		0.219		-0.904	
% Non-migrant population	-0.990		0.004		-0.921**	

** 'β' coefficient is significant at the 0.01% level (2-tailed)
* 'β' coefficient is significant at the 0.05% level (2-tailed).

Regression results of Socioeconomic Factors on IMR: The regression results of socioeconomic factors on the IMR are presented in Table 6. The variation explained in the IMR by model 2 is about 65 per cent in the total, rural and urban populations. The variation explained in the IMR between models 1 and 2 is small in rural population (14 percentage points) and is large in the total (24 percentage points) and urban (28 percentage points) populations.

The per cent literates in the total and rural population and the per cent Christians in urban population are able to explain significant variation in the IMR. As the percentages of literates and the Christians increase, the IMR tends to decrease because the observed 'β' coefficients are negative.

Male and Female IMR: The factors explaining significant variation are the same in both male and female IMR. The per cent literates in the total and rural population, the per cent population speaking two languages in the total population and the per cent Christians in urban population are significant in explaining the variation among sex specific IMRs. As the percentages of literatures and Christians increase, the IMR tends to decrease because the observed 'β coefficients are negative. As the percentage

of population peaking two languages increases, the ethnic character of the population and also IMR tend to decrease the observed 'β coefficients are negative (data not presented).

Conclusions

An attempt is made to identify significant socioeconomic factors influencing fertility and motility transition by using 'transition and transformation' framework of analysis. Secondly, ethnicity is used first time as one of the explanatory factors of fertility and mortality transition in demographic research.

The socioeconomic data are computed from 2011 census, the fertility and mortality estimates for the year 2011 are collected from the published reports of the Sample Registration System, (SRS). Since the data on fertility and mortality estimates are available at state level, the analysis also is presented at state level by residence and sex.

The correlation and regression techniques have been used in the data analysis. Of all the multiple regression techniques, stepwise regression is found to a suitable to minimize the multicollinearity among socioeconomic factors. The procedure adds the most significant factor or removes the least significant factor in the model and produces a single regression model when the algorithm ends.

The measurement of ethnicity is an issue resolved after literature review. It is observed that language is an important ethnic trait of population than religion and caste because religion and caste identities include many ethnic groups. Data on language are available for many census years. The percentage of population speaking only mother tongue would have been a good measure of ethnicity, but such data are not directly available. Therefore, the percentage of population speaking two languages is used to a measure ethnicity under the assumption that the population speaking more languages would have exposed to other ethnic cultures and are not closed for new and innovative ideas. Therefore, as the percentage of population speaking two languages increase, the ethnic character of the population decreases.

The socioeconomic development varies widely across states. However, the broad conclusion is that the states/union territories excepting in Andhra Pradesh in south, Dadra and Nagar Haveli in West and Rajasthan in North regions are doing better in socioeconomic development. Similarly, all states/union

territories in East, Central and Northeast regions excepting Mizoram in Northeast have found to be lagging behind in socioeconomic development.

Fertility (CBR): Of all factors, fertility is significantly influenced by the percentages of literates and the population speaking two languages. As the percentages of literates and the population speaking two languages increase, the CBR tends to decrease. In other words, as the ethnic character of the population increases, the CBR also tends to increase.

Mortality (CDR): The percentage of Christians, literates, non-migrants and workers are found to explain significant variation in the CDR in any one or more of the population sub-groups like, rural or urban and male or female. The percentages of Christians, literates and non-migrants, and workers are negatively associated with the CDR.

The population speaking two languages is a significant factor in explaining variation in CDR in many population sub-groups like rural or urban and male or female. Therefore, it turned out to be an important factor influencing CDR. The percentage of population peaking two languages and the CDR are negatively associated or as the ethnic character of the population increases, the CDR tends to increase.

Mortality (IMR): The per cent literates in the total and rural population and the per cent Christians in urban population are able to explain significant variation in the IMR. As the percentages of literates and the Christians increase, the IMR tends to decrease.

The per cent literates in the total and rural population, the percentage of population speaking two languages in the total population and the percentage of Christians in urban population are significant in explaining the variation among sex specific IMR. As the percentages of literatures and Christians increase, the IMR tends to decrease. As the percentage of population peaking two languages increases, the ethnic character of the population and also IMR tend to decrease.

The study found that the percentage of population speaking two languages or the ethnicity is a most significant factor influencing fertility and mortality. The vital rates like CBR, CDR and IMR vary positively with the ethnicity. Or as the ethnic character of population increases, the fertility and mortality tends to increase. Secondly, the language seems to a better proxy to measure ethnicity than religion of

caste as religion and caste include many ethnic groups. Thirdly, fairly detailed data on languages is available in each census to carry out cross section or temporal analysis.

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Levels, Trends and Fertility Differentials in Bihar

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Abstract

India has experienced fertility decline and several Indian states have achieved or on the way of achieving the replacement level fertility but Bihar still has a fertility rate as high as above three children per woman with considerable variations in the levels and trends of fertility. This paper has examined the levels, trends, and fertility differentials in Bihar. The data from the secondary sources has been used and an analysis of changes and trends has been conducted from 1981 to 2017. The analysis revealed that the total fertility rate in Bihar declined from 5.7 in 1981 to 3.2 in 2017, according to Sample Registration System estimates. The results confirm high fertility and the persistence of district wise differences in fertility. The pattern of fertility decline was not uniform in rural and urban areas and rural areas were lagging behind urban areas. It also shows that fertility is declining slowly in Bihar. The fertility decline was mainly due to the education, decrease in higher-order births of three and above. There has not been any significant decline in first and second-order births in Bihar. There is a negative relationship between education and fertility. This indicates the education of women has contributed to lower fertility. Therefore, the education of girls needs to be encouraged. There is a need to give more thrust on rural areas for achieving below-replacement fertility in Bihar.

Keywords: Fertility, Transition, Levels, Trends, Differentials, Bihar

Introduction

India had experienced substantial fertility reduction and fertility transition in all the states but the levels and trends of fertility vary considerably in the districts of Bihar. Bihar is among five of the nine high focus states still have fertility rate as high as above three children per woman. There

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are considerable variations in the levels and trends of fertility in Bihar. The fertility transition in India may be dependent upon fertility change in the nine high focus states. Fertility transition appeared for the first time during the 1970s in Bihar, Rajasthan, and Uttar Pradesh (UP). During 1970-90 fertility declined by about 1.6 children in Bihar and Rajasthan, but only by about 1.2 in Madhya Pradesh and Uttar Pradesh. Changes in fertility occurred among older women. TFR was higher in Uttar Pradesh and lower in Bihar in 1991 compared to 1961. Fertility decline accelerated over time (Ram and Ram, 1997).

The future fertility scenario in Bihar and Uttar Pradesh mainly decides the population stabilization of India, as these states constitute one-fourth of India's population. Of all the bigger states of India, the decadal growth rate of the population during 2001-2011 was the highest 25.07 percent in the state of Bihar (Registrar General of India, 2011). Fertility in Bihar continues to remain well above the replacement level although it is decreasing at a slower pace. The replacement level fertility and population stabilization in India can not be achieved without a faster fertility decline in Bihar and Uttar Pradesh (Planning Commission, 2008).

The fertility transition was slow in most districts of Bihar. Factors such as women's years of schooling, age at marriage, the size of the Muslim population, and child mortality are the most important predictors of fertility variations across the districts in Bihar (Das and Mohanty, 2012). The study of rural-urban differentials in India based on the Sample Registration System data of 1972-81 revealed that there was a decline in marital fertility at the older ages and a marginal increase in fertility at the younger ages. Urban women were found to have lower fertility than rural women did and voluntary fertility control was the main reason responsible for a larger decline in marital fertility (Pathak and Murthy, 1987). Many studies highlighted the importance of women's education as a significant predictor of small family norms and fertility decline regardless of religion, culture, and level of development (Vaidyanathan, 1989; Jejeebhoy, 1995; UN, 1995; Parasuraman et. al., 1999; Dreze and Murthi, 2001). Evidence also suggests that fertility reduction in recent years in India is largely due to fertility reduction among uneducated and poor women (Bhat, 2002; McNay *et al*., 2003; Arokiasamy, 2009).

Bihar is also lagging in many of the key socio-economic and health indicators. Bihar is ranked at the bottom of the human development index (Planning Commission, 2011; Mohanty and Ram, 2011). Bihar is the twelfth largest state in India, with a total area of 94,163 square kilometres. Bihar is having the third highest population among all the States/Union Territories in India. The population of Bihar increased from 52 million in 1981 to 104 million in 2011. Out of every 100 persons in India, nine are from Bihar. The population of Bihar doubled during 1981 and 2011, an increase of 52 million in Bihar for 30 years. The population growth in the Bihar varies from decade to decade. The decadal growth of the population in Bihar has been increased from 24.23 percent in 1981 to 25.33 percent in 2011. The literacy rate in Bihar has increased from 32.1 percent in 1981 to 61.8 percent in 2011. According to the 2011 census, male literacy stands at 71.20 percent while female literacy is at 46.40 percent in Bihar. The sex ratio in Bihar has increased from 933 females per 1000 males in 1981 to 940 females per 1000 males in 2011. The density of the population in Bihar has increased from 402 persons per square kilometre in 1981 to 1102 persons per square kilometre in 2011. The percentage of the urban population in Bihar has decreased from 12 percent in 1981 to 11 percent in 2011.

Few researchers have studied the fertility transition in Bihar. Though all the states of India are experiencing fertility transition, the pace of change is not uniform across the states. The fertility level in Bihar remains high, TFR of Bihar declined from 5.7 in 1981 to 3.2 in 2017 (Registrar General of India, 2018). The state of Bihar have attracted the attention of demographers and development planners in recent years because Bihar is among the bigger states in India and lagging in many socioeconomic and demographic indicators. The marked variations in fertility by residence combined with well-known differences in education provide the opportunity for systematic examination of the levels, trends, and the factors contributing to fertility differentials. Therefore, the present paper is an attempt to study the fertility transition in Bihar.

Data and Methods

The data have been used from various secondary sources such as Sample Registration System, Fertility in India: An analysis of 1981 census data, District level estimates of fertility and child

mortality for 1991 and their inter-relations with other variables in India, Fertility at District Level in India: Lessons from the 2011 Census and Estimation of district-level TFR of eight EAG states and Assam from NFHS-4, 2015-16. An analysis of changes and trends has been conducted from 1981 to 2017.

Results

Vital rates in Bihar

The vital rates play an important role in the growth of the population. The trends in birth, death, and infant mortality rate in Bihar are presented in Table 1. It is revealed from the table that the birth rate in Bihar has declined from 39.1 per thousand populations in 1981 to 26.4 per thousand populations in 2017. Similarly, the birth rate in rural areas has declined from 39.7 per thousand populations in 1981 to 27.2 per thousand populations in 2017 whereas the birth rate in urban areas has declined from 33.9 per thousand populations in 1981 to 20.9 per thousand populations in 2017.

Table 1: Trends in birth rate, death rate and infant mortality rate by residence in Bihar, 1981-2017

Year	Total	Rural	Urban
Birth Rate			
1981	39.1	39.7	33.9
1986	36.5	37.2	29.8
1991	30.7	31.3	25.5
1996	32.1	33.1	23.6
2001	31.2	32.3	23.4
2006	29.9	30.7	23
2011	27.7	28.4	21.7
2017	26.4	27.2	20.9
% change during 1981-2017	-32.5	-31.5	-38.4
Death Rate			
1981	13.9	14.7	8
1986	13.8	14.4	8.8
1991	9.8	10.2	6.3
1996	10.2	10.6	6.9
2001	8.2	8.5	6.3
2006	7.7	7.8	6.3
2011	6.7	6.9	5.5
2017	5.8	5.9	5.4

% change during 1981-2017	-58.3	-59.9	-32.5
Infant Mortality Rate			
1981	118	124	60
1986	101	104	68
1991	69	71	46
1996	71	73	54
2001	62	63	52
2006	60	62	45
2011	44	45	34
2017	35	36	31
% change during 1981-2017	**-70.3**	**71.0**	**-48.3**

Note: Bihar excludes Jharkhand in 2006, 2011; and 2017
Source: India, Registrar General, Compendium of India's Fertility and Mortality Indicators, 1971-2007; India, Registrar General, Sample Registration System Statistical Report 2017.

The percentage change in the average birth rate in Bihar is 32.5 percent but the percentage change in urban areas is higher 38.4 percent as compared to 31.5 percent in rural areas of Bihar between the periods 1981 and 2017. At the same time, the crude death rate in Bihar has also declined from 13.9 per thousand populations in 1981 to 5.8 per thousand populations in 2017. Similarly, the death rate in rural areas has declined from 14.7 per thousand populations in 1981 to 5.9 per thousand populations in 2017 whereas the birth rate in urban areas has declined from eight per thousand populations in 1981 to 5.4 per thousand populations in 2017. The percentage change in the average death rate in Bihar is 58.3 percent but the percentage change in rural areas is higher 59.9 percent as compared to 32.5 percent in urban areas of Bihar between the periods 1981 and 2017. Infant Mortality Rate (IMR) per thousand live births in Bihar has steadily declined from 118 in 1981 to 35 in 2017. Similarly, the infant mortality rate per thousand live births both in rural and urban areas of Bihar has steadily declined from 124 and 60 in 1981 to 36 and 31 in 2017 respectively. The percentage change in infant mortality rate in Bihar is 70 percent but in rural areas of Bihar, it is higher 71 percent as compared to 48.3 percent in urban areas of Bihar between the periods 1981 and 2017.

Fertility trends in Bihar

Trends in age-specific fertility rates per 1000 women by residence in Bihar are depicted in Table 2. The age-specific fertility rates are much higher in rural areas than in urban areas of Bihar in all age

groups. There is a consistent fertility decline by residence among all age groups in Bihar. The age-specific fertility rates declined in both urban and rural areas of Bihar from 1981 to 2017. The peak age of childbearing is 20-29, with steadily declining fertility rates thereafter. The high fertility is still concentrated in the prime childbearing age 20-29 years in both urban and rural areas in Bihar. Fertility rates declined sharply in the age group 15-19 and beyond the age of 25, reaching extremely low levels for women age 40-44 and 45-49 in Bihar. Early childbearing is substantial in Bihar, which accounted for 2.17 percent of births in the age group 15-19. It was also observed that 63.57 percent of births occur to women below the age of 30 in Bihar. The contribution of early childbearing (age 15-19) is higher 2 percent in rural areas than 1.84 percent in urban areas of Bihar. It is also found that the percentage of births occur to women below the age of 30 in 2017 is 63.57 in rural areas and 70.39 percent in urban areas of Bihar. The percentage change in age-specific fertility rate during 1981-2017 reveals that the overall decline in fertility rates is more in urban areas compared to rural areas in Bihar. The fertility decline is slower in the middle age groups 25-29 for both rural and urban areas in Bihar. The minimum declines of 17 percent and 19 percent have been noticed in the age group 25-29 both in rural and urban areas of Bihar respectively.

The total fertility rate declined considerably from 1981 to 2017 in Bihar. The trends of total fertility rate by residence in Bihar from 1981-2017 is presented in Table 3. Fertility has been declined from 5.7 in 1981 to 3.2 in 2017. The fertility in rural areas has been declined from 5.8 in 1981 to 3.3 in 2017 as compared to 4.8 in 1981 to 2.4 in 2017 in urban areas of Bihar. The pace of fertility decline is accelerated in Bihar during the period 1981-91, with an estimated TFR of 5.7 per woman in 1981 to 4.4 in 1991. The pace of fertility decline is decelerated, with an estimated TFR of 4.4 in 1991 and 2001 in Bihar. In 2011, it further declined to 3.6 in Bihar. The fertility decline also shows an accelerated fall in Bihar during 1981-91 but there is no fertility decline during 1991-2001 in Bihar. A steep drop during the 2001-2011 decade and 2011-2017 was observed in Bihar. The annual decline in fertility during the period 1981-2017 was 2.17 percent, higher 1.39 percent in rural areas of Bihar than 1.20 percent in urban areas of Bihar. The

comparison of the TFR between 1981-91 and 1991-2001, shows that the rate of decline in the TFR is lower during 1991-2001 (no decline) compared to 2.28 percent during 1981-1991 in Bihar.

Table 2: Trends in age-specific fertility rate by residence in Bihar, 1981 to 2017, (Per 1000 women).

Age Group	1981	1991	2001	2011	2017	% change during 1981-2017
Total						
15-19	114.0	78.5	53.5	33.0	14.0	-87.72
20-24	275.5	230.8	244.6	247.5	164.9	-40.15
25-29	277.4	203.9	233.3	221.4	229.8	-17.16
30-34	214.0	165.1	180.9	128.8	156.2	-27.01
35-39	145.0	116.1	104.3	58.4	48.6	-66.48
40-44	73.1	59.9	54.6	26.3	21.9	-70.04
45-49	33.2	26.5	15.3	6.3	7.5	-77.41
Rural						
15-19	118.9	82.2	56.8	34.0	14.7	-87.64
20-24	276.5	234.0	255.6	257.4	169.9	-38.55
25-29	281.8	205.4	238.5	226.4	234.7	-16.71
30-34	218.4	169.8	189.6	133.2	165.5	-24.22
35-39	151.3	119.4	108.7	61.3	52.5	-65.30
40-44	74.6	63.4	58.6	28.1	23.9	-67.96
45-49	33.8	27.6	15.6	6.8	8.0	-76.33
Urban						
15-19	78.3	45.7	27.8	24.2	8.9	-88.63
20-24	267.6	204.7	176.5	172.2	133.3	-50.19
25-29	243.4	190.8	193.5	180.3	197.7	-18.78
30-34	177.0	121.8	118.0	91.7	102.7	-41.98
35-39	97.9	87.8	70.0	33.1	25.3	-74.16
40-44	61.3	28.9	28.2	12.5	10.7	-82.54
45-49	27.4	16.8	13.2	2.9	4.3	-84.31

Note: Bihar excludes Jharkhand in 2006, 2011 and 2017
Source: India, Registrar General, Compendium of India's Fertility and Mortality Indicators, 1971-2007; India, Registrar General, Sample Registration System Statistical Report, 2017.

Similarly, the comparison of the TFR between 1991-2001 and 2001-2011 in Bihar indicates that the rate of decline in the TFR is lower during 1991-2001 compared to 2001-2011. There was no fertility decline during 1991-2001 compared to 1.82 percent per year during 2001-2011 children (3.2) as compared to six children (5.7) in 1981. The TFR of rural Bihar was 5.8 and in the urban areas, it was 4.8 in 1981, thus having a difference of 17 percent. It declined to 3.3 in rural areas

and 2.4 in urban areas of Bihar in 2017, a difference of 27 percent. The percentage of annual decline in the TFR was 1.20 in rural areas and in urban areas; it was 1.39 during 1981-2017 in Bihar. During 2011-17, the fertility decline in rural Bihar has been faster (an average annual decline of 1.80 percent in the TFR) as compared to 1.28 percent in urban areas. The difference between rural and urban TFRs in Bihar has increased from 17 percent in 1981 to 27 percent in 2017.

Table 3: Trends in total fertility rate by residence in Bihar, 1981 to 2017

Year	Total	Rural	Urban
1981	5.7	5.8	4.8
1986	5.2	5.3	4.2
1991	4.4	4.5	3.5
1996	4.5	4.6	3.2
2001	4.4	4.6	3.1
2006	4.2	4.3	3
2011	3.6	3.7	2.6
2017	3.2	3.3	2.4
Index of TFR			
1981	100	100	100
1986	91.23	91.38	87.50
1991	77.19	77.59	72.92
1996	78.95	79.31	66.67
2001	77.19	79.31	64.58
2006	73.68	74.14	62.50
2011	63.16	63.79	54.17
2017	56.14	56.90	50.00
Percent Decline in TFR			
1981-1991	-22.81	-22.41	-27.08
1991-2001	0.00	2.22	-11.43
2001-2011	-18.18	-19.57	-16.13
2011-2017	-11.11	-10.81	-7.69
1981-2017	-43.86	-43.10	-50.00
Percent Annual Decline in TFR			
1981-1991	-2.28	-2.24	-2.71
1991-2001	0.00	0.22	-1.14
2001-2011	-1.82	-1.96	-1.61
2011-2017	-1.85	-1.80	-1.28
1981-2017	-2.17	-1.20	-1.39

Note: Bihar excludes Jharkhand in 2006 and 2011 and 2017

Source: India, Registrar General, Compendium of India's Fertility and Mortality Indicators, 1971-2007; India, Registrar General, Sample Registration System Statistical Report, 2017.

Marital Fertility Trends in Bihar

Age at the marriage of females is a key factor that influences fertility. Based on the distribution of live births by age of married females, age-specific marital fertility rates (ASMFRs) are calculated. Trends in age-specific marital fertility rates per 1000 women by residence in Bihar are depicted in Table 4.

Table 4: Trends in age-specific marital fertility rate by residence in Bihar, 1984-2017

Age Group	1984	1991	2001	2011	2017	% change during 1984-2011
Total						
15-19	202.4	188.9	186.7	235.3	413.5	104.30
20-24	300.8	273.9	310	344.6	329.3	9.47
25-29	258.4	214.2	245.3	235.8	255.5	-1.12
30-34	215.8	171.7	184.7	132.4	160.9	-25.44
35-39	135.9	122.9	108	60.4	49.9	-63.28
40-44	86.8	65.6	58.2	27.7	22.8	-73.73
45-49	52.2	30.9	17	6.8	8	-84.67
Rural						
15-19	199.8	189.2	189.2	234.7	416.3	108.36
20-24	297	270.8	311.7	347.5	327.7	10.34
25-29	259.8	214.8	248.7	238.1	256.3	-1.35
30-34	220.1	176.7	193.5	136.6	169.4	-23.03
35-39	141.2	126.3	112.5	63.4	53.7	-61.97
40-44	90.5	69.6	62.5	29.6	24.8	-72.60
45-49	55.2	32	17.3	7.3	8.5	-84.60
Urban						
15-19	241.6	184.7	155.2	244.2	383.1	58.57
20-24	345.4	305.9	295.4	315.3	343.1	-0.67
25-29	245.9	208.8	217.5	214.1	249.6	1.50
30-34	176.6	127.2	121.2	96	109.9	-37.77
35-39	91.4	93.1	72.6	34.6	26.5	-71.01
40-44	49.7	31.5	29.9	13.4	11.3	-77.26
45-49	21.4	19.8	14.6	3.1	4.6	-78.50

Note: Bihar excludes Jharkhand in 2006, 2011 and 2017
Source: India, Registrar General, Compendium of India's Fertility and Mortality Indicators, 1971-2007; India, Registrar General, Sample Registration System Statistical Report, 2017.

There is consistent marital fertility decline by residence among all age groups except the age group 15-24. The age-specific marital fertility rates declined from 1984 to 2017 in Bihar. Marital fertility in Bihar is much higher in rural areas than in urban areas in all the age groups and its peak is in the age group 20-24 years. A perceptible decline in marital fertility is seen for a female-aged 30 years and above both in rural areas and urban areas of Bihar. The high marital fertility is still concentrated in the prime childbearing age 20-29 years in both urban and rural areas of Bihar. Marital fertility rates increased in the age group 15-24 and it declined sharply beyond the age of 25, reaching extremely low levels for women age 40-44 and 45-49. Early marital fertility is substantial in Bihar, which accounted for 33 percent of births in the age group 15-19 in Bihar. It was also observed that 81 percent of births in Bihar occur to women below the age of 30. Surprisingly, the contribution of early marital fertility (age 15-19) is slightly higher 34 percent in urban areas than 33 percent in rural areas of Bihar. But a higher 87 percent of births occur to women below the age of 30 in urban areas than 80 percent of births occur to women below the age of 30 in rural areas of Bihar in 2017. The percentage change in age-specific marital fertility rate during 1981-2017 reveals that the overall decline in fertility rates is more in urban areas compared to rural areas in Bihar. The decline is perceptible for the higher age groups 40-49 in both urban and rural areas of Bihar. During 1984-2017, the marital fertility in the age groups 40-49, declined by 85 percent in rural areas and 79 percent in urban areas in Bihar. The marital fertility increased in the early age groups (15-19 and 20-24) for the rural areas and 15-19 age groups in urban areas in Bihar. The increase in marital fertility of 104 percent in the age group of 15-19 and 9 percent in age group 20-24 has been noticed in Bihar.

The total marital fertility rate declined considerably from 1984 to 2017 in Bihar. The trends of total marital fertility rate from 1984-2017 in Bihar are presented in Table 5. From the beginning, the TMFR of rural areas is found to be higher than the urban areas in Bihar. During the period 1984-86, marital fertility seems to have decreased from a TMFR of 6.3 per woman in 1984 to 6 in 1986 in Bihar. It further decreased to 5.3 in 1991 but it increased to 5.5 in 2001 and declined to 5.2 in 2011 but they again increased to 6.2 in 2017 in Bihar. The marital fertility decline also

shows a moderate fall through the 1980s, decelerated in Bihar during 1991-2001, and a drop during the 2001-2011 decade but an increase in marital fertility during 2011-2017. The annual decline in marital fertility during the period 1984-2017 was 0.05 percent for Bihar. The comparison of the TMFR between 1984-91 and 1991-2001, shows that the rate of decline in the TMFR is lower during 1991-2001 (an increase of 0.38 percent per year) compared to 2.27 percent during 1984-1991 in Bihar. Similarly, the comparison of the TMFR between 1991-2001 and 2001-2011, indicates that the rate of decline in the TMFR is higher in the recent decade (0.55 percent per year) compared to an increase of 0.38 percent during 1991-2001 and marital fertility increased by 3.21 percent per annum during 2011-2017 in Bihar. On average, married women in Bihar gave birth to six children (6.2) as it was in the early 1980s. The TMFR of rural Bihar in 1984 was 6.3 and in the urban areas, it was 5.9, thus having a difference of 6 percent. It remained 6.3 in rural areas and declined to 5.6 in urban areas of Bihar in 2017, a difference of 11 percent. The percentage of annual decline in the TMFR was 0.15 percent in urban areas whereas there was no decline in rural areas during 1984-2017 in Bihar. During 2011-2017, marital fertility increased both in rural and urban areas of Bihar. The difference between rural and urban TMFRs in Bihar has increased from 6 percent in 1984 to 11 percent in 2017.

Table 5: Trends in total marital fertility rate by residence in Bihar, 1984-2017

Year	Total	Rural	Urban
1984	6.3	6.3	5.9
1986	6.0	6.1	5.7
1991	5.3	5.4	4.9
1996	5.3	5.4	4.5
2001	5.5	5.7	4.5
2006	5.2	5.2	4.8
2011	5.2	5.3	4.6
2017	6.2	6.3	5.6
Index of TMFR			
1984	100	100	100
1986	95.24	96.83	96.61
1991	84.13	85.71	83.05
1996	84.13	85.71	76.27
2001	87.30	90.48	76.27

2006	82.54	82.54	81.36
2011	82.54	84.13	77.97
2017	98.41	100.00	94.92
Percent Decline in TMFR			
1984-1991	-15.87	-14.29	-16.95
1991-2001	3.77	5.56	-8.16
2001-2011	-5.45	-7.02	2.22
2011-2017	19.23	18.87	21.74
1984-2017	-1.59	0.00	-5.08
Percent Annual Decline in TMFR			
1984-1991	-2.27	-2.04	-2.42
1991-2001	0.38	0.56	-0.82
2001-2011	-0.55	-0.70	0.22
2011-2017	3.21	3.14	3.62
1984-2017	-0.05	0.00	-0.15

Note: Bihar excludes Jharkhand in 2006, 2011and 2017
Source: India, Registrar General, Compendium of India's Fertility and Mortality Indicators, 1971-2007; India, Registrar General, Sample Registration System Statistical Report, 2017.

Fertility differentials by the level of education of the women

Female education has a direct impact on fertility. To ascertain levels of fertility by the educational status of the women age-specific fertility rate and total fertility rate by the educational status of the women in Bihar is depicted in Table 6. The data reveals marked rural-urban differences with the rural areas generally reporting higher levels of fertility than the urban areas for all age groups. Fertility attains the peak in the age group 25-29 years both in the rural and urban areas for both illiterate and literate female population. 'Illiterate' women have higher levels of age-specific fertility rates both in the rural and urban areas than the 'Literate', except for the age group 25-29 of the rural areas. Within the 'Literate' group, there is a general decline in the fertility rates with the increase in the educational status both in the rural and urban areas, barring a few exceptions. The total fertility rate for the women having educational status 'Illiterate' for 2017 is 3.1. This is much higher than the 'Literate' group of women. Among the 'Literate' (2.4), there is a gradual decline of TFR with the increase in the level of educational status in Bihar, barring a few exceptions.

Table 6: Age-specific fertility rates and total fertility rates by education and residence in Bihar, 2017

Age Group	Educational level								
	Illiterate	Literate							
		Total Literate	Without any formal education	Below primary	Primary	Middle	Class X	Class XII	Graduate and above
Total									
15-19	39.5	12.2	44.5	29.9	12.9	7.7	6.9	5.0	0.0
20-24	209.4	155.9	214.0	285.6	227.4	181.4	136.6	65.6	52.4
25-29	229.2	230.5	225.4	254.6	257.6	248.9	240.5	217.3	137.2
30-34	164.5	152.8	166.5	170.5	146.9	156.2	131.5	140.7	143.2
35-39	57.3	42.3	42.8	69.1	43.4	35.6	22.6	50.3	43.8
40-44	27.3	17.9	21.7	39.6	11.2	14.1	9.4	12.4	9.8
45-49	7.8	7.3	6.3	12.4	4.0	13.5	6.1	0.0	3.4
TFR	**3.7**	**3.1**	**3.6**	**4.3**	**3.5**	**3.3**	**2.8**	**2.5**	**1.9**
Rural									
15-19	39.8	12.8	43.9	30.8	12.4	8.7	7.1	4.8	0.0
20-24	209.7	160.9	216.2	283.5	228.4	178.4	137.7	64.3	54.4
25-29	230.1	237.4	226.0	250.5	257.6	251.9	251.5	219.7	151.4
30-34	168.1	165.4	172.9	178.9	149.3	172.4	146.3	157.3	189.4
35-39	58.4	47.6	46.1	69.5	48.2	40.1	28.4	69.0	54.1
40-44	28.1	20.4	22.7	44.5	9.8	15.8	11.7	17.4	5.0
45-49	8.0	8.0	6.3	12.7	4.6	17.2	4.3	0.0	3.0
TFR	**3.7**	**3.3**	**3.7**	**4.4**	**3.6**	**3.4**	**2.9**	**2.7**	**2.3**
Urban									
15-19	32.7	8.2	54.2	21.7	17.1	0.8	5.8	5.8	0.0
20-24	203.6	128.5	188.9	307.7	218.3	205.8	130.3	70.3	49.0
25-29	213.1	195.7	217.2	292.6	257.2	229.8	191.0	210.4	117.9
30-34	109.2	102.5	99.9	106.5	130.3	77.0	88.6	115.7	109.0
35-39	42.2	21.5	10.5	65.8	16.4	16.4	7.2	25.3	35.0
40-44	17.2	9.2	11.9	7.3	17.3	7.8	4.9	4.4	12.3
45-49	3.3	4.6	6.2	10.3	0.0	0.0	9.9	0.0	3.9
TFR	**3.1**	**2.4**	**2.9**	**4.1**	**3.3**	**2.7**	**2.2**	**2.2**	**1.6**

Note: Bihar excludes Jharkhand in 2017

Source: India, Registrar General, Sample Registration System Statistical Report, 2017.

The pattern of higher-order births

The distribution of live births by order of birth gives an idea about the total number of children ever born to the eligible women and it gives a broad idea for the preference of the small family. The examination of the trends in the pattern of higher-order births (four and above) also indicates a decline in fertility. The change in higher-order births is a good indicator of fertility change and helps to assess the overall fertility impact of contraceptive prevalence. Since the focus of the family planning program in India is to reduce higher-order births, changes in the proportion of higher-order births over a period are expected to reflect changes in the fertility levels. The proportion of lower-order births are expected to increase because of the reduction in higher-order births when fertility declines from high to low levels.

Table 7: Percentage distribution of live births by order of birth in Bihar, 1991-2017

Year	Order of births			
	1	2	3	4+
Total				
1991	25	21.4	19.6	34
1996	24.8	21.1	19	35.1
2001	25.1	23.1	18.8	33
2006	26.8	23.9	18.1	31.3
2011	32	25	18.4	24.6
2017	32.9	27.9	19.8	19.4
Rural				
1991	24.8	21.2	19.8	34.2
1996	24.4	20.9	19.1	35.6
2001	24.8	22.6	18.9	33.7
2006	26.4	23.7	18.3	31.7
2011	31.4	25	18.5	25.1
2017	32.0	27.6	20.2	20.2
Urban				
1991	26.9	22.7	18.5	32
1996	28.9	23.9	18.7	28.6
2001	28.7	27.7	17.7	25.9

2006	31.3	26.3	16	26.5
2011	38.8	25.1	17.9	18.2
2017	41.0	30.8	16.5	11.8

Note: Bihar excludes Jharkhand in 2006, 2011 and 2017
Source: India, Registrar General, Compendium of India's Fertility and Mortality Indicators, 1971-2007; India, Registrar General, Sample Registration System Statistical Report, 2017.

The distribution of live births by order of births in Bihar is given in Table 7. From the table, it may be observed that the percentage of births of four children and above in Bihar has declined from 34 percent in 1991 to 19.4 percent in 2017. As expected, the percentage of first-order births and second-order births has been increased from 25 percent and 21.4 percent in Bihar in 1991 to 33 percent and 28 percent in Bihar in 2017. The percentage of 3 order births in Bihar has decreased from 19.6 percent in 1991 to 18.4 percent in 2011 and increased to 20 percent in 2017. It may also be noticed that the percentage of birth order up to 2 has increased from 46.4 percent in 1991 to 60.8 percent in 2017 whereas the percentage of birth order 3 and above in Bihar has declined from 53.6 percent in 1991 to 39.2 percent in 2017. A similar pattern is found in both rural and urban areas of Bihar.

Fertility differentials by socio-economic characteristics in Bihar

The total fertility rate for the three years preceding the survey, percentage of women age 15-49 currently pregnant, the mean number of children ever born to women age 15-49, and total fertility rate by background characteristics in Bihar is presented in Table 8.

Table 8: Total fertility rate for the three years preceding the survey, percentage of women age 15-49 currently pregnant, the mean number of children ever born to women age 40-49, and total wanted fertility rate by background characteristics, Bihar, 2015-16.

Socioeconomic characteristics	Total fertility rate	Percentage of women age 15-49 currently pregnant	Mean number of children ever born to women age 40-49	Total wanted fertility rate
Residence				
Urban	2.42	5.0	3.9	1.83
Rural	3.56	7.7	4.6	2.58
Education				
No schooling	4.13	7.7	4.8	2.96

< 5 years complete	3.78	8.8	4.4	2.82
5 - 9 years complete	3.02	7.0	4.0	2.33
10-11 years complete	2.60	5.9	3.5	2.12
12 or more years complete	2.22	6.9	2.9	1.85
Religion				
Hindu	3.29	7.0	4.4	2.43
Muslim	4.11	8.7	5.5	2.75
Other[1]	*	(2.2)	*	*
Caste/Tribe				
Scheduled caste	3.92	8.4	4.9	2.75
Scheduled tribe	3.81	7.1	4.6	2.71
Other backward class	3.38	7.6	4.6	2.51
Other[1]	2.84	5.1	4.0	2.04
Don't know	4.19	8.3	(4.6)	2.56
Total	**3.41**	**7.3**	**4.5**	**2.48**

Note: Total includes Christian women, who are not shown separately. 1 Not a Hindu, Muslim, or Christian ( ) Based on 25-49 unweighted cases * Not shown; based on fewer than 125 unweighted woman-years of exposure for the fertility rates and fewer than 25 unweighted cases for the mean number of children ever born.
Source: IIPS and ICF, 2017.

It is evident from the table that, total fertility rate, the percentage of women currently pregnant, and the mean number of children ever born to women age 40-49 by background characteristics vary in Bihar. The TFR for Bihar is 3.4 children higher for women with no education (4.13) than for women with 12 or more years of education (2.22). The TFR for Muslims is 0.82 children higher than the TFR for Hindus. By caste/tribe, the TFR is 1.08 children higher for scheduled-caste women, 0.97 children higher for scheduled-tribe women, and 0.54 children higher for women belonging to other backward classes (OBC) than for women who do not belong to any of these groups. Fertility transitions in other countries have shown that fertility differentials typically diverge early in the transition and reconverge (though rarely completely) toward the end of the transition as fertility approaches the replacement level. NFHS-4 shows that Bihar as a whole still has substantial fertility differentials with the largest differentials in TFR by the education. Overall, 7.3 percent of women age 15-49 are currently pregnant. The direction of differentials in the percentage of women who are currently pregnant generally parallels the direction of differentials in the TFR. The percentage of currently pregnant women is relatively high in rural areas and among women with no education and less than 5 years of schooling complete, Muslims, and scheduled castes. The mean number of children ever born to women age

40-49 at the time of the survey, who are at the end of their childbearing years, is 4.5. In almost every case, the pattern of differentials in the mean number of children ever born is similar to the pattern of differentials in the TFR. The differentials by religion and caste are a partial exception. Such exceptions can occur because the mean number of children ever born at age 40-49 reflects fertility in the past, whereas the TFR only reflects fertility in the three years preceding the survey.

Discussion and Conclusion

The analysis revealed that the total fertility rate in Bihar declined from 5.7 in 1981 to 3.2 in 2017, according to Sample Registration System estimates. Bihar had experienced a reduction in fertility but still, Bihar is having higher fertility, and the levels and trends of fertility vary considerably. The results confirm the persistence of differences in fertility and it varies by residence and education. The pattern of fertility decline was not uniform in rural and urban areas and rural areas were lagging behind in Bihar. It also shows that fertility is declining slowly in Bihar. It also shows a faster decline during 1981-91 and a moderate fall during 1991-2001, a steep drop during the 2001-2011 and a moderate fall during 2011-2017 in Bihar. A strong negative association was observed between the education level of women and fertility, both in rural and urban areas of Bihar. The fertility decline was mainly due to the education, decrease in higher-order births of three and above and decrease in fertility among older women in the age group 30 and above. Despite fertility differentials, the decline has been observed in rural and urban areas including the illiterate. Despite fertility differentials, the decline has been observed among all sections of the population, including the illiterate and poor. The causes of decline may be different among various socio-economic groups and districts of the Bihar. The socio economic development can more effectively reduce the fertility rate if it emphasizes an equal distribution of benefits. This would entail a more widely dispersed development program, stressing wider improvements in conditions that influence fertility reduction.

From the above analysis, it may be concluded that fertility differentials exist in Bihar because of variations in socio-economic development including education. There is a negative relationship

between education and fertility. This indicates the education of women is contributed to lower fertility. Therefore, the education of girls needs to be encouraged. There is a need to give more thrust on rural areas for achieving below-replacement fertility in Bihar.

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Declining Child Sex Ratio of Maharashtra: A Tehsil-Level Analysis

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Abstract

This study analyses the impact of socio-cultural and developmental variables on 'Declining Child Sex Ratio of Maharashtra' with the help of statistical tools such ascorrelation and multiple regressions. It studies Total CSR (TCSR), along with Rural CSR (RCSR) and Urban CSR (UCSR) at the tehsil level and CSR of Mumbai Wards at the wards level,usingcensus data of 2001 and 2011, to examine rural-urban differences. Socio-cultural variables include percentage of Scheduled Castes (SCs), Scheduled Tribes (STs) and 'Others' (Upper Castes). Developmental variables are related to Literacy, Work Participation, Other Workers and Urbanisation. The major findings are: a) socio-cultural variables had more impact on RCSRthan on UCSR and CSR of Mumbai wards both in 2001 and 2011; b) percentage of SCs and 'Others' had negative effect butpercentage of STs had positive impact; c) positive impact of percentage of SCs and negative impact of percentage of STs on CSR of Mumbai wards was notable; (d) positive impact of developmental variables on CSR was more in 2011 than in 2001; (e) literacy-related variables influenced CSR more positively than work-related variables; f) among literacy-related variables, literacy sex ratio (LSR), followed by female literacy rate, had significant positive impact, but male literacy rate did not have any significant positive impact on CSR; g)among work-related variables, only male work participation rate had significant positive impact on CSR;h) percentage of other workers affected TCSR and RCSR very positively mostly in the case of percentage of 'Others'. The study suggests that, CSR of Maharashtra can be improved by reducing a gap between male and female literacy, creating more jobsin non-agricultural sectors and reforming men, especially of scheduled castes and upper castes.

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Introduction

Maharashtra is the most developed and industrialized state in India. It showed an improvement in many social indicators like infant and maternal mortality, life expectancy and literacy over a period of time. Its sex ratio also improved in 2011 over 2001 census. However, it experienced a steep fall in Child Sex Ratio (CSR) in the last two decades. It declined from 946 in 1991 to 913 in 2001 and to 894 in 2011. Therefore, it calls for in–depth research to find out the reasons behind it and also the solutions to improve it in future. This issue was also faced by many south Asian and recently, by eastern European countries. Researchers have come to the conclusion that, the main reasons of decline in Child Sex Ratio (CSR) are,son preference (patriarchal society), decline in fertility and sex selective abortions (Guilmoto, 2010).Maharashtra also experienced these factors as follows:

Decline in fertility: Over time, people started realizing benefits of having small families and it led to a decline in Total Fertility Rate (TFR) of Maharashtra from 2.9 (NFHS-1) in 1991-92 to 1.9 (NFHS-4) in 2015-16, i.e. by 1 child per woman in the last two decades.

Son preference: Son preference being intact, couples now wanted at least one son and at the most one daughter between the two children. Thus, Maharashtra also experienced co-existence of fertility decline and son preference. According to the NFHS-3 (2005-06) data, son preference was exhibited by the couples in many ways such as, 14% of men and women wanted more sons than daughters as against only 3% wanted more daughters than sons; among women with two children, 96% with two sons and 93% with one son wanted no more children, as compared with 55% of women with two daughters; among women with two children, 88% women with two sons and only 42% women with two daughtersused contraceptives andthe percentage of ultrasound tests performed during pregnancies in the five years preceding the survey was 47% in Maharashtra as compared to only 24% at the national level.

Sex selective abortions –With the availability of sex detection techniques, sex selective abortions of female foetus became common, which led to a steep fall in CSR of Maharashtra in 2001. A study by Nagarajan & Mulay (2008) established a negative correlation between the number of ultrasound/sonographies centres (USCs) and CSR in Maharashtra. The average child

sex ratio for districts with more than 100 (USCs) was 901 & districts with less than 100 (USCs), it was 937 in 2001. The researchers agree that the basic reason of declining CSR is 'Son preference', which is the culmination of both economic andsocio-cultural factors.It is suggested by researchers that CSR can be improved by urbanization and industrialization to increase jobs, improve incomes and retirement savings, which will reduce dependence on son. (Chung W. and Dasgupta M, 2007). Further, by promoting education and employment among women, their economic value will increase and will lead to less discrimination against girl child, resulting in high CSR (Agnihotri S, 2002). He also observed that, wherever the proportion of Scheduled Tribes is high, CSR tends to be higher.In contrast; CSR of upper castes is lower than that of lower castes.

Methodology

Nature of Study: This study is analytical and has used statistical tools such as correlation and multiple regressions. Correlation is used to examine the relationship between CSR and different variables individually.These variables are classified into two, socio–cultural variables and economic or developmental variables. Socio-cultural variables include percentage of Scheduled Castes, Scheduled Tribes and 'Others' (Upper Castes). To examine the impact of these socio-cultural variables on CSR individually, this study analyzes CSR in three different cases i.e. SCs, STs and Others along with four combinations of developmental variables, using multiple regressions. Developmental variables are related to literacy, work participation, non-agricultural (Other) workers and urbanization. Since declining CSR is a gender issue, thisstudy analyses the impact of gender neutral as well as gender specific developmental variables on CSR separately in four types of multiple regressions.The first type includes gender neutral variables like the percentage of workers, percentage of literates, percentage of other workers and percentage of urbanization. The second and third type include gender specific variables like male literacy rate and male work participation rate; andfemale literacy rate andfemale work participation rate respectively. The fourthtype includes different ratios such as sex ratio of literacy, sex ratio of work participation and sex ratio of other workers, since Child Sex Ratio itself is a ratio. This analysis ascertains the factors which have a positive or negative impact on CSR, thus enabling us

to find out the reasons behind the fall in CSR and also recommend solutions to improve the same in future.

Area of study: This study analyses the impact of socio-cultural and developmental variables on tehsil-level CSR in four types i.e. Total CSR (TCSR), Rural CSR (RCSR) and Urban CSR (UCSR) at the tehsil level andCSR of Mumbai Wards at the wards level to assess rural-urban differences, if any. It also briefly analyses the levels, trend and pattern shown by CSR of Maharashtra and its tehsils over a period of time.

Period of study: The study focuses on the census years of 2001 and 2011 to examine the relationship between CSR and different variables.

Sources of data: It is based on secondary data. It is collected from census reports of 2001 and 2011.

Limitations of study: The study is based on secondary data collected from the census reports of 2001 and 2011, selecting those relevant variables whose data is available in the census. The researcher is aware that there are many other variables affecting CSR of Maharashtra, but due to non-availability of such data, these are not considered.

Table 1: Rural and Urban Trends

CSR	1991	2001	2011
TCSR	946	913	894
RCSR	953	916	890
UCSR	931	908	899
CSR (Mumbai Wards)	n. a.	923	913

Table 2: Number of Districts and Tehsils of Maharashtra and Wards of Mumbai (1991, 2001 and 2011)

Type	Total			Rural			Urban			Mumbai wards	
Year	1991	2001	2011	1991	2001	2011	1991	2001	2011	2001	2011
Districts	30	35	35	29	33	33	30	35	35	NA	NA
Tehsils/ wards	NA	353	355	NA	349	353	NA	238	266	99	97

Source: Census of India, 1991, 2001 and 2011; Note: NA = Not applicable.

CSR of Maharashtra: Levels, Trend and Pattern

It is clear from Table 1 that Total CSR (TCSR) of Maharashtra declined steeply in the last two decades (1991 – 2011), but its decadal decline was relatively less in 2011 than in 2001. The decline in Rural CSR (RCSR) was much steeper than that in the case of Urban CSR (UCSR) and CSR of Mumbai Wards in 2011 over 2001; and both UCSR and CSR of Mumbai Wards were greater than RCSR in 2011. It was shocking to see TCSR, RCSR and UCSR below 900, in spite of Maharashtra being the most developed state in India. Sex selective abortions may be the main reason behind this decline and it exemplifies negative attitude towards a girl child. Only consolation was that, CSR of Mumbai wards was above 900, though it also declined from in 2011 over 2001. The information about the number of districts, tehsils and Mumbai Wards in the years 1991, 2001 and 2011 is given in Table 2. Among the tehsils of Maharashtra, CSR of all types showed mixed trends, but fallwas more pronounced than improvement. In the case of TCSR and RCSR, 72% of the tehsils had a fall and 28% showed an improvement, whereas 58% of the tehsils showed a decline and 42% showed a rise in UCSR; and 61% of the tehsils recorded a fall, while 39% had an improvement in CSR of Mumbai Wards in 2011 over 2001. Bid district showed the lowest TCSR and RCSR even below 800 and was among the ten worst districts in India in 2011. Its six and seven tehsils showed TCSR and RCSR below 800 respectively. Though tehsils from the eastern and coastal districts showed relatively higher TCSR and RCSR, they also showed a decline and many tehsils showed UCSR below 900 in 2011.Only southern districts showed a greater number of tehsils showing a rise than the number of tehsils recording a fall in UCSR in 2011. The situation was exactly opposite in the case of the tehsils from the other regions.

Analysis of tehsil level CSR (2001 and 2011 Censuses)

The list of socio-cultural and developmental variables used for the analysis, along with abbreviations and the number of tehsils along with districts is given below.

Table 3: List of variables used for the analysis

Socio Cultural Variables	Abbreviations
% of scheduled cast population	SC %
% of scheduled tribes population	ST %
% of "others" population	OTHRS%

Developmental Variables	Abbreviations
% of Literates	LIT %
% of Workers	W %
% of Other Workers	OW %
% of Urbanization	URBN %
Male Literacy Rate	MLITRT
Female Literacy Rate	FLITRT
Male Work Participation Rate	MWPRT
Female Work Participation Rate	FWPRT
Literacy Sex Ratio	LSR
Work Participation Sex Ratio	WPSR
Other Workers Sex Ratio	OWSR
Dependent Variables	**Abbreviations**
Total Child Sex Ratio	TCSR
Rural Child Sex Ratio	RCSR
Urban Child Sex Ratio	UCSR
Child Sex Ratio of Mumbai Wards	CSR (Mumbai Wards)

Correlation analysis of tehsil level CSR (2001 and 2011 Censuses)

The summary of correlation between CSR and socio-cultural variables as well as developmental variables in the table 4 shows that, negative correlation of SC (per cent) and OTHRS (per cent) and positive correlation of ST (per cent) with CSR was prominent in the rural areas than in the urban areas both in 2001 and 2011.However, positive correlation of SC (percent) and negative correlation of ST (per cent) with CSR (Mumbai wards) was notable. Among developmental variables, negative or significant negative correlation of variables related to literacy with CSR in 2001 reduced or became positive in 2011. Literacy sex ratio showed significant positive correlation with CSR of all four types, followed by female literacy rate and LIT (per cent) with UCSR and CSR of Mumbai Wards in 2011. However, male literacy rate did not have very positive correlation with CSR. Thus, all literacy-related variables, except male literacy rate had very positive correlation with CSR in 2011. Among work-related variables, male work participation rate showed significant positive correlation with TCSR, RCSR and UCSR, but negative one with Mumbai Wards in 2011. In case of W (per cent), work participation sex ratio, female work participation rate and OW (per cent), positive or significant positive correlation with CSR in 2001 became negative one in many cases in 2011. Other workers sex ratio had no

significant correlation with CSR. Thus, only male work participation had highly positive correlation with CSR of all types, except with CSR of Mumbai Wards in 2011.

Table 4: Correlation of CSR of tehsils and Mumbai Wards (2001 and 2011)

Variables	2001				2011			
	Total	Rural	Urban	Mumbai Wards	Total	Rural	Urban	Mumbai Wards
SC per cent	-0.20***	-19***	-0.13**	-0.13	-0.22***	-0.24***	-0.06	0.08
ST per cent	0.51***	0.51***	0.14**	0.15	0.48***	0.48***	0.09*	-0.17
Others per cent	-0.48***	-0.48***	-0.03	0.04	-0.47***	-0.46***	-0.05	-0.02
LIT per cent	-0.23***	-0.21***	0.06	-0.20*	-0.09*	-0.05	0.10*	0.16
W per cent	0.08	-0.32***	0.03	0.26**	0.08	0.02	-0.004	-0.22**
OW per cent	0.15***	-0.06	-0.05	0.20*	-0.01	-0.05	0.08	-0.19*
MLIT RT	-0.36***	-0.32***	-0.02	-0.21**	-0.13**	-0.13**	0.06	0.1
FLIT RT	-0.18***	-0.14***	0.07	-0.16	0.03	0.04	0.12*	0.20*
MWP RT	0.1	0.09	0.08	0.18	0.26***	0.25***	0.11**	-0.12
FWP RT	0.15***	0.06	0.02	0.11	0.06	-0.01	-0.05	-0.19*
LSR	0.09	0.12**	0.14**	-0.14	0.37***	0.42***	0.14**	0.25**
WPSR	0.19***	0.12**	0.05	0.08	0.17	0.03	-0.06	-0.01
OWSR	0.05	0.06	-0.06	0.05	0.19	0.16	-0.08	-0.003
URBNper cent			0.09				0.09	

Note: ***, ** and * significant at 1per cent, 5 per cent and 10 per cent levels respectively.

Table 4 given above, depicts correlation between CSR and different variables individually, but not their impact on CSR. Further, CSR being a complex issue, is influenced by many factors. Hence, three socio-cultural and eleven developmental variables are combined in four types of multiple regressions, again each containing three cases (SCs, STs and Others) for studying their impact individually on CSR both in 2001 and 2011.

Analysis of tehsil level TCSR (2001 and 2011 Censuses)

The analysis of tehsil level TCSR in table 5 shows that, among socio-cultural variables, SC (per cent) and OTHRS (per cent) had a significant negative impact, while ST (per cent) showed a significant positive impact on TCSR both in 2001 and 2011. Among literacy-related variables, literacy sex ratio was the only variable which influenced TCSR significantly as well as positively both in 2001 and 2011, followed by female literacy rate showing strong positive impact on

TCSR both in 2001 and 2011, except in the first case of SC (per cent) in 2001. LIT (per cent) had a positive or significant positive impact among ST (per cent) and OTHRS (per cent), but a significant negative or negative one in case of SC (per cent)on TCSR in 2001 and 2011. Male literacy rate had significant negative impact in the case of SC (per cent) both in 2001 and 2011 but its negative impactin the case of ST (per cent) and OTHRS (per cent) in 2001, became significantly positive and positive respectively on TCSR in 2011.

Among work-related variables, male work participation rate was the only variable which affected TCSR positively in 2001 and positively to a significant extent in all three cases in 2011. In case of W (per cent), negative or highly negative impact on TCSR in 2001, became slightly positive in 2011 but female work participation ratehad no significant effect on TCSR both in 2001 and 2011. The variable work participation sex ratio had a significant positive impact on TCSR in 2001 in all the three cases and it was the same in the case of SC (per cent) and positive in the case of OTHRS (per cent), but slightly negative in the case of ST (per cent) in 2011. The variable other workers sex ratio influenced TCSR negatively or significantly negatively in all the three cases in 2001 but had highly positive effect in the case of SC per cent only in 2011. The negative or significantly negative influence of OW (per cent) on TCSR in 2001, became slightly positive or significantly positive, especially in the case of ST (per cent) and OTHRS (per cent) in 2011.

Analysis of tehsil level RCSR (2001 and 2011 Census)

The analysis of tehsil level RCSR in table 6 shows that, among socio-cultural variables, significant negative impact of OTHRS (per cent) was more pronounced than that of SC (per cent) on RCSR while ST (per cent) continued to have significant positive impact on RCSR both in 2001 and 2011. Among developmental variables related to literacy, literacy sex ratio had significant positive impact on RCSR both in 2001 and 2011, while female literacy rate influenced RCSR both significantly and positively in 2011 in all the three cases. LIT (per cent) had a significant positive impact on RCSR only in the case of ST (per cent) both in 2001 and 2011, while in the case of OTHRS (per cent) in 2011. Male literacy rate had a negative and

significant negative impact on RCSR in the case of OTHRS (per cent) and SC (per cent) respectively both in 2001 and 2011. It affected RCSR very positively only in the case of ST (per cent) in 2011. Among work related variables, male work participation rate was the only variable which influenced RCSR both significantly and positively in all the three cases in 2011. It had a significant positive impact in the case of SC (per cent) and a positive but not significant one in the case of ST (per cent) on RCSR in 2001. Work participation sex ratio had a positive impact in the case of SC (per cent) and very positive impact in the case of ST (per cent) and OTHRS (per cent) on RCSR in 2001 which became negative in 2011. W (per cent) influenced RCSR significantly negatively in the case of ST (per cent) and OTHRS (per cent) in 2001, but slightly positively in the case of SC (per cent) and OTHRS (per cent) in 2011. Female work participation had no significant positive or negative impact on RCSR. A variable like OW (per cent) did not have any significant positive or negative impact on RCSR in 2001, but had a significant positive impact on RCSR in the case of ST (per cent) and OTHRS (per cent), but slightly negative in the case of SC (per cent) in 2011, while Other workers sex ratio had a negative impact in the case of SC (per cent) and significant negative impact in the case of ST (per cent) and OTHRS (per cent) in 2001, but significant positive impact only in the case of SC (per cent) in 2011.

Analysis of UCSR tehsil level (2001 and 2011 Censuses)

The analysis of tehsil level UCSR in table 7shows that, among socio-cultural variables, significance of negative impact of SC (per cent) on UCSR in 2001 disappeared in 2011, negative impact of OTHRS (per cent) on UCSR was not significant in 2001 and 2011, and significant positive impact of ST (per cent) on UCSR in 2001 continued in 2011. Among developmental variables related to literacy, literacy sex ratio made significant positive impact on UCSR in all the three cases both in 2001 and 2011. Female literacy rate and LIT (per cent) made a positive or significant positive impact and male literacy rate did not have a negative impact on UCSR in all the three cases in 2001 and 2011, except negative impact in the case of SC (per cent) and OTHRS (per cent) in 2001. Among work related variables, work participation sex ratio had a significant positive impact in all the three cases in 2001, but it continued only in the case of ST

(per cent) on UCSRin 2011. The positive impact of male work participation rate was significant only in case of ST (per cent) and OTHRS (per cent) in 2001, but not significant in 2011. Female work participation rate or W (per cent) had no significant positive or negative impact on UCSR both in 2001 and 2011.

The significant negative impact of OW (per cent) in all the three cases on UCSR in 2001 disappeared and became positive in 2011. But the significant negative impact of other workers sex ratio continued in 2011 in the case of SC (per cent) and OTHRS (per cent). The impact of URBN (per cent) on UCSR was significant positive and positive in 2001 and 2011, except negative and significant negative in the case of SC (per cent) and ST (per cent) respectively in the fourth type in 2011.

Analysis of CSR of Mumbai Wards: (2001 and 2011 Censuses)

The analysis of CSR of Mumbai wards in table 8 shows that, socio-cultural variables like SC (per cent), ST (per cent) and OTHRS (per cent) had no significant impact on CSR of Mumbai wards both in 2001 and 2011. However, the negative impact of SC (per cent) in 2001 became positive in 2011, while the positive impact of ST (per cent) and OTHRS (per cent) in 2001 became negative in 2011 on CSR.

Among developmental variables related to literacy, negative impact of literacy sex ratio and female literacy rate in the case of ST (per cent) and significant negative impact in the case of SC (per cent) and OTHRS (per cent) on CSR of Mumbai wards in 2001 became significant positive or positive one in 2011.The negative impact of male literacy rate in the case of ST (per cent) and significant negative influence in the case of SC (per cent) and OTHRS (per cent) on CSR of Mumbai Wards in 2001 became slightly positive in 2011. The marginal negative impact of LIT (per cent) on CSR of Mumbai Wards in all the three cases in 2001 became somewhat positive in 2011.No work-related variable had anysignificant impact on CSR of Mumbai Wards either in 2001 or in 2011 in all the three cases. The positive or significant positive impact of OW (per cent) on CSR of Mumbai Wards in the second and third type in 2001, became negative or

significant negative, and slightly negative one in the first type in 2001, became positive in the first type in the case of SC (per cent) and OTHRS (per cent) in 2011. In the fourth type, Other Workers Sex Ratio had no significant impact on CSR of Mumbai Wards in 2001orin 2011.

Table 5: Regression of determinants of tehsil level TCSR (2001 and 2011)

TYPE 1								
Scheduled castes			Scheduled tribes			OTHERS		
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
TSCper cent	-1.40 (-4.11***)	-1.71 (-3.67***)	TSTper cent	1.11 (10.55***)	1.43 (10.98***)	TOTHRper cent	-1.06 (-9.22***)	-1.47 (-10.02***)
TLITper cent	-0.78 (-2.86***)	-0.22 (-0.50)	TLITper cent	0.62 (2.19**)	1.33 (3.20***)	TLITper cent	0.41 (1.41)	1.04 (2.48**)
TWper cent	-1.04 (-2.11**)	0.57 (0.89)	TWper cent	-0.94 (-2.20**)	0.16 (0.29)	TWper cent	-0.56 (-1.27)	0.68 (1.20)
TOWper cent	-1.10 (-2.27**)	0.18 (0.35)	TOWper cent	-1.17 (-2.80***)	0.59 (1.34)	TOWper cent	-0.70 (-1.65*)	1.08 (2.38**)
Adj. R SQ	**0.07**	**0.04**	**Adj. R SQ**	**0.28**	**0.26**	**Adj. R SQ**	**0.23**	**0.23**
TYPE - 2								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
TSCper cent	-1.02 (-3.19***)	-1.53 (-3.39***)	TSTper cent	0.90 (7.69***)	1.44 (10.52***)	TOTHRper cent	-0.85 (-6.67***)	-1.50 (-9.70***)
TMLITRT	-1.30 (-5.94***)	-1.33 (-2.54**)	TMLITRT	-0.14 (-0.52)	1.35 (2.51**)	TMLITRT	-0.31 (-1.18)	0.75 (1.43)
TMWPRT	0.50 (1.58)	5.13 (5.79***)	TMWPRT	0.18 (0.60)	3.81 (4.77***)	TMWPRT	0.27 (0.88)	3.96 (4.89***)
TOWper cent	-0.26 (-0.74)	0.41 (1.01)	TOWper cent	-0.19 (-0.57)	0.79 (2.25**)	TOWper cent	-0.03 (-0.08)	1.03 (2.88***)
Adj. R SQ	**0.15**	**0.12**	**Adj. R SQ**	**0.26**	**0.31**	**Adj. R SQ**	**0.23**	**0.29**
TYPE - 3								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
TSCper cent	-1.41 (-3.98***)	-2.06 (-4.45***)	TSTper cent	1.05 (10.74***)	1.43 (11.77***)	TOTHRper cent	-1.03 (-9.7***)	-1.53 (-10.93***)
TFLITRT	-0.33 (-1.38)	0.88 (2.43**)	TFLITRT	0.52 (2.25**)	1.45 (4.58***)	TFLITRT	0.41 (1.75*)	1.23 (3.85***)
TFWPRT	-0.24 (-0.79)	0.44 (1.23)	TFWPRT	-0.12 (-0.48)	0.06 (0.20)	TFWPRT	0.167 (0.63)	0.22 (0.70)
TOWper cent	-1.07 (-1.99**)	-0.28 (-0.54)	TOWper cent	-0.86 (-1.89*)	0.24 (0.54)	TOWper cent	-0.30 (-0.65)	0.63 (1.38)
Adj. R SQ	**0.07**	**0.05**	**Adj. R SQ**	**0.27**	**0.28**	**Adj. R SQ**	**0.23**	**0.25**
TYPE - 4								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**

TSCper cent	-1.03 (-2.97***)	-0.98 (-0.98)	TSTper cent	1.12 (12.54***)	1.30 (11.39***)	TOTHRper cent	-1.17 (-12.15***)	-1.43 (-11.60***)
TLSR	0.04 (1.79*)	0.31 (7.77***)	TLSR	0.12 (6.01***)	0.33 (10.004***)	TLSR	0.14 (6.63***)	0.38 (11.31***)
TWPSR	0.04 (3.26***)	0.03 (2.23**)	TWPSR	0.03 (3.13***)	-0.003 (-0.20)	TWPSR	0.04 (3.76***)	0.01 (0.96)
TOWSR	-0.05 (-1.26)	0.10 (3.18***)	TOWSR	-0.14 (-4.03***)	-0.002 (-0.05)	TOWSR	-0.13 (-3.66***)	0.002 (0.07)
Adj. R SQ	**0.06**	**0.2**	**Adj. R SQ**	**0.34**	**0.41**	**Adj. R SQ**	**0.33**	**0.41**

Notes: Figures in parentheses indicate absolute t-values; ***, ** and * show significant at 1 per cent, 5 per cent and 10 per cent levels respectively.

Table 6: Regression of determinants of tehsil level RCSR (2001 and 2011)

Type 1								
Scheduled castes			**Scheduled tribes**			**OTHERS**		
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
RSCper cent	-0.97 (-7.59***)	-2.16 (-4.40***)	RSTper cent	1.11 (10.51***)	1.56 (11.81***)	ROTHRper cent	-1.12 (-9.70***)	-1.46 (-9.01***)
RLITper cent	-0.13 (-0.50)	0.26 (0.56)	RLITper cent	0.50 (1.77*)	1.90 (4.47***)	RLITper cent	0.29 (1.02)	0.97 (2.26**)
RWper cent	0.14 (0.41)	0.31 (0.45)	RWper cent	-1.43 (-2.78***)	-0.54 (-0.90)	RWper cent	-1.28 (-2.46**)	0.04 (0.07)
ROWper cent	0.56 (1.02)	-0.22 (-0.35)	ROWper cent	-0.61 (-1.11)	0.91 (1.71*)	ROWper cent	0.09 (0.16)	1.57 (2.71***)
Adj. R SQ	**0.23**	**0.05**	**Adj.R SQ**	**0.27**	**0.28**	**Adj. R SQ**	**0.25**	**0.18**
Type 2								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
RSCper cent	-0.94 (-2.83***)	-2.02 (-4.37***)	RSTper cent	0.96 (8.23***)	1.46 (10.28***)	ROTHRper cent	-0.97 (-7.59***)	1.31 (-7.82***)
RMLITRT	-1.21 (-5.32***)	-1.45 (-2.77***)	RMLITRT	0.01 (0.04)	1.34 (2.37**)	RMLITRT	-0.13 (-0.50)	-0.04 (-0.07)
RMWPRT	0.69 (1.98**)	6.17 (6.34***)	RMWPRT	0.16 (0.50)	3.93 (4.38***)	RTMWPRT	0.14 (0.41)	4.75 (5.10***)
ROWper cent	-0.48 (-0.79)	-0.08 (-0.15)	ROWper cent	0.03 (0.06)	1.19 (2.50**)	ROWper cent	0.56 (1.02)	1.56 (3.07***)
Adj. R SQ	**0.12**	**0.15**	**Adj. R SQ**	**0.25**	**0.31**	**Adj. R SQ**	**0.23**	**0.24**
Type 3								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
RSCper cent	-1.27 (-3.57***)	-2.39 (-4.98***)	RSTper cent	1.06 (10.75***)	1.52 (12.26***)	ROTHRper cent	-1.08 (-10.01***)	-1.46 (-9.43***)
RFLITRT	-0.39 (-1.56)	0.83 (2.12**)	RFLITRT	0.43 (1.85*)	1.66 (4.84***)	RFLITRT	0.29 (1.26)	1.10 (3.09***)
RFWPRT	-0.18 (-0.52)	0.10 (0.28)	RFWPRT	-0.25 (-0.85)	-0.29 (-0.89)	RFWPRT	-0.05 (-0.17)	-0.03 (-0.07)
ROWper	-0.94	-0.54	ROWper	-0.45	0.79	ROWper cent	0.30	1.42

cent	(-1.37)	(-0.83)	cent	(-0.79)	(1.47)		(0.52)	(2.42**)
Adj. R SQ	**0.05**	**0.06**	**Adj. R SQ**	**0.26**	**0.3**	**Adj. R SQ**	**0.23**	**0.38**
Type 4								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
RSCper cent	-0.98 (-2.82***)	-1.11 (-2.68***)	RSTper cent	1.13 (12.53***)	1.37 (11.51***)	ROTHRper cent	-1.23 (-12.55***)	-1.33 (-9.48***)
RLSR	0.04 (1.67*)	0.35 (8.69***)	RLSR	0.12 (5.76***)	0.36 (10.72***)	RLSR	0.14 (6.6***)	0.39 (11.06***)
RWPSR	0.03 (1.53)	-0.01 (-0.29)	RWPSR	0.02 (1.66*)	-0.02 (-1.21)	RWPSR	0.04 (2.49**)	-0.01 (-0.77)
ROWSR	-0.02 (-0.44)	0.15 (3.43***)	ROWSR	-0.12 (-3.60***)	-0.04 (-0.99)	ROWSR	-0.11 (-3.46***)	0.03 (0.77)
Adj.R SQ	**0.04**	**0.23**	**Adj. R SQ**	**0.33**	**0.43**	**Adj. R SQ**	**0.33**	**0.38**

Note: Figures in parentheses indicate absolute t-values; ***, ** and * indicate significant 1 per cent, 5 per cent and 10 per cent levels respectively.

Table 7: Regression of determinants of tehsil level UCSR (2001 and 2011)

TYPE- 1								
Scheduled Castes			**Scheduled Tribes**			**OTHERS**		
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
USC per cent	-1.18 (-2.14**)	-0.50 (-1.04)	UST per cent	1.16 (2.48**)	0.61 (1.87*)	UOTHR per cent	-0.19 (-0.51)	-0.29 (-1.01)
ULIT per cent	0.80 (1.41)	0.76 (1.21)	ULIT per cent	1.05 (1.87*)	0.80 (1.27)	ULIT per cent	0.97 (1.69*)	0.81 (1.28)
UW per cent	0.60 (0.73)	-0.11 (-0.13)	UW per cent	0.70 (0.86)	-0.23 (-0.28)	UW per cent	0.85 (1.04)	-0.10 (-0.12)
UOW per cent	-1.65 (-2.31**)	0.13 (0.24)	UOW per cent	-1.59 (-2.23**)	0.20 (0.38)	UOW per cent	-1.51 (-2.10**)	0.23 (0.44)
URBN per cent	0.35 (2.23**)	0.17 (1.16)	URBN per cent	0.33 (2.14**)	0.18 (1.28)	URBN per cent	0.30 (1.92*)	0.14 (0.99)
Adj R SQ	**0.03**	**0.001**	**Adj R SQ**	**0.04**	**0.01**	**Adj R SQ**	**0.01**	**0.001**
TYPE - 2								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
USC per cent	-1.15 (-2.07**)	-0.46 (-0.96)	UST per cent	1.08 (2.31**)	0.66 (2.02**)	UOTHR per cent	-0.16 (-0.43)	-0.35 (-1.21)
UMLITRT	-0.05 (-0.07)	0.51 (0.62)	UMLITRT	0.17 (0.23)	0.48 (0.58)	UMLITRT	-0.05 (-0.07)	0.42 (0.51)
UMWPRT	0.77 (1.34)	0.86 (1.06)	UMWPRT	0.95 (1.68*)	1.17 (1.47)	UMWPRT	1.05 (1.83*)	1.16 (1.43)
UOW per cent	-1.42 (-2.00**)	0.09 (0.17)	UOW per cent	-1.34 (-1.91*)	0.11 (0.22)	UOW per cent	-1.27 (-1.78**)	0.17 (0.33)
URBN per cent	0.34 (2.17**)	0.15 (1.03)	URBN per cent	0.32 (2.07**)	0.16 (1.14)	URBN per cent	0.28 (1.83*)	0.12 (0.83)
Adj R SQ	**0.03**	**0.01**	**Adj R SQ**	**0.03**	**0.01**	**Adj R SQ**	**0.01**	**0.004**
TYPE - 3								

Variables	Coeff 2001	Coeff 2011	Variables	Coeff 2001	Coeff 2011	Variables	Coeff 2001	Coeff 2011
USC per cent	-1.21 (-2.22**)	-0.47 (-0.99)	UST per cent	1.10 (2.35**)	0.63 (1.90*)	UOTHR per cent	-0.13 (-0.35)	-0.31 (-1.05)
UFLITRT	0.61 (1.38)	0.75 (1.51)	UFLITRT	0.76 (1.71*)	0.76 (1.55)	UFLITRT	0.75 (1.67*)	0.80 (1.62*)
UFWPRT	0.51 (0.87)	0.04 (0.06)	UFWPRT	0.36 (0.61)	-0.30 (-0.49)	UFWPRT	0.52 (0.87)	-0.14 (-0.23)
UOW per cent	-1.48 (-2.12**)	0.04 (0.08)	UOW per cent	-1.36 (-1.97**)	0.11 (0.22)	UOW per cent	-1.30 (-1.85**)	0.14 (0.27)
URBN per cent	0.36 (2.21**)	0.19 (1.32)	URBN per cent	0.32 (2.00**)	0.18 (1.26)	URBN per cent	0.29 (1.83*)	0.15 (1.05)
Adj R SQ	**0.03**	**0.01**	**Adj R SQ**	**0.03**	**0.02**	**Adj R SQ**	**0.01**	**0.01**
TYPE - 4								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
USC per cent	-0.97 (-1.8*)	-0.55 (-1.17)	UST per cent	1.18 (2.55**)	0.81 (2.40**)	UOTHR per cent	-0.29 (-0.78)	-0.42 (-1.38)
ULSR	0.11 (2.33**)	0.13 (2.80***)	ULSR	0.13 (2.86***)	0.15 (1.94*)	ULSR	0.13 (2.78***)	0.14 (3.02***)
UWPSR	0.08 (2.19**)	0.04 (0.96)	UWPSR	0.07 (1.92*)	0.01 (3.15***)	UWPSR	0.07 (2.00*)	0.02 (0.37)
UOWSR	-0.11 (-1.87*)	-0.14 (-2.22**)	UOWSR	-0.13 (-2.22**)	-0.14 (0.18)	UOWSR	-0.13 (-2.04**)	-0.13 (-2.13**)
URBN per cent	0.37 (2.35**)	0.27 (-1.17)	URBN per cent	0.36 (2.31**)	0.25 (-2.27**)	URBN per cent	0.33 (2.12**)	0.23 (1.71*)
Adj R SQ	**0.05**	**0.03**	**Adj R SQ**	**0.06**	**0.03**	**Adj R SQ**	**0.03**	**0.04**

Note: Figures in parentheses indicate absolute t-values; ***, **, and * significant 1per cent, 5per cent and 10per cent levels respectively.

Table 8: Regression of CSR of Mumbai Wards (2001 and 2011)

TYPE 1								
Scheduled castes			**Scheduled tribes**			**OTHERS**		
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
SCper cent	-0.72 (-0.78)	0.41 (0.41)	STper cent	-0.94 (-0.38)	-2.62 (-0.75)	OTHRper cent	0.80 (0.90)	-0.20 (-0.20)
LITper cent	-0.54 (-0.73)	1.32 (0.98)	LITper cent	-0.50 (-0.67)	0.87 (0.61)	LITper cent	-0.61 (-0.82)	1.32 (0.96)
Wper cent	2.44 (1.09)	2.02 (-0.53)	Wper cent	3.22 (1.27)	-1.18 (-0.29)	Wper cent	2.82 (1.28)	2.14 (-0.56)
OWper cent	-1.32 (-0.64)	0.31 (0.08)	OWper cent	-1.89 (-0.80)	-0.61 (-0.15)	OWper cent	-1.67 (-0.80)	0.36 (0.09)
Adj. R SQ	**0.06**	**0.02**	**Adj. R SQ**	**0.06**	**0.03**	**Adj. R SQ**	**0.06**	**0.02**
TYPE – 2								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
SCper cent	-1.14 (-1.17)	0.51 (0.50)	STper cent	0.73 (0.33)	-3.40 (-1.05)	OTHRper cent	0.97 (1.01)	-0.17 (-0.17)
MLITRT	-1.42	1.67	MLITRT	-1.1	0.79	MLITRT	-1.63	1.67

	(-2.11**)	(1.15)		(-1.29)	(0.48)		(-2.18**)	(1.12)
MWPRT	-1.85 (-1.08)	2.82 (1.25)	MWPRT	-1.03 (-0.630	1.60 (0.67)	MWPRT	-1.88 (-1.06)	2.72 (1.17)
OWper cent	2.32 (1.44)	-3.90 (-1.89*)	OWper cent	1.79 (1.13)	-3.04 (-1.39)	OWper cent	2.35 (1.44)	-3.91 (-1.88*)
Adj. R SQ	**0.05**	**0.02**	**Adj. R SQ**	**0.04**	**0.03**	**Adj. R SQ**	**0.05**	**0.01**
TYPE – 3								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
SCper cent	-0.92 (-1.00)	0.69 (0.70)	STper cent	0.07 (0.03)	0.30 (0.07)	OTHRper cent	0.90 (0.99)	-0.77 (-0.74)
FLITRT	-0.76 (-1.87*)	1.59 (2.00**)	FLITRT	-0.68 (-1.36)	1.54 (1.49)	FLITRT	-0.87 (-1.98**)	1.72 (2.05**)
FWPRT	0.99 (0.82)	-0.77 (-0.85)	FWPRT	1.05 (0.73)	-0.79 (-0.69)	FWPRT	1.28 (1.05)	-0.89 (-0.96)
OWper cent	0.98 (1.79*)	-1.28 (-1.12)	OWper cent	1.13 (2.11**)	-1.48 (-1.29)	OWper cent	1.01 (1.87*)	-1.21 (-1.03)
Adj. R SQ	**0.05**	**0.05**	**Adj. R SQ**	**0.04**	**0.04**	**Adj. R SQ**	**0.05**	**0.05**
TYPE – 4								
Variables	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**	**Variables**	**Coeff 2001**	**Coeff 2011**
SCper cent	-1.35 (-1.54)	0.80 (0.84)	STper cent	0.19 (0.19)	-0.08 (-0.02)	OTHRper cent	1.28 (1.48)	-0.81 (-0.84)
LSR	-0.08 (-2.46**)	0.16 (3.20***)	LSR	-0.08 (-0.08)	0.16 (2.69***)	LSR	-0.1 (-2.67***)	0.17 (3.32***)
WPSR	0.06 (0.65)	-0.21 (-0.47)	WPSR	0.07 (0.07)	-0.12 (-0.26)	WPSR	0.08 (0.79)	-0.24 (0.52)
OWSR	0.04 (0.31)	0.09 (0.19)	OWSR	0.02 (0.02)	-0.002 (-0.01)	OWSR	0.04 (0.37)	0.11 (0.23)
Adj. R SQ	**0.05**	**0.07**	**Adj. R SQ**	**0.02**	**0.07**	**Adj. R SQ**	**0.05**	**0.07**

Note: Figures in parentheses indicate absolute t-values; ***, **, and * significant at 1 per cent, 5 per cent and 10 per cent levels respectively.

Conclusions

Socio-cultural variables: The negative impact of SC (per cent) and OTHRS (per cent) and positive impact of ST (per cent) was stronger in the rural areas than in the urban areas. It implies that, patriarchal norms are more dominant in the rural areas than in the urban areas and scheduled castes and upper castes are more patriarchal and so have negative attitude towards a girl child as compared to that among scheduled tribes.

Developmental variables: These played more positive role in 2011 than in 2001. Among them, all literacy-related variables, except male literacy rate, influenced CSR very positively. It implies that, literate women and not necessarily, literate men, develop a positive attitude towards a girl

child. Among work-related variables, only male work participation rate affected CSR very positively. The positive impact of OW (per cent) on CSR was relatively more than that of other workers sex ratio on CSR in 2011.The significant positive impact of URBN in 2001on UCSR, reduced in 2011. These findings suggest that, employed men in general and the availability of non-agricultural jobs among upper castes, may develop positive attitude towards a girl child. From this analysis, it is clear that, the positive impact of the developmental variables was not strong enough to arrest a decline in CSR of Maharashtra in 2011 over 2001. Encouraging the female education, thereby reducing the gap between male and female literacy, creating more jobs in non agricultural sector, empowerment of marginalized sections are some of the critical interventions required.

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An Assessment of Hepatitis B0 Vaccine Coverage in Kerala

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Abstract

The prevalence of Hepatitis B in general population in India is 2-10 percent, which places it in an intermediate endemic zone and second largest global pool of chronic Hepatitis B infection. Government of India has incorporated the vaccine in the Universal Immunization programme (UPI). The Hepatitis B vaccination schedule in UIP includes Birth dose within 24 hour of delivery, followed by three more doses. The present study focuses on the coverage of Hepatitis B0 in the State of Kerala and its districts using HMIS portal data. For assessing the coverage of the vaccine, monthly uploaded data for the period of April 2017 to March 2019 has been analyzed. Though the coverage of other vaccines hovers around 100 percent in the State, coverage of Hepatitis B0 was below 65 percent. Large level variation exists among the districts. The likelihood of gap in the coverage suggest introduction of special programmes in the poor performing districts to improve the coverage. Proper data quality check in the uploaded data by the authorities is also advised. Qualitative analysis on Knowledge and Practice of administration of vaccine by health providers points to the necessity of universal implementation of guidelines. Some of the health facilities have not provided the birth dose of Hepatitis B due to shortage of vaccine and steps have not been taken to initiate local purchase also. Some of the private institutes do not insist on Hepatitis B0 within 24 hours of delivery as it is not recommended by the Peadiatric Association of India. Regarding awareness, low birth weight of the newborn is still considered as a contraindication regardless of new guidelines.

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Introduction

Hepatitis B Virus (HBV) is the leading known cause of chronic hepatitis, cirrhosis and hepatocellular carcinoma. Infection with HBV may be acquired by the perinatal route (vertical transmission), during childhood close contact with infected family members (horizontal transmission) through transfusions or use of infected needles and by sexual contact. Chronic Hepatitis B infection occurs in about 350 million people with more than 6 lakh deaths each year. About 3 percent of the world population has been infected with Hepatitis C Virus worldwide with more than 170 million chronic carriers and 3.5 lakh deaths every year (WHO 2016). Access to affordable hepatitis testing is limited. Few people have been diagnosed worldwide and among them, treatment has reached only a small fraction (WHO, 2017). The number of HepB surface Antigen (HBsAg) carriers in India has been estimated to be over 4 crore (40 million). About 15-25 percent of HBsAg carriers is likely to suffer from cirrhosis and liver cancer and may die prematurely. Infections occurring during infancy and childhood have the greatest risk of becoming chronic. Of the 2.6 crore (26 million) infants born every year in India, approximately one million run the life-time risk of developing chronic HBV infection. Hence WHO recommends universal hepatitis vaccination in these regions.

By 2008, 177 countries, including the Government of India have fully included Hepatitis B vaccine in their National immunization programmes. The Hepatitis B vaccination schedule in UIP includes Birth dose within 24 hours of delivery, followed by three more doses along with DPT or Pentavalent. In 2015, global coverage with the three doses of Hepatitis B vaccine in infancy reached 84 percent. However, coverage with the initial birth dose vaccination is still low at 39 percent (WHO, 2015).

Generally studies regarding Hepatitis B focused on prevalence and its determinants, status and knowledge of transmission among the health care providers (Thyagarajan et al., 1996; WHO, 2002; Singh et al, 2018 etc). Like the rest of the country data regarding the true prevalence of Hepatitis B is deficient in Kerala also. Hospital based studies reported 0.71 to 4.49 percent of

HBsAg positivity cases in north Kerala (Kuriakose, 2018).Different media reported higher level of Hepatitis B cases than E in the State. HBsAg prevalence of 0.5 percent in the normal population has been reported in northern Kerala (Sandesh, 2006) and 1.5 percent was detected among voluntary blood donors from Thiruvananthapuram (Anjali, 2012). However paucity of information on the prevalence of HBV is reported in Kerala (Gopalakrishnan, 2013). Studies related to coverage of birth dose of Hepatitis B are not properly documented but other immunization studies are large in number.

Beasley and Hwang (1983) reported that 38 percent of babies born to HBsAg positive mothers, who did not acquire infection perinatally, became infected by four years of age. This emphasizes the need to equip mothers with knowledge to prevent horizontal transmission of Hepatitis B infection, and the importance of completion of the Hepatitis B vaccination schedule. Studies have shown significant gaps in hospital practices and policies to prevent vertical transmission of Hepatitis B (Willis et al., 2010). Holla et al (2017) reported that the Hepatitis B birth dose coverage within 24 hours was low in Private hospitals than in Government hospitals.

Knowledge and practices towards Hepatitis B virus and immunization (especially birth dose) among the Pediatricians, Staff Nurses and other Health staff working in the labour room and immunization wing are important for the prevention, intervention and curative activities of Hepatitis B infection. Studies related to immunization practices and coverage of Hepatitis B vaccine is very few in India. Kerala is not an exception in this regard. Since immunization at birth prevents horizontal transmission, vaccination should begin at birth if the mothers HBsAg status is not known.

Objectives: The main objectives of the study are

1. To analyze the coverage of birth dose of Hepatitis B (Hepatitis B0) in Kerala using HMIS Portal data

2. To assess the knowledge about Hepatitis B0 vaccine and ideal practices of Hepatitis B0 vaccine among health staff and Pediatricians in selected Government hospitals and private hospitals in Kerala.

Data and Methodology

In order to analyze coverage of Hepatitis B0 in Kerala, monthly HMIS data for two years were used. A macro level analysis of monthly consolidated HMIS data for the period from April 2017 to March 2019 has been done for assessing the district wise variation in coverage of birth dose of Hepatitis B in Kerala. The data from the site of www.nrhm.nic.in has been used for the analysis. All the hospitals in the country report the health statistics in the portal designed by Ministry of Health and Family Welfare. Apart from public health facilities all the registered private hospitals also report the monthly health statistics to the portal through the Block level health facilities or District level health facilities. Though the coverage of data is not fully ensured from the private health facilities, the details of births, delivery and basic immunization services are properly reported. The data goes through different validation process. However, the accuracy of the HMIS data is not fully ensured and thus it is not widely used. The first section tries to utilize the HMIS data to understand the level of coverage of different birth doses in Kerala and its districts. The coverage of each birth dose has been calculated by dividing the number of newborn vaccinated against a particular vaccine by the number of live birth in the district. For assessing the effect of preterm babies and low birth weight babies, an adjusted coverage of Hepatitis B0 is calculated replacing the live births in the denominator by reducing the number of preterm and low birth weight babies from the live birth. Likelihood of gap in coverage is estimated for assessing the gap of coverage in each district in the state.

In order to know the knowledge and Practice, eight hospitals were visited and information was collected from Pediatricians (8), Junior Public Health Nurses (JPHN) (10), Lady Health Inspector (LHI) (8) and Staff Nurses (28) in the labour room and immunization sections of the hospitals. A semi-structured schedule was used for collecting qualitative information and observed their practices.

Eight district hospitals from six districts in Kerala namely Kannur, Kozhikode, Malappuram, Thrissur, Alappuzha and Thiruvananthapuram are covered. Five private hospitals were also visited – two from Thiruvananthapuram and three from Malappuram district.

Result

HMIS Data Analysis

HMIS data revealed that the coverage of birth dose of Hepatitis B in Kerala is about 65 percent during both 2017-18 and 2018-19. But district wise variation is evident. Pathanamthitta (97.5 percent) and Kottayam (95 percent) recorded highest coverage followed by Wayanad (93 percent), Idukki (90.6 percent) and Kollam (90 percent) in 2017-18. Kottayam (95.4 percent) and Pathanamthitta (93.5 percent) also have recorded more than 90 percent of coverage in the consecutive year.

The coverage in the district like Kollam, Wayanad and Idukki has declined in the second year. Kasaragod followed by Malappuram and Kannur experienced lowest level of coverage in both the years (Figure 4.1). While the districts like Alappuzha, Thrissur, Palakkad, Malappuram, Kozhikode, Kannur and Kasaragod has continued the same coverage in 2018-19, Thiruvananthapuram and Wayanad has recorded sharp decline in coverage. Ernakulam has experienced 17 percent increase in the coverage.

The districts like Thiruvananthapuram, Malappuram, Kannur and Kasaragod has recorded lower level of coverage of the vaccine and the reason for this needs to be further analyzed. Some of the reasons pointed out for the lower coverage of birth dose of Hepatitis B in the state are shortage of vaccine, lack of adherence of new guidelines etc.

Table 4.

	2017-18	2018-19
Kerala	64.74	65.06
Thiruvananthapuram	63.84	48.49
Kollam	90.08	85.02
Pathanamthitta	97.51	93.57
Alappuzha	70.25	70.11
Kottayam	95.05	95.41
Idukki	90.61	85.16
Ernakulam	61.23	78.62
Thrissur	62.74	62.64
Palakkad	63.77	67.47
Malappuram	46.15	49.51
Kozhikode	72.43	74.51
Wayanad	93.65	75.99
Kannur	49.12	50.18
Kasaragod	40.46	43.5

Figure 4.1: District wise coverage of Hepatitis B0, 2017-19

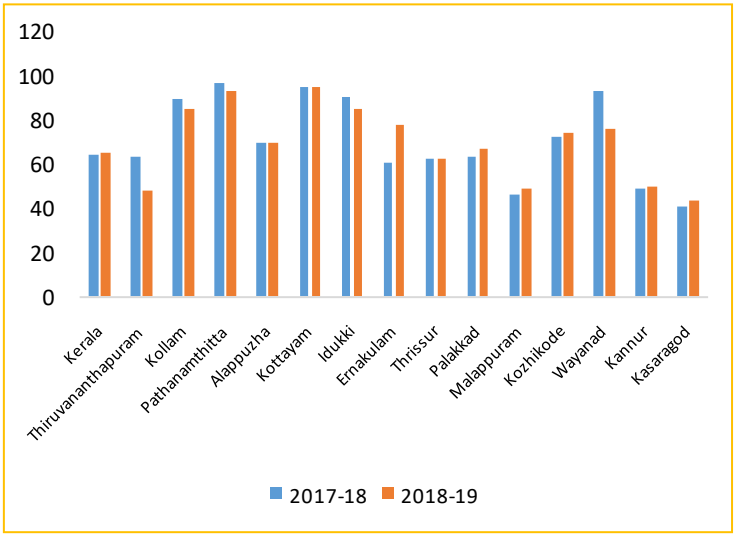
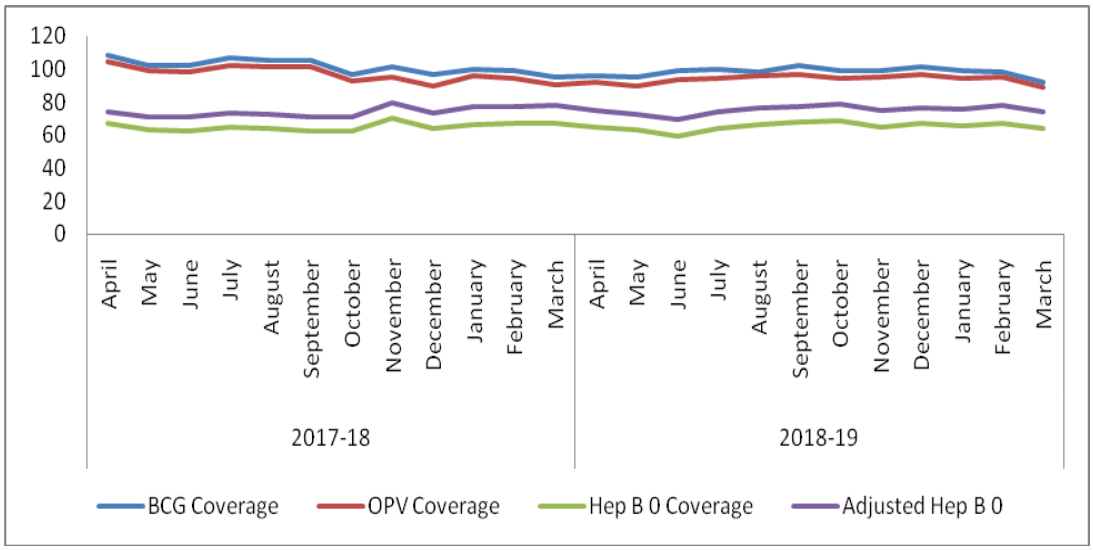


Figure 4.2 Month wise coverage of birth doses in Kerala, 2017-19

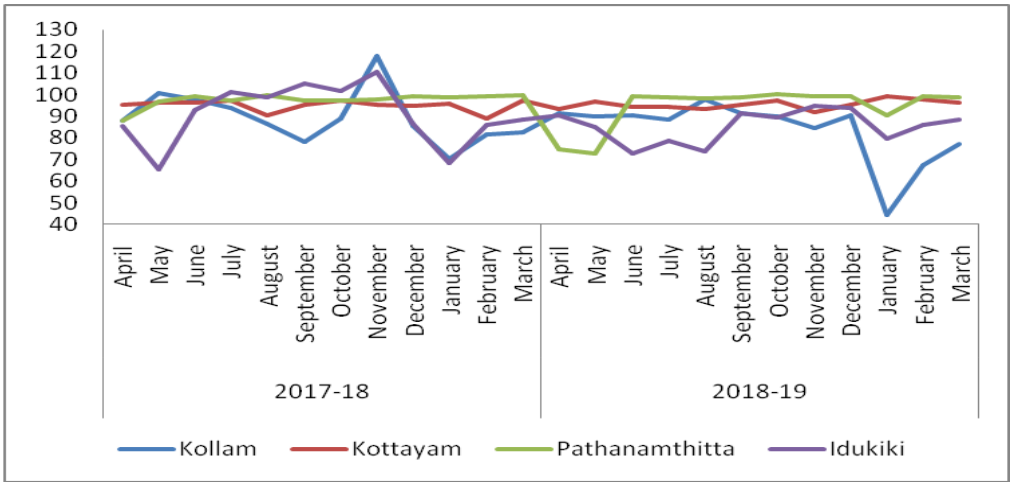


Graphical representation of coverage of all birth doses in Kerala over the period of two years from April 2017 to March 2019 (Figure 4.2) shows a zigzag nature throughout the period. Coverage of BCG and OPV has also been incorporated to assess the calculation errors of vaccination coverage over the period. As BCG can be taken within one year of delivery, and OPV in 15 days, there are chances of outnumbering the number of live births by the number of

children immunized for both birth doses. But the general pattern in the State points that all the children are getting their birth doses apart from Hepatitis B on the day of routine immunization. In general, birth doses of both OPV and BCG are complete in the State over the period of 24 months. But the same pattern is not followed for Hepatitis B. Over the period of study, the percent of Hepatitis B0 in the State has not improved beyond 65 percent. The gap of nearly 30 percent needs to be explained by further research. However, an attempt has been made to assess the role of low birth weight for the lower immunization coverage. As per the early guidelines, newborn having birth weight below 2 Kg has not been vaccinated against Hepatitis B. Adjusted Hepatitis B coverage has been calculated by reducing the pre- term and low birth weight babies from the denominator (live birth).

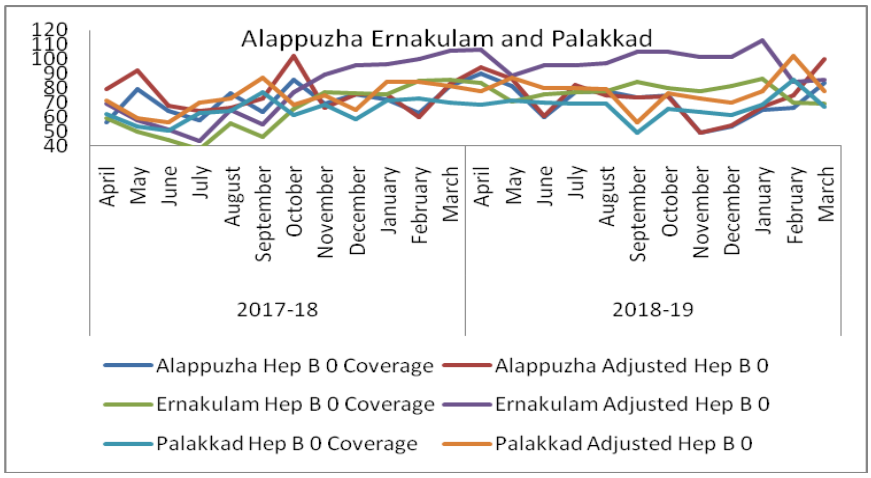
Level of coverage was used to classify the districts into three groups. The districts like Kollam, Pathanamthitta, Kottayam and Idukki has reported more than 80 percent of coverage in the above period. Alappuzha, Ernakulam, Thrissur, Palakkad, Kozhikode, and Wayanad have recorded an average coverage between 50 to 80 percent during the period. Four districts namely Thiruvananthapuram, Malappuram, Kannur and Kasaragod have reported lower coverage and are grouped into one. As the coverage of other birth dozes are almost 100 percent, they have not been included in the graphical representation.

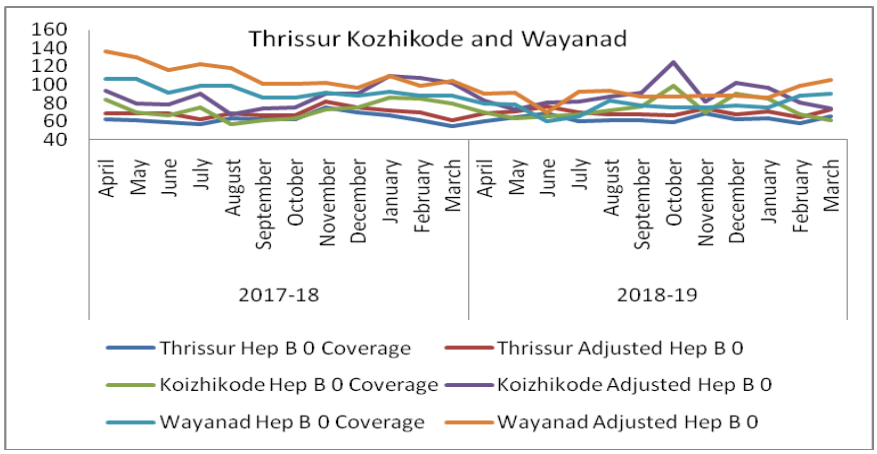
Figure 4.3: Coverage of birth dose of Hepatitis B in Kollam, Kottayam, Pathanamthitta and Idukki



Kollam, Pathanamthitta, Kottayam and Idukki have reported coverage of Hepatitis B in a consistent manner with more than 80 percent over the period. We cannot see much difference in the coverage of different birth doses. However, coverage of 100 percent of birth dose in HMIS does not ensure the reality in the field. Zigzag flow of coverage of Hepatitis point towards low data quality in Kollam (44 percent in January 2019 and 67 in February). The coverage of birth dose in Pathanamthitta and Kottayam followed the same pace throughout the period except in the months of April and May 2018 for Pathanamthitta. Idukki district also had coverage of more than 85 percent during the period.

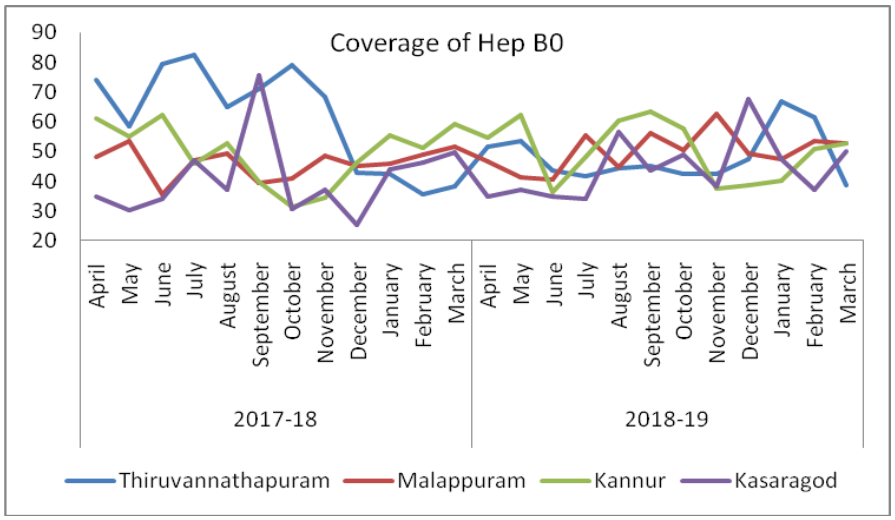
Figure 4.4: Districts with medium coverage of Hepatitis B0 and adjusted Hep B0





The coverage of Hepatitis B0 has always been between 50 and 80 percent in these districts. The suitability of Adjusted Hep B0 has been tested here and suits only for three districts like Alappuzha, Ernakulam and Palakkad. The same has given unrealistic outputs in the districts Kozhikode, Wayanad and Thrissur. Inaccuracies are observed in data in general. Consistency of data is observed in Thrissur while Wayanad has recorded more than 100 percent coverage in some months (April & May,2017).

Figure 4.5: Districts with lower coverage of birth doze of Hepatitis B, 2017-19



The southernmost district Thiruvananthapuram and northern districts like Kasaragod, Kannur and high fertility district Malappuram comes under the category of lower coverage of Hepatitis B0 in the State. Substantial data variation can be seen in Thiruvananthapuram. Malappuram has shown the same level of coverage over the period, but the values are not comparable with other birth dozes. There is a clear gap between coverage of other vaccines and Hepatitis B0 over the period. As the share of delivery in the private clinics is more in Malappuram, accuracy of reporting to HMIS need verification. Data inaccuracy has been seen in both Kannur and Kasaragod. The suitability of Adjusted Hep B0 is tested in these districts but failed to provide any desirable improvement in the coverage. Apart from low birth weight and pre-term babies, other factors also affect the coverage of Hepatitis B0. This is more significant in Kasaragod and Malappuram.

Data quality issues in HMIS may be the primary reason for the flawed reporting of Hepatitis B0 coverage in different districts during the period of analysis. However, coverage of other birth dozes is almost complete. The attempt of correction by adjusted Hepatitis B0 partially works in some districts (Palakkad, Alappuzha and Ernakulam) and feebly joints in other districts (Kasaragod, Wayanad, and Kottayam). The coverage of Hepatitis has not correlated with this. Further investigation is necessary before reaching any conclusion based on HMIS data analysis.

Likelihood of Gap in coverage of Hepatitis B birth dose

It provides an opportunity to compare scientifically the coverage of birth dose of Hepatitis B of each district with the coverage of the State. The average coverage of 2017-18 and 2018-19 has been used for assessing the likelihood of coverage among the districts in Kerala. The ratio has been calculated by dividing the average value of each district by the (1-X) values. Likelihood of coverage has been estimated by dividing the ratio of each district by the values of the State (Kerala).

Table 4.3: Likelihood of gap in coverage of Hepatitis B0 among the districts in Kerala, 2017-19

Districts	Average	1-X	Ratio	Likelihood of Coverage
Kasaragod	41.98	58.02	0.723544	0.39
Malappuram	47.83	52.17	0.91681	0.5
Kannur	49.65	50.35	0.986097	0.53
Thiruvananthapuram	56.165	43.835	1.281282	0.69
Thrissur	62.69	37.31	1.680247	0.91
Kerala	64.9	35.1	1.849003	1
Palakkad	65.62	34.38	1.908668	1.03
Ernakulam	69.925	30.075	2.325021	1.26
Alappuzha	70.18	29.82	2.353454	1.27
Kozhikode	73.47	26.53	2.769318	1.5
Wayanad	84.82	15.18	5.587615	3.02
Kollam	87.55	12.45	7.032129	3.8
Idukki	87.885	12.115	7.25423	3.92
Kottayam	95.23	4.77	19.96436	10.8
Pathanamthitta	95.54	4.46	21.42152	11.59

The likelihood of gap in coverage of birth dose of Hepatitis B in Kerala is 11.2, which is the difference between the coverage of better performing district and the least performing district. This gap points large level inter-district variation in the coverage of the said vaccine. The less likelihood of coverage in districts like Kasaragod, Kannur, Malappuram and Thiruvananthapuram need to be further analysed and emphasis should be given to overcome the current lower coverage. The performance of Pathanamthitta, Wayanad, Kollam, Idukki and Kottayam with relatively better coverage needs to be modeled for other districts. Special focus need to be provided in improving the coverage of the vaccine in other districts apart from the State level initiatives.

Knowledge and Practice of health care providers

Operational Guidelines for Hepatitis B Vaccine in the Universal Immunization Programme by MoHFW, Government of India (2011) provides the details about Hepatitis B vaccine. The risk of serious adverse events associated with Hepatitis vaccine is very low (1 -2/ 1000,000). Knowledge regarding Hepatitis B virus and transmission is needed to maximize vaccine coverage to neonates and knowledge regarding safety precautions and disposal minimize the acquired infections among health workers and other neonates. As the vaccine is given just after delivery, knowledge of health care providers is important than the parent's.

Knowledge of health personnel on Hepatitis B and birth dose of vaccine was assessed among staff nurses and JPHNs in both Government and private hospitals. Summary is given in Table 4.2.1. Qualitative assessment shows that the transmission of Hepatitis from child to another child which is the most reported transmission in India is known to only 20 health staff out of 46 interviewed. Most of the nurses are aware about immunization schedule, dose etc. Almost all health staff interviewed except one has the knowledge about the route of mother to child transmission. Transmission through injection and sexual contact is known to all the health staff. Out of 46, only 24 health staff has the knowledge about the transmission of HBV through sharing razors and 20 have the knowledge about the transmission of HBV through ear piercing or tattooing. Some of them are confused whether the transmission occurs at the time of delivery or pregnancy. Symptoms associated with Hepatitis B are known to everybody except one.

Similarly, except one, all reported that HBV is more infectious than HIV. Majority of them are aware that HBV is active on surfaces like table top, razor blades for about one week. They are confused whether the disease is fatal or not. Thirty nine out of total staff think that Hepatitis B causes liver cancer and the remaining staff has no knowledge about it. Dose of Hepatitis B0 and number of doses in one vial are correctly reported by almost all staff but a fewer number of staff have the knowledge about the correct incubation period of the HBV. Side effect of the vaccine is reported correctly by majority of staff. Only 18 staff has the awareness about correct contraindications and a less number (only 5) of staff have the knowledge about the condition which are 'not contraindications'. None of the staff have knowledge about the correct freezing point of Hepatitis B vaccine. One staff nurse reported that one dose of Hepatitis B0 contains 1.5ml and all others are aware that it is 0.5ml. Similarly when asked about number of doses of Hepatitis B in one vial of vaccine, only one among the staff reported as 20 doses and all others correctly reported as 10 doses.

Table 4.2.1 Details of the awareness level of Hepatitis B among Health staff

Awareness level of Staff on Hepatitis B		
Aspects known to all respondents	*Aspects known to half of the respondents*	*Aspects known to very few respondents*
➢ Route of transmission is from mother to child, ➢ Transmission from mother to child is during delivery time ➢ Symptoms associated with Hepatitis B like fever, loss of appetite, nausea, vomiting, jaundice etc ➢ Virus is active on surfaces like table top, razor blades for about one week. ➢ Hepatitis B causes liver cancer ➢ Side effect of Hepatitis B0 ➢ HBV is more infectious than HIV ➢ One dose of Hepatitis B0 contains 0.5ml ➢ Number of doses of Hepatitis B in one vial of vaccine	➢ Transmission from child to child ➢ Transmission of HBV through sharing razors and ear piercing ➢ Hepatitis B is curable or fatal ➢ Conditions that are Contra indications	➢ HBV vaccination is a protection to liver cancer ➢ About the incubation period 2 - 5 months ➢ Conditions that are not contraindications ➢ Freezing point of Hepatitis B vaccine is -0.5

Practices like instrument sterilization, wearing gloves are proper in the health facilities. Majority of the participants reported that vaccination is an important protective measure. However, still there are staff who are not properly vaccinated against Hepatitis B. Most of the staff nurses working in the labour room, immunization section and OT reported that they have not received any training or advice from the authority about the operational guidelines for Hepatitis B0 vaccination. They have attained the basic knowledge as part of their course only. The above observations point to the need of proper training to the health staff about the Operational Guidelines by MoHFW to the staff nurses who are engaged in the routine immunization work in the hospitals.

Practices followed regarding Hepatitis B0 in the selected Hospitals

Pediatricians from the selected Government and private hospitals in Kerala were interviewed to understand the practices followed regarding Hepatitis B0 vaccination. Major observations are as follows:

Low birth weight (birth weight less than 2 kg or <1.8 Kg) neonates were not being given HepB0 vaccine within 24 hours in some of the hospitals which is against the operational guidelines. Some hospitals are not providing Hepatitis Bo vaccine within 24 hours to neonates who have temperature below 38.5 degree Celsius, prematurity, have infection with jaundice at birth, HIV, history of seizures, diseases of the heart /lungs/ liver or kidney, treatment with antibiotics, congenital abnormalities, neurological conditions or cerebral palsy. It is identified that some hospitals had faced shortage of Hepatitis B0 vaccine in one or two months during the year 2018-19 as per record and some delivery points reported the shortage of immunoglobulin or non-availability of the same at the time of delivery, and hence could not provide Hepatitis B0 to babies within 24 hours of birth.

Generally all neonates are given Hepatitis B0 before shifting from labour room to ward or from operation theatre to ward in the government hospitals. In majority of the hospitals, one vial of

vaccine is being stored at the refrigerator in the labour room for ensuring the vaccine for night time delivery otherwise it is provided by the JPHN from PP unit. No universal pattern is seen in the case of low birth weight babies. Neonates admitted in SNCU or NICU with low birth weight are not given the birth dose in some hospitals but the same is given at the SNCU in some other places. Status of Hepatitis B0 is marked in the case sheets when referrals are made to other hospitals. Some hospitals are considering muscle mass for administering the vaccine.

Practices in Private Hospitals

To understand the practices of giving Hepatitis B0 in private hospitals, five private hospitals (two from Thiruvananthapuram district and three from Malappuram district) were selected. Paediatricians and Staff Nurses handling immunization services were interviewed. The pattern is different for different hospitals. One hospital in the rural area of Thiruvananthapuram ensured proper vaccine storage and distribution of Hepatitis B0 to the labour room, OT and SNCU/ NICU and staff guarantee that no one missed the vaccination. The status of vaccination is marked in the case sheet in case of referral. Pediatricians reported that earlier they had not given Hepatitis B0 for babies weighing less than 2kg. However, those in an urban hospital in Thiruvananthapuram reported that they are not providing Hepatitis B0 vaccine if baby weighs less than 1.8kg and for premature births. In Malappuram district, consent of parents plays a crucial role. But, Paediatricians in the private Medical College Hospital Malappuram reported that they are providing Hepatitis B0 to the newborns within 24 hours of birth and not waiting for the permission of the parents for the same. But in other two private hospitals from the same district, Paediatrician sought permission from the parents or the birth companions and they pointed that, about 5 percent do not get Hepatitis B0 vaccine due to the resistance of parents. It is noticed that in one hospital, they provided all the vaccines including Hepatitis B0 to newborn babies only on immunization day. The baby born on the day of immunization gets the vaccine on the same day; otherwise the baby gets it only on the immunization day or before discharge. According to a senior Paediatrician in this hospital, they have not received any instruction or

guidelines from Indian Association of Peadiatrics (IAP) for giving the vaccine to newborns within 24 hours of birth. They wait till the baby become stable to provide birth dozes if any health issues are reported. There is no uniform practice among private hospitals; it is evident that there are missing cases which points out that all newborns are not getting Hepatitis B0 vaccine on proper time.

Discussion

The study found the coverage of birth doze of Hepatitis B as 65 percent in the State of Kerala using the HMIS data for the years 2017-19 with a large gap between other birth dozes. However, the same is also reported in several part of the world (WHO, 2015). State level average conceal a large level inequality exist in the districts. The district wise disparities need to be explained through further research. As the study has depended on the HMIS portal data, quality of data and technical issues also need to be considered. Yet, due to non-availability of other robust estimates the currently available sources need to be depended and it points to a large gap in the coverage of the said vaccine. National level surveys do not cover the birth doze of Hepatitis B. The worry is the gap between birth doze and its consecutive dozes. Khan (2019) clustered all the districts in Kerala in the better part of coverage while considering the three dozes of Hepatitis vaccine. However, they haven't considered the birth doze. The likelihood of gap scientifically provided volume of regional difference among the districts. District specific measures need to be adopted for low performing districts like Thiruvananthapuram, Malappuram, Kannur and Kasaragod.

Data quality issues of HMIS may be the primary reason for the flawed reporting of Hepatitis B0 coverage in different districts during the period of analysis. The attempt of correction by adjusted Hepatitis B0 successfully suit for districts with average coverage. Yet, such a method has not gone well with better coverage and poor coverage ones. A cross verification of registers of immunization in the PP unit with uploaded HMIS data in the selected districts points no unique pattern of data reporting. The districts where vaccine shortage was reported (Kozhikode and Alappuzha) have not experienced much decline in coverage as per HMIS. At the same time, in

Thiruvananthapuram where data is properly documented by both Government and private hospitals, coverage of the vaccine has declined over the period. Again proper data monitoring emerged as the basic problem here also (Sing et al, 2016). Data monitoring from the supervising authorities has to be ensured in order to minimize the errors and improve data quality. Otherwise the actual services given by the health units won't be reflected in the national portal. Delay in vaccination was also found in some hospitals. The tendency to report birth dozes on time in the HMIS portal instead of actual was correlated with the findings of Sood et al (2015) in Himachal Pradesh.

The qualitative analysis on Knowledge and Practices of health personnel points the necessity of adequate training. A significant proportion of the participants lack the necessary knowledge about management and prevention of occupational exposures. Administering the vaccine differs even among the Pediatricians and Staff Nurses, which is relevant with the latest studies (Mursy, 2019; Mighlani, 2014). Latest guidelines instructed by MoHFW must be generally reached to all the Medical Officers irrespective of Government or private institutes. Vaccine shortage need to be reported in HMIS and also to higher authorities and initiation of local purchase must be done to ensure proper stock in each delivery point. Inclusion of private health care providers on all training programmes is also essential. New guidelines which are updated by Government of India should be intimated through email or social media also. Information of the vaccine needs to be provided to the public and especially to the pregnant mothers.

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Healthcare, Health Service Utilization and Dependency Burden of Greying Population in India: A Macro Perspective

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Abstract

Old age is entirely different from the other stages of life in the sense that, ageing is characterised by ill health, disabilities and depression leads to chronic diseases, low physical activities, high financial dependency and stiffness. These impairments increase further vulnerabilities and thereby affects their standard of living and self-reliance. Therefore, increasing life expectancy does not ensure good and stable retirement life, instead it may cause poor health, diseases and more sufferings especially to women and marginalised sectionsin the society. There is a gross inadequacy of studies on the incidence of diseases and healthcare utilization among Indian elderly. Old age is characterised by severe health problems and disabilities. The situation becomes complex for poor and marginalised sections.In this background the study tries to analyse the health problems, health care utilization and the dependency burden of the aged people in in India based on the NSSO 71st Round and 75th Round data. Presence of physical disabilities and disease burden among the aged persons are found to be very high. This creates a high dependency load to the earning members in their family. The study reveals anincongruity in the perception on self-health condition among the respondents. It has been perceived that aged with different ailments consider themselves as healthy. The misconception is higher for the male representatives than females. People living in urban area possess a higher negative notion about their own health. All this exposes the need for providing better awareness for the aged persons, since majority are ignorant about their actual health condition. The situationdemands the need and role for immediate Governmentimmersion and intrusion both at the Centre and States in handling the growing health care issues of the aged population.

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Introduction

Interest among researchers in gerontological issues in India has been of recent origin. This is because the absolute numbers and proportions of the elderly people to the general population were relatively small prior to 1960s, whereas they now are growing rapidly. The elderly population increased from 19.61 million in 1951 to 24.71 in 1961, to 32.70 in 1971 and 43.98 in 1981. It has been increased from 56 million to 76 million between 1991 and 2001. In terms of proportions to the general population it is expected to grow by 37 per cent while the general population would increase by 18 per cent. During the period 2001 and 2025 it is estimated that the elderly population will increase by 133 per cent, whereas the general population is expected to increase by 47 per cent. In absolute terms, the elderly population will increase from 76 to 177 million. This trend is likely to continue in future. Both numerically and proportionally, therefore, the incidence of old age is assuming importance (Bhagat and Kumar, 2011).

Old age is distinct from the earlier periods of life. For many, old age is allied with ill health, physical and sensory deficiencies and increased exposure to ailment. These impairments increase vulnerability and decrease viability and cause interference in the performance of daily activities of living.

Table 1- Percentage of Aged Population, India, 1901-2026

Year	Aged 60+(in million)	%Aged 60+
1901	12.0	5.06
1911	13.1	5.22
1921	13.4	5.37
1931	14.2	5.09
1941	18.0	5.66
1951	19.6	5.43
1961	24.7	5.63
1971	32.6	5.97
1981	43.1	6.32
1991	56.6	6.75
2001	76.6	7.46
2011	98.5	8.30
2021*	143.2	10.7
2026*	173.1	12.4

Source: Figures up to 1991 are based on Registrar General, India. 2001, 2011, Census of India reports.
*Figures for 2021 and subsequent years are projected figures.

Table shows that the number of the 60 plus and above aged people was 19.6 million constituting 5.43 percent of the total population in 1951 which is increased to nearly to 77 million within next 50 years and it accounts nearly 7.5 per cent of the total population. Although, the change in the proportion of the aged during the fifty years from 1951 to 2001 was about 2 percentage points, it has added nearly 57 million more to the total aged population of the country. The aged population grew three and half times compared to less than three times growth in the total population.

The growth rate was also observed to be higher among the aged compared to the total population after 1961. During the decades 1961-2001, the aged population grew rapidly compared to overall growth of the population.At present, India has a huge elderly population of nearly 77 million enumerated in 2001 which likely to increase to 173 million by the year 2026 (Bhagat and Kumar, 2011). That is over and above 13 fold increase in actual number of aged persons is expected by 2026. That is huge considering the present demand and supply of health care services in India.

Methods

There is a gross inadequacy of studies on the incidence of diseases and healthcare utilization among Indian elderly. Old age is characterised by severe health problems and disabilities. The situation becomes worse in case of people with poor financial background and high dependency rate. The present study tries to analyse the health problem, health care utilization and the dependency burden of aged people in India. Since the survey conducted by NSSO is of unique in nature and focus the problem in a very elaborative manner by covering all the important variable, the present study is based on the extracted data from the NSSO 71st Round 'Social Consumption: Health' and the Reports on NSSO 75th Round published in 2020. Data related to health perception, Nature, type and utilization of the treatment, dependency rate and physical mobility conditions were collected and analysed for the study.Tables, cross tabulation and Graphs were used to analyse and explain data.

Results

Old age is characterised by comparatively more ailments, low physical mobility, insecurity, low social participation and mental depression. This all makes the life old aged people more difficult. Economic insufficiency and high level of dependency rate adds more pressure to their daily life. As a result people become more and more vulnerable to chronic diseases, physical disabilities and mental incapacities. Therefore, thesickness of the elderly are multiple and chronic in nature.

Out of the total NSSO surveyed data, the present study analyses the extracted data for the respondents having 60 years or more age. Table 2 depicts the general characteristics of the 60+ respondents considered for the study. The total respondents under the specific 60 to 120 age group was 27,245 and among them 63 percent belonging to the 60 to 69 age group, followed by 27.3 in the 70-79 and 8.2 percent in the 80-89 age group. The remaining1.5 percent of the respondents were of the age between 90 and 120 i.e., most senior among the senior citizens.

Table 2- General classification of the Respondents

	Category	Frequency	Percentage
Age	60-69	17160	63.0
	70-79	7438	27.3
	80-89	2221	8.2
	90-99	389	1.4
	100-120	37	0.1
Gender	Male	13692	50.3
	Female	13553	49.7
Location	Rural	15019	55.1
	Urban	12226	44.9
Marital Status	Never Married	202	0.7
	Currently Married	17947	65.9
	Widowed	8983	33.0
	Divorced/Separated	113	0.4
Total		**27245**	**100.0**

Source: Calculated from NSSO 71st Round data

Data signifies an almost equal representation of male and female respondents in the sample. Males are 50.3 percent of the total and the remaining are females. The location wise distribution of the sample reveals that 55.1 percent of the sample respondents are from rural area, the rest of them belonging to the urban areas (44.49) in India. Similarly, 65.9 percent of them were married and living with their spouse. Nearly one third of the samples are widowed.

The awareness on one's own health is an important factor in deciding the level of care and treatment availed by him. A person may be considered himself in good health if he feels so. It also reflects the mental health of that person. Table 3 depicts the categorisation of the aged respondents based on their own perception about their health.It has been found that 59 percent of the aged with different ailments felt that they were in a good health condition. Probablythey considered their condition as a problem of ageing. Among the aged, the males looked to be feeling that they had a healthier condition even with sickness compared their female counterparts. As against this, about 17 percent of the aged who were not even sick considered themselves as having a poor state of health. Urban aged appeared to be feeling that they had a better health condition even with sickness as compared to the rural aged.

Table 3 –Respondents ownperception about currentstateofhealth

Characteristics	Percentagedistribution(60+)					
	Rural			Urban		
	Male	Female	Total	Male	Female	Total
Ownawarenessaboutcurrentstateofhealth withchronic illness						
Excellent/verygood	2.0	2.0	2.0	7.0	4.0	5.0
Good/fair	62.0	56.0	59.0	67.0	67.0	67.0
Poor	36.0	43.0	39.0	26.0	29.0	28.0
all	100.0	100.0	100.0	100.0	100.0	100.0
Ownawarenessaboutcurrentstateofhealth withoutchronic illness						
Excellent/verygood	11.0	7.0	9.0	15.0	11.0	13.0
Good/fair	74.0	73.0	74.0	75.0	76.0	76.0
Poor	15.0	19.0	17.0	9.0	13.0	11.0
all	100.0	100.0	100.0	100.0	100.0	100.0

Source: NSSO 75th Round Report, 2020

Thus, the prevention of misconception among the respondents about their own health condition is evident from the data.

Table 4- Age categorisation of the In Patient respondents

Age category	Frequency	Percent
60-69	5195	54.5
70-79	3070	32.2
80-89	1053	11.0
90-99	197	2.1
100-120	18	0.2
Total	**9533**	**100.0**

Source: Calculated from NSSO 71st Round data

Among the 27245 aged (60+) respondents (data from Table 2) covered for the study, 9533 respondents received IP treatment during the last 1 year study period. The rest of them were neither suffered a disease nor subject to an IP treatment in any of the medical institutions during the prescribed period. Among these 54.5 percent are in 60-69 age group followed by 32.2 in the 70-79 age group (Table 4), reveals that compared to the senior most respondents, the preference for availing treatment is higher among their counterparts, that is among the comparatively younger old people.

Table 5- Treatment utilization among the respondents

	Category	**Frequency**	**Percentage**
Nature of treatment	Allopathy	9465	99.28
	Indian System of medicine: (Ayurveda, Unanietc)	53	.56
	Homoeopathy	9	.10
	Yoga & Naturopathy	5	.05
	Other	1	.010
Level of care	HSC/ANM/ASHA	3	.03
	PHC/CHC	338	3.55
	Govt Hospital	3525	36.98
	Private Hospital	5667	59.44
Type of ward	Free	3655	38.3

	Paying General	4067	42.7
	Paying Special	1811	19.0
Treated before hospitalisation	Yes	6375	66.9
	No	3158	33.1
Treatment continued after discharge	Yes	8142	85.4
	No	1355	14.2
	No response	36	.4
Major source of finance for treatment	Household Income/ Savings	7269	76.25
	Borrowings	1503	15.77
	Sale Of Physical Assets	55	.58
	Contributions From Friends and Relatives	577	6.05
	Other Sources	97	1.02
	No Response	32	.33
Total		**9533**	**100.0**

Source: Calculated from NSSO 71st Round data

The treatment characteristics and service utilization of the 60 plus respondents who have undergone IP treatment during the last one year of survey is presented in the table 5. With the presence of Ayurveda and Homeopathy, Allopathy is still considered the most accepted and preferred treatment practise in India. In accordance to this, the data reveals that more than 99 percent of the total sick persons availed Allopathy treatment.

Nearly 59 percent of the respondents availed the service of private hospitals and the number of persons approached Government hospitals for IP treatment was just 3525 (37 percent), much lower than the private. Since the In-Patient facilities are meagre in PHC, the number of utilisation is comparatively low for there. Since the number of person opted for private hospital is higher among the IP patients, opting paying ward over free ward for treatment is also evident from the data. Only 38.3 percent prefer free wards in hospital and the rest goes for paying ward (42 percent in general and 19 percent in special wards). The table also makes it clear that over two third of the total patients are under treatment before they got admitted for the current ailment, and 85.4 percent continued their treatment after discharge. Therefore most of the old people are under treatment either in OP or in IP for a long term, implies the presence of poor health condition among the aged ones.

Table 6- Percentagedistributionofagedpersonsbystateofphysical mobility

Characteristics		Percentagedistributionofagedpersons				
		Physically mobile	Immobile			All
			Confinedto		Wheelchair bound	
			bed	home		
Sector		**Gender**				
Rural	Male	93.5	1.3	4.8	0.4	100.0
	Female	91.4	1.5	6.1	1.0	100.0
	Person	**92.4**	**1.4**	**5.5**	**0.7**	100.0
		Age-groups				
	60-64	96.4	0.5	2.5	0.6	100.0
	65-69	95.0	0.8	3.7	0.5	100.0
	70-74	90.4	1.3	7.8	0.4	100.0
	75-79	88.9	2.0	8.3	0.7	100.0
	80+	72.5	6.9	18.1	2.5	100.0
	all	**92.4**	**1.4**	**5.5**	**0.7**	100.0
Urban		**Gender**				
	Male	94.5	1.1	4.0	0.4	100.0
	Female	90.5	1.6	7.1	0.7	100.0
	Person	**92.5**	**1.4**	**5.6**	**0.6**	100.0
		Age-groups				
	60-64	96.6	0.8	2.4	0.2	100.0
	65-69	93.0	1.2	5.4	0.5	100.0
	70-74	93.3	1.0	5.1	0.6	100.0
	75-79	90.8	1.1	7.4	0.6	100.0
	80+	72.4	5.7	19.6	2.2	100.0
	all	**92.5**	**1.4**	**5.6**	**0.6**	100.0

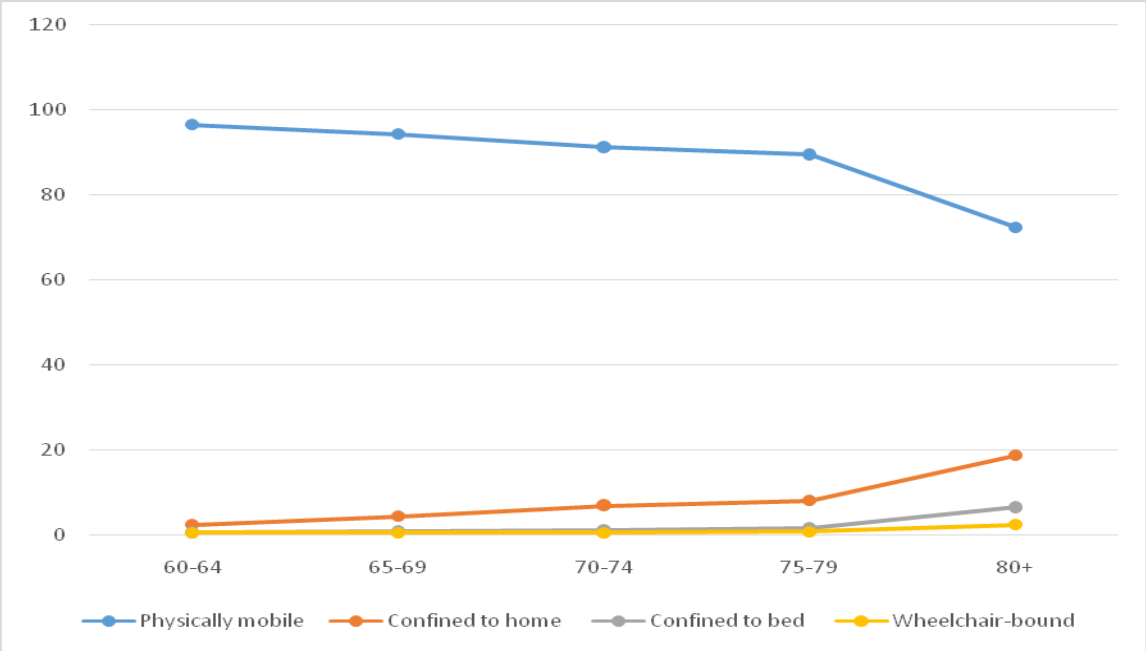
Source: NSSO 75th Round Report, 2020

As per the table 6, both in urban and rural area the level of physical mobility among the aged is comparatively higher for male respondents. Similarly, the rate of confinement in to home in the later ages is higher for females than their counter parts. The fall in the rate of physical mobility is evident with a rise in the age category of the respondents, and it became obvious for people above 80 years of age. The trend is similar in both urban and rural peoples, implies greying burden has a similar effect irrespective of the place of living.

It is evident from the figure 1 that with the increase in age, the physical mobility of the people portrays a steep fall and on the other hand the immobility status of people either in the form of home, bed or wheel chair increases with rise in age. That is the life of majority of the aged

persons restricted into their homes with further rise in their ages. This creates more financial and dependency burden to their family.

Figure 1- Relation between age and physical mobility



Source: Calculated from NSSO 75th Round Report, 2020

The table 7 reveals that 72 percent of the rural aged people and 67 percent of the urban aged people are fully or partially depends on others for managing their livelihood. The economic independence among the old aged person is very low, that is more than two third (69.5 percent) of the respondents are in state of economic dependence to others. Females are more prone to the financial dependence and males in both rural and urban depicts comparatively higher level of economic independence.

Their children and the spouse are the major financial supporters for the financially weak and dependent aged persons. About 79 percent (92 percent males and 72 percent females) aged persons in rural and about 76 percent (91 percent male and 70 percent female) aged persons in urban India were financially supported by their own children. Similarly, in rural India, about 15 percent (4 percent males and 21 percent females) and in urban India, about 18 percent (4 percent

males and 24 percent females) economically dependent aged persons were financially supported by their spouse.

Table 7 – Distribution of dependency rate of aged persons

Characteristics	Percentage distribution of aged persons					
	Rural			Urban		
	Male	Female	Total	Male	Female	Total
Status of economic dependence						
Not dependent on others	48.0	10.0	28.0	57.0	11.0	33.0
Partially dependent on others	25.0	24.0	25.0	19.0	21.0	20.0
Fully dependent on others	27.0	66.0	47.0	24.0	68.0	47.0
all	100.0	100.0	100.0	100.0	100.0	100.0
Economically dependent aged persons financially supported by						
Spouse	4.0	21.0	15.0	4.0	24.0	18.0
Own children	92.0	72.0	79.0	91.0	70.0	76.0
Grandchildren	1.0	3.0	2.0	1.0	2.0	2.0
Others	3.0	5.0	4.0	4.0	4.0	4.0
all	100.0	100.0	100.0	100.0	100.0	100.0

Source: NSSO 75th Round Report, 2020

Table 8 – Distribution of dependency rate of aged persons

Characteristics	Percentage distribution of aged persons					
	Rural			Urban		
	Male	Female	Total	Male	Female	Total
Place of stay						
Owned house	95.7	89.1	92.4	91.0	83.3	87.0
Other's house	4.3	10.9	7.6	9.0	16.7	13.0
all	100.0	100.0	100.0	100.0	100.0	100.0
Type of living arrangement						
Living alone	1.6	7.2	4.4	1.7	5.5	3.7
With spouse only	17.1	9.9	13.5	19.7	11.5	15.5
With spouse and other members	64.2	38.3	51.2	63.7	34.4	48.6
Without spouse but with children	15.0	39.8	27.5	13.3	44.4	29.3
Without spouse but with other	2.0	4.8	3.4	1.6	4.0	2.8
With non-relations	0.1	0.0	0.0	0.0	0.2	0.1
all	100.0	100.0	100.0	100.0	100.0	100.0

Source: NSSO 75th Round Report, 2020

The table 8 depicts that, majority owns a house and the number of respondents living with other or in other arrangements is comparatively low, however, the lack of own house is more visible among urban females.

Nearly 51 percent of the rural people and 48.6 percent of the urban people living with their spouse and family. Type of living arrangement reveals that rural females are more subjected to isolated living than their counterparts. The higher life expectancy among female is one of the major cause for these result. The high percentage of females living without spouse and with children (nearly 40 percent in rural and 44 percent in urban area) also supports the same fact.

Discussion

The number of aged persons in total population in terms on its actual number and in percent value depicts a rapid growth rate in India. The present experience proves thatthis trend is further expected to rise in the coming decades also. Thus, senior citizen contributes a larger proportion in Indian population and therefore, the incidence of old age is assuming importance.

Old age is completely different from the other periods of life in the sense that, ageing is characterised by more of ill health, disabilities and depression. These impairments increase vulnerabilitiesand affects their standard of living and self-reliance. They were forced to depend on others, as a result leads to rise in the financial burden on the earing members and these all adds more pressure to their daily life.

The NSSO survey on Social Consumption- Health covers 27245 aged respondents and among them majority are in the 60 to 69 age group, and 1.5 percent of the respondents were of the age between 90 and 120 i.e., most senior among the senior citizens. The male, female representation in the sample is almost equal and more respondents are from rural area. Nearly two third of the respondents currently living with their spouse and the rate of widowed is comparatively very high due to the age specific character of the study.

The study reveals a discrepancy in the perception on self-health condition among the respondents. It has been perceived that aged with different ailments consider themselves as healthy. Most of them consider the health difficulties as a part of the aging, therefore does not give proper importance and care to treat it. The misconception is higher for the male representatives than females.Similarly, 17 percent of the aged who were not even sick considered themselves as having a poor state of health. People living in urban area possess a higher negative notion about their own health. Since majority are ignorant about their actual health condition, the findings reveals the importance for providing better awareness for the aged persons.

People within the age group of 60 to 80 were more concerned about their health and therefore prefer to avail treatments and sticking to the general perception of the Indian people that the Allopathy is the most preferable method of treatment among them.

The dependents among the aged persons on the private hospital for treatment is evident from the study. Since the number of person opted for private hospital is higher among the IP patients, choosing paying ward over free ward for treatment is also manifest from the data. The study also makes it clear that over two third of the total patients are under treatment before they got admitted for the current ailment, and 85.4 percent continued their treatment after the discharge. Therefore, most of the old people are under treatment either in OP or in IP for a long term, implies the presence of poor health condition among the aged ones.

Both in urban and rural area, the level of physical mobility among the aged is comparatively higher for male respondents. Similarly, the rate of confinement in to home in the later ages is higher for females than their counter parts. The fall in the rate of physical mobility is evident with a rise in the age category of the respondents. With the increase in age, the physical mobility of the people portrays a steep fall and on the other hand the immobility status of people either in the form of home, bed or wheel chair increase with rise in age and the trend is similar to both urban and rural peoples, implies greying burden has a similar effect irrespective of the place of living. That is the life of majority of the aged persons restricted into their homes with further rise in their ages. This creates more financial and dependency burden to their family.

This all leads to a very poor economic freedom to the old aged people in their later life. The economic independence among the old aged person is very low, that is more than two third of the respondents are in state of economic dependence to others. Females are more prone to the financial reliance and males in both rural and urban depicts comparatively higher level of economic independence. Children and spouse bear major part of the financial burden for the greying population. The living status of the respondents reveal thatonly half of the people lives with their spouse and family. Rural females are more subjected to isolated living than male respondents.

Thus, it can be stated that increasing life expectancy does not ensure good and stable retirement life, instead it may cause poor health, diseases and more sufferings especially to women and marginalised section sin the society.

Conclusions

People always expect to live their life by enjoying its full potential. However, as years passes people become more aged and ageing causes more health problems and disabilities. The study reveals a higher prevailing rate of ailments and low financial stability among the aged persons and this creates financial burden to their family. An increase in the financial dependence on earning member; their own children as found from the study; may cause further depression/pressure on the people. Thus, health problems in the old age are of cumulative nature. The increase in old age population causes an increased demand for health care facilities and we can't cope with the situation without upgrading the present capacity and supply of our health system.Geriatric health care yet does not figure top on the nation's health care agenda. Geriatric wards and geriatric care specialists are to be provided in all secondary and tertiary care hospitals to cater the rising needs of aged persons. Thus aserious social and economic liability, crippling over millions ofelderly have yet to be completely addressed. This necessitates the need and role for immediate Government involvement and intervention both at the Centre and States in handling the burgeoning health care issues of the aged population.

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Popular Article

Community De-Addiction Camp: Replicable model of SKDRDP

Alcoholic abuse is a bane for progress. Alcohol addiction is a serious health hazard with deep rooted negative consequences for the individual as well as his family in particular and the economy at large. Inpatient based de addiction treatment is commonly seen to tackle the problem of addiction. Of late, Community de addiction camps are providing de addiction treatment at the community level in India. This article highlights the success of community de addiction camp organized by SKDRDP, a leading NGO, in Belthangady taluk, Karnataka State, India.

Impact of alcohol use in India: According to one of the estimations health impact and economic burden attributable to alcohol use in India. This study estimated that between 2011 and 2050, alcohol attributable deaths would lead to a loss of 258 million life years. In contrast, 552 million QALYs (quality adjusted life years) would be gained by eliminating alcohol consumption. Treatment of these conditions will impose an economic burden of INR 3127 billion (US$ 48.11 billion) on the health system. Societal burden of alcohol, inclusive of health system cost, out of pocket expenditure and productivity losses will be INR 121,364 billion (US$ 1867 billion). Even after adjusting for tax receipts from sale of alcohol, alcohol poses a net economic loss of INR 97,895 billion (US$ 1506 billion). This amounts to an average loss of 1.45% of the gross domestic product (GDP) per year to the Indian economy.

NGO Experiment: Shri Kshestra Dharmasthala Rural Development Project (SKDRDP) is one of the pioneers in the country, in promoting socio-economic wellbeing of society at large, located its head office at Dharmasthala, a holy place from Karnataka. Its experience has found that addiction to liquor is a major bane for poor people. To wean away the working class from liquor SKDRDP in support of the public has promoted Janajagruthi a movement against alcoholism. Under this programme awareness is created through village meets, house to house canvas, jathas and community deaddiction camps against alcoholism. In the deaddiction camps addicts are treated and counseled. This is one of the more successful social initiatives of SKDRDP.

In order to curb this tendency, the people of Belthangady taluk, in association with SKDRDP, formed "Janajagruthi Vedhike", mainly to fight silently against alcoholism. The de-addictions camps evolved by SKDRDP, a leading NGO in Karnataka adopts behavioural procedures in the treatment programmes which include relaxation, aversion therapies, covert sensitization, self-control training, social skills and assertiveness training and contingency management. This is a community based de addiction treatment at the community level.

The total duration of the residential community de addiction camp is eight days. Attempts are made in the camps to convince the alcoholics of the economic, social and spiritual benefits of being free of addiction, with minimal use of medical aid. Most of the de addicted people become volunteers to encourage other addicts to quit alcoholismand this also prevents them from returning back to the addiction. Nava Jeevan Samithi from amongthe de-addicted are formed to help them to lead a permanently -addiction -free life.

Impact of Community level actions: The success and the acceptability of the model are reflected from the fact that during the last three decades the Forum has organised 1466 de-addiction camps and as per the survey conducted 80% of the campers lead addiction free life. Annually the forum organises around 150 community level camps. The de-addiction camps ultimately paved the way for 101807 families to lead peaceful and self-reliant life.

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Covid-19 in India: Challenges in Vaccination and Establishing Herd Immunity

Introduction

Important issues, emerging through different print and media reports, during COVID-19 management in India include limited health care infrastructure (with limited manpower and other resources) with implications on limited number of ICU bed availability and other life saving equipments such as ventilators; primary health care institutions not at all ready to meet COVID-19 challenge; private sector especially private practitioners did not join hands with public sector in dealing with the pandemic; elderly population are most hard hit with prevailing cardio-vascular and other diseases. The cost of treatment for Covid-19 patients continues to be high with most population without health insurance or inadequate health insurance. The period of lock-down also witnessed adverse effects on nutrition and wage loss with families not going to work to take care of children at home. Migration emerged as a major problem with labourers migrating to their native states. In addition, there are reports that both GDP and tax-collection this year may turn out to be negative with larger implications for future economic activities and jobs. In some of the States like Maharasthra, the areas with higher population density, particularly slums, have emerged as epi-centers of diseases. The present health care system, though trying to cope-up the challenge, seems inadequate and is overstretched pre-dominantly relying on medical colleges and nearly six hundred district hospitals across India. Many people, who were under regular treatment, now find it difficult to visit the hospitals for fear of getting in touch with the Covid-19 patients.

The first person to have contacted Covid-19 was probably a 55-year-old individual from Hubei province in China on November 17, 2019 which is more than a month earlier than doctors noted cases in Wuhan, China, which is also located in Hubei province, at the end of December 2019. World Health Organization (WHO) declared this as a severe respiratory disorder syndrome as a global public health emergency and named the disease as Covid-19 on 11th February 2020 and further declared it as a pandemic exactly one month after on 11th March 2020. Many countries and organization within countries are struggling to produce a vaccine since the origin of the

disease. Normally any new vaccine development takes 10–15 years but the search for vaccine against Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2) is going on at a very fast pace resulting in almost breakthrough in vaccine development by several research institutions and vaccine manufacturers. In pandemic situation, however, the entire process of vaccine development including clinical trials gets shortened and may be fast tracked to 15–18 months time. It is expected that there shall be simultaneous marketing of several vaccines by the beginning of 2021. As on 5 October 2020, as per WHO, currently there are over 169 COVID-19 vaccine candidates under development, with 26 of these in the human trial phase. In fact, human trials on various COVID vaccines are currently underway across the world, including in India.

The Vaccine

Treatment and recovery patterns from COVID-19 show that 80 percent of patients recover from the disease without requiring any special treatment. The COVID illness is generally minor for most, especially children and young adults. However, for some people, it can cause serious illness. Around 1 in every 5 person infected with COVID-19, develops difficulty in breathing and requires hospital care. People who are aged over 60 years and people who are already suffering from co-morbidities such as diabetes, heart disease, respiratory disease, renal or liver diseases or hypertension are among those who are at greater risk. It is heartening to note, though not conclusive, that 25 States/Union Territories have reported a fall in the number of active cases during the last week of September 2020 due to higher number of daily recoveries and persistently regressing fatality rates.

WHO feels that there is a big challenge of being able to scale, distribute and allocate fairly around the world without letting the rich countries corner the limited doses. There is an urgent need to focus on global collaboration to deal with the virus diagnostics, therapeutics, behavioural and mental health concerns, transmission and vaccine development. We need to develop a better emergency plan that would allow us to produce and distribute vaccines within a short time frame. Some inherent hurdles in procurement, supplies and administration of COVID-19 vaccine cannot be ruled out. These include but not limited to the administration of right vaccine (choosing from several formulations across the globe), cost per dose, the number of doses and duration of doses required, the supply chain (which may require a different temperature than a simple refrigerator),

the trained manpower for administration of vaccine. Will existing manpower like Multi-purpose Health Workers (MPWs) accompanied by Accredited Social Health Activitists (ASHAs) be sufficient or a more specialized manpower will be required administer the doses. All this warrants specific guidelines for vaccine administration, as and when it comes.

Since initial supplies of vaccine doses will be limited, and there is going to be huge demand, a distribution policy or vaccine access strategy must be finalized at the level of Ministry of Health and Family Welfare, Government of India in which the distribution of vaccine needs to be prioritize. Some of the priority population can be medical and para-medical staff and other frontline workers, defense and para-defense forces, corona patients and their families (to protect from a second episode of COVID-19 disease which can result in significant increase in mortality), persons with existing co-morbidities, etc. The principles of welfare economics also suggest that there should be a fair distribution of vaccine at affordable prices with inclusive and equitable vaccine access policy.

Herd Immunity

The ultimate aim of any vaccine is to create herd immunity (herd protection) which means most of the population becomes immune from a contagious infectious disease. This happens when a population is immune either through vaccination or immunity developed through previous infection. This means that even people who aren't vaccinated, or in whom the vaccine doesn't trigger immunity, are protected because people around them who are immune can act as buffers between them and an infected person. Once herd immunity establishes for a while, and the ability of the disease to spread is hindered, the disease can eventually be eliminated. This is how the world eradicated smallpox, measles, mumps, chickenpox and polio. Further, the more infectious a disease, the greater the population immunity needed to ensure herd immunity. For instance, measles is highly contagious as one person with measles can infect up to 18 other people. This means that around 95% of people need to be immune in order for the wider group to have herd immunity while the SARS-CoV2 has a lower infection rate than measles, with each infected person passing it on to two or three new people, on average. This means that herd immunity should be achieved when around 60% of the population becomes immune to COVID-19. On the other hand, natural herd immunity – achieved through infection rather than

vaccination – can be challenging to induce through unchecked infection as there would be a very high rate of serious illness and death, with health systems overwhelmed well beyond their surge capacity, even in high-income countries. This is why herd immunity is generally pursued through vaccination programs. Even when vaccines are available, it is not always possible to achieve herd immunity for very long. Some viruses, such as seasonal flu, mutate frequently, evading the body's immune response. So immunity doesn't always last forever, which is why the flu shot is necessary every single year. When herd immunity is well established, however, some people choose to behave as 'free riders', essentially benefitting from everyone else getting vaccinated, while abstaining from vaccination either because they choose not to or are actively anti-vaccination. When a population has too many of these free riders, the overall immunity level is compromised and herd immunity can be lost, putting everyone at risk.

The Centre has already set-up an expert committee headed by NITI Aayog member VK Paul to consider the logistics and ethical aspects of procuring and administering the COVID-19 vaccine. This committee has already met five times till October 4, 2020 to deliberate on issues related to vaccine procurement, distribution and costs. An effective vaccine strategy which is full-proof still remains an unrealised dream.

It is commonly seen that maximum cases of flu, viral, cough, cold and breathlessness are reported during the winter season which enhances the vulnerability and more rapid diagnostic technologies to detect the virus. The coming six months, will be very critical to develop an effective vaccine or therapeutic options to battle with this pandemic. Lesson learnt from the pandemic so far suggests that it would be the right time to consider investing in the development of better vaccine technologies and an effective and viable strategy that helps to develop a protective vaccine as quickly as possible with little or no side effects.

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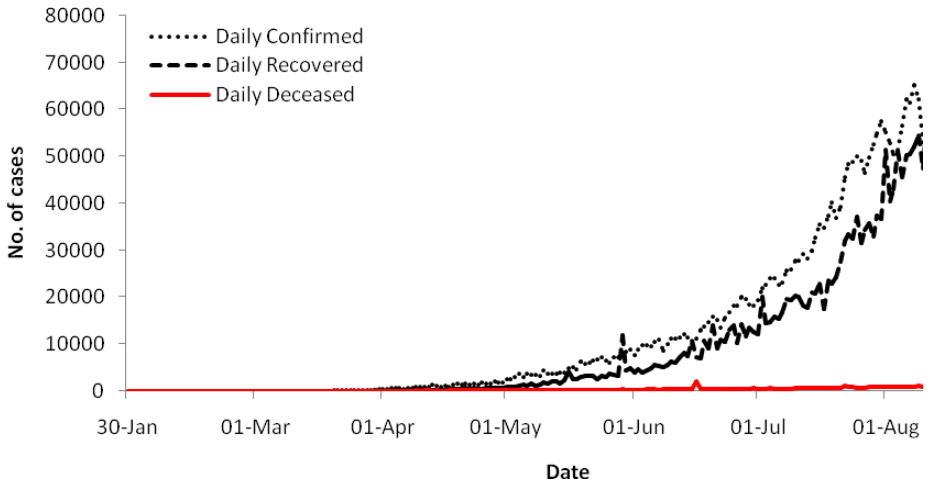
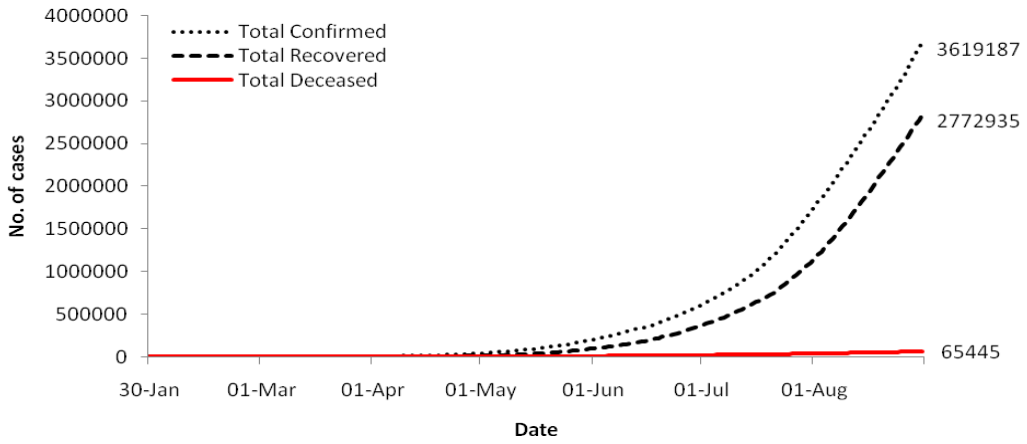
Current Statistics

Figure 1: Trends in daily COVID-19 Conformed, Recovered and Deceased cases (absolute No.) reported, India, 30 January to 31 August.



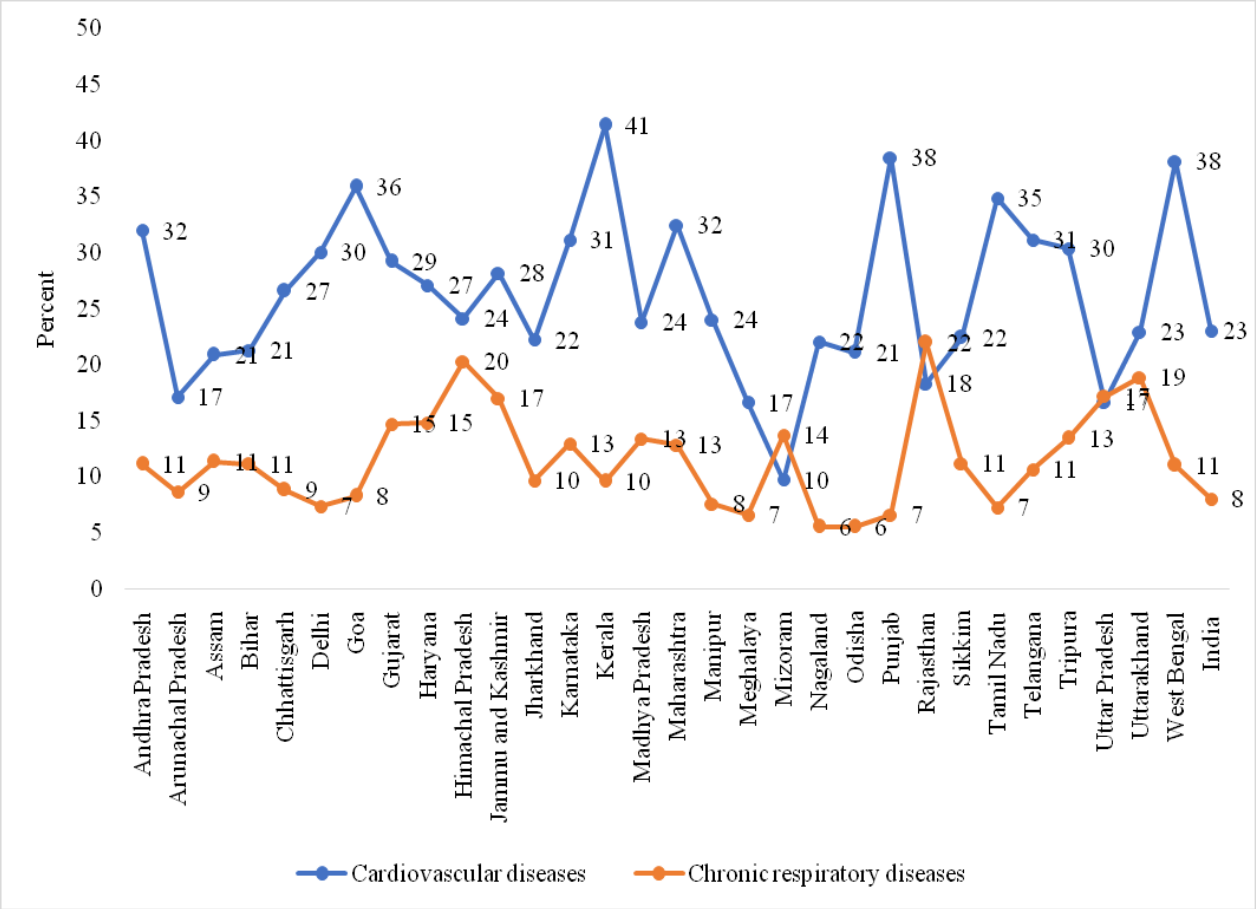
Note: Above Figure illustrate the absolute numbers of daily conformed, recovered and deceased Covid-19 cases reported in India. Covid-19 first case was reported on 30 January 2020 in India, and first recovered case was reported on 13 February 2020. However, almost one and half month later, on 12 March 2020, first death due to Covid-19 was reported in India.
Source: https://api.covid19india.org/.

Figure 2: Trends in total COVID-19 Conformed, Recovered and Deceased cases (absolute No.) reported, India, 30 January to 31 August.



Note: Above Figure illustrate the absolute numbers of total conformed, recovered and deceased Covid-19 cases reported in India. Covid-19 first case was reported on 30 January 2020 in India, and first recovered case was reported on 13 February 2020. However, almost one and half month later, on 12 March 2020, first death due to Covid-19 was reported in India.
Source: https://api.covid19india.org/.

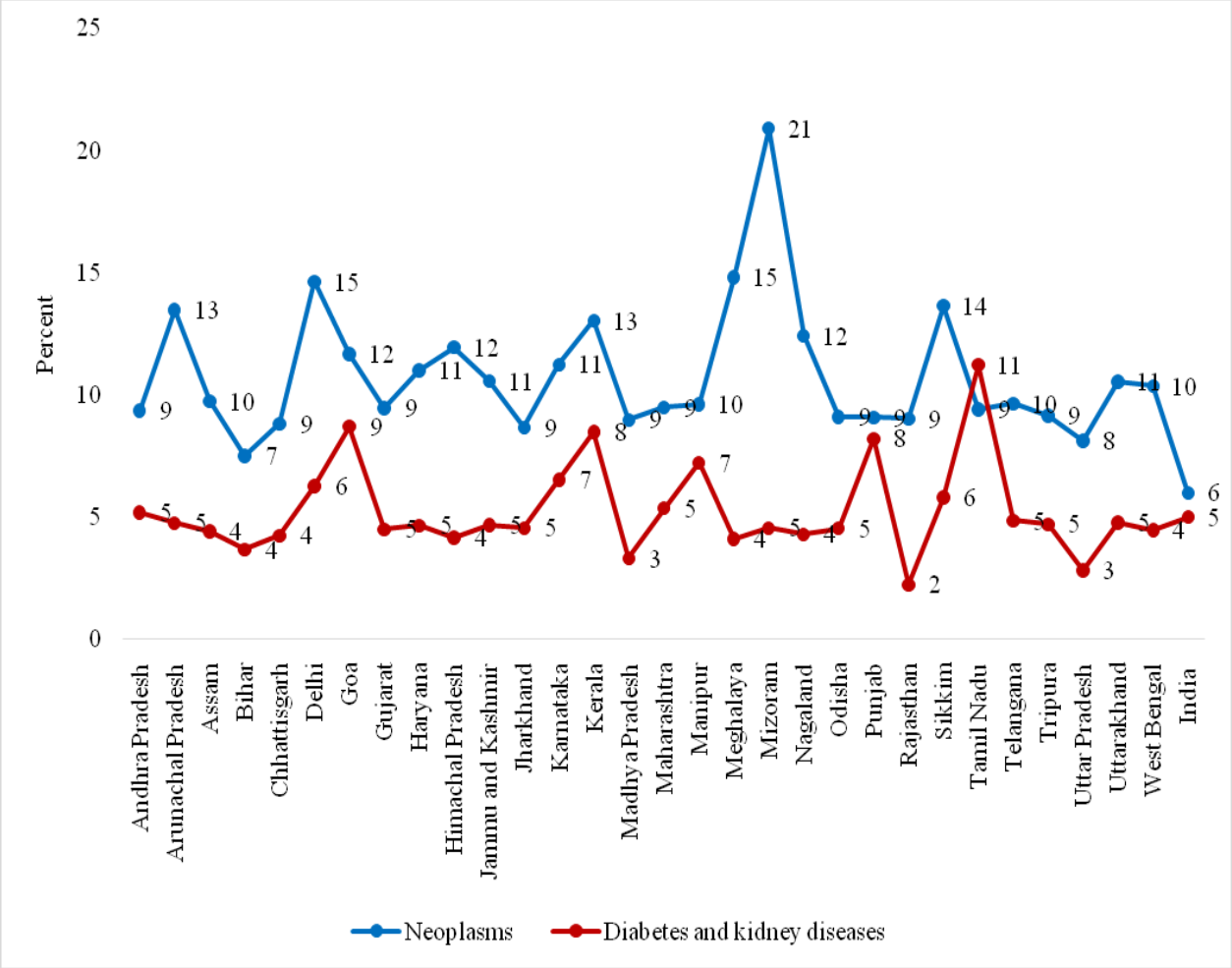
Figure 3 Cardiovascular and Chronic Respiratory diseases related deaths in India



Note: One-fourths (23%) deaths in India are attributed to the cardiovascular diseases (CVDs) and 8% deaths are due to the chronic respiratory disease. Kerala (41%), West Bengal and Punjab (38% respectively), Goa (36%), Telangana (35%), Andhra Pradesh and Maharashtra (32% respectively) have the highest deaths of CVDs. Rajasthan (22%), Himachal Pradesh (20%), Uttarakhand (19%), Uttar Pradesh and Jammu and Kashmir (17% respectively) highest deaths of chronic respiratory diseases.

Source:*Global Burden of Disease Study 2017 (GBD 2017) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2018*

Figure 4: Neoplasms, Diabetes and Kidney diseases related deaths in India



Note: At the India level 6% of deaths are attributed to the Neoplasms whereas Diabetes and Kidney diseases tolled 5% of deaths. Mizoram (21%), Meghalaya and Delhi (15% respectively), Sikkim (14%), Kerala and Arunachal Pradesh (13%) have highest deaths. Diabetes and Kidney disease causes more deaths in Tamil Nadu (11%), Goa (9%), Kerala and Punjab (8% respectively) and Manipur and Karnataka (7% respectively).

Source:*Global Burden of Disease Study 2017 (GBD 2017) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2018*